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Prevalence of *Schistosomiasis* and Associated Risks Factors Among Patients with Urinary Tract Infections in Azare Metropolis

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Schistosomiasis is among the neglected tropical diseases, with significant prevalence rates in developing countries. This study aimed to assess the prevalence of *Schistosomiasis* and associated risk factors among patients with urinary tract infections in Azare. A total of 200 urine samples were collected from patients at Extreme Hospital Azare, while 200 structured questionnaires were distributed to obtain demographic information and evaluate potential risk factors. Each urine sample (10 mL) was centrifuged at 2000 rpm for 2 minutes, with the sediment examined microscopically under ×10 and ×40 objective lenses. Samples containing eggs of *Schistosoma haematobium* were classified as positive, and those without eggs as negative. The overall prevalence of infection was found to be 7%, with higher rates among females, adolescents and individuals from lower socioeconomic backgrounds. The risk factors assessed included socioeconomic status, personal hygiene, environmental sanitation, source of drinking water, and swimming in water bodies. Of these, only swimming in water bodies reached a statistically significant level associated with infection. The study highlighted the need for targeted public health interventions, particularly among vulnerable groups such as adolescents and low-income communities.

Keywords: Azare, Extreme, Swimming, Water-bodies, Schistosoma.

1. Introduction

Schistosomiasis is one of the most neglected tropical diseases, significantly contributing to morbidity and mortality in many developing nations within tropical and subtropical regions of Africa, Latin America, and Asia. It remains a major public health issue, particularly in areas where control efforts are inadequate, sanitation is poor, and poverty is widespread (Sady *et al*., 2013). The global prevalence of *Schistosomiasis* is particularly high in developing countries, with recent estimates indicating that approximately 779 million people are at risk of infection, 85% of whom are in Africa. Around 207 million people in 74 countries are infected, with 120 million experiencing symptoms of the disease. In Africa alone, 31 countries, including Sudan, are disproportionately affected (Sady *et al*., 2013).

In many developing regions, children aged 5 to 17 are at the highest risk of *Schistosomiasis*, often due to poor hygiene practices and frequent water contact in endemic areas (Ezeh *et al*., 2019; Kabuyaya *et al*., 2017). Factors such as insufficient sanitation, swimming or wading in contaminated rivers, walking barefoot through water on the way to school, reliance on unsafe water sources for household or agricultural use, and a lack of awareness about the disease all contribute to higher infection rates (Ezeh *et al*., 2019).

Schistosomiasis is a parasitic disease transmitted through contact with contaminated freshwater, caused by trematodes of the *Schistosoma* genus. It is estimated that up to 252 million people worldwide may be affected (Utzinger *et al*., 2009). The incidence of *Schistosomiasis* is rising globally due to the expansion of irrigated agriculture, which provides breeding grounds for the vector snails, the construction of dams for hydroelectric power, inadequate sanitation, and a lack of access to clean drinking water (Abubakar *et al*., 2020; Mansur *et al*., 2020).

The species of *Schistosoma* known to cause human infection, include; *Schistosoma haematobium*, *Schistosoma mansoni, Schistosoma japonicum, Schistosoma intercalatum*, and *Schistosoma mekongi*. Among these, *S. haematobium, S. mansoni*, and *S. japonicum account* for 95% of human *Schistosomiasis* cases globally. In sub-Saharan Africa alone, it is estimated that *Schistosomiasis* causes around 280,000 deaths each year (Abubakar *et al*., 2020). *S. haematobium,* is prevalent across sub-Saharan Africa, with approximately 112 million individuals infected (Abubakar *et al*., 2020). In regions where *S. haematobium* is endemic, up to 75% of infected individuals suffer from genital *Schistosomiasis*, often acquired in childhood. Female genital *Schistosomiasis* leads to ulcerations and inflammation of the cervix and vagina, while male genital *Schistosomiasis* is linked to conditions such as leukocytospermia and haematospermia (Abubakar *et al*., 2020).

Due to the specific transmission cycle of *Schistosomiasis*, which requires contact with freshwater hosts, the disease spreads in highly localized areas. Both intestinal and urinary forms of the disease occur in Nigeria, where studies have reported prevalence rates ranging from 14.2% to 91.4% (Nwabuez and Opara, 2007; Ishaleku *et al*., 2012).

Despite this shocking information, there is paucity of information and documentation on the risk factors, socio-demographic determinants and epidemiology of this infection in Azare, Katagum local government Bauchi state Nigeria. This study aimed to assess the prevalence of *Schistosomiasis* and associated risk factors among patients with urinary tract infections in Azare Bauchi state Nigeria.

2. Materials and Methods

The study was carried out at Extreme hospital Azare, Katagum local government Bauchi State, from where the ethical approval with reference number EHA/09/02/23/003 was obtained.

The target populations for this study were patients attending Extreme hospital Azare, with signs and symptoms of urinary tract infections. Nonetheless, the patients without cases of urinary tract infections and those not willing to participate in the study were excluded.

The sample size was calculated using:

$n = z^2pq/e^2$

Z= z-score and equals to 1.96 at 95% confidence level, margin error (e) of 5% was taken and P= 0.9 from previous study (Belonwu, 2007). But q= 1- p. Therefore, two hundred patients were taken for the study.

2.1. Data Collection

Two hundred urine samples were collected and taken to the laboratory for processing and examination. Meanwhile, 200 standardized structured questionnaires were distributed to the patients at the time of sample collection to obtain their demographic details and assess the associated risk factors.

2.2. Parasitological Examination of the Urine Samples

Ten milliliters (10mL) of the urine sample were centrifuged for 2min at 2000rpm. The supernatants were discarded to obtain the sediment from which a drop was placed on a clean glass slide using a pipette and covered with a cover slip. The slide was then examined under microscope using × 10 and × 40 objective lenses. The samples containing eggs of *S. haematobium* were categorized as positive, while those without the eggs were classified as negative (Deribe *et al*., 2011).

3. Results and Discussion

3.1. Results

The present study revealed that, out of 200 patients enrolled in the study 93(46.5%) were males out of which 6(3%) were tested positive. Of 107(53.5%) females enrolled in the study, 8(4%) were positive. However, neither children (0-9 years) nor elderly (65years and above) persons were found with the infection, 7(3.5%) adolescents (10-19 years), 4(2%) young adults (20-24years), and 3(1.5%) adults (25-64years) were positive. Regarding socioeconomic status, 8 (4%) from the low-income group were positive, while, 4 (2%) middle-class and 2 (1%) upper-class patients were found positive.

Additionally, among the 76 patients who reported swimming in the river, 8 (4%) were tested positive, while 6 (3%) of the 124 patients who did not swim in the river were found to be positive.

The study also revealed that, 74(37%) of the patients enrolled in the study were having access to clean drinking water out of which 6(3%) were tested positive, while, 8(4%) of those who were lacking access to clean drinking water were found positive. Similarly, 80(40%) of the patients were living in environments with good sanitary conditions out of which 5(2.5%) were tested positive. 9(4.5%) of the 120(60%)

patients living in untidy environments were found positive of the infection. 44(22%) of the patients enrolled in the study were practicing good personal hygiene out of which 6(3%) were tested positive, while 156(78%) of the patients were living in an unhygienic condition out of which 8(4%) were tested positive (Table 3).

Also, the current study revealed that, the overall prevalence of *Schistosomiasis* in the study area was 7%. The prevalence according to the sex of the patients was found to be 3% among males and 4% among females. On the age basis, the prevalence was found to be 3.5% among Adolescents (10-19 years), 2% among young adults (20-24years), 1.5% among Adults (25-64years), but neither Children (0-9 years) nor Elderly (65years and above) individuals were found with the infection (Table 1).

Similarly, in relation to the risk factors of the infection, the prevalence of 4% was recorded among patients from low income families, 2% among middle class patients and 1% among high class patients. Also, high prevalence of the infection (4%) was seen among those who were swimming, while, 3% among those who did not swim in the river and other water bodies. Low prevalence of 3% was recorded among those who were having access to clean drinking water, while, 4% was seen among those who were lacking access to clean drinking water. Similarly, low prevalence (2.5%) was seen among patients living in environments with good sanitary conditions, while, high prevalence of 4.5% was seen among patients living in untidy environments. Furthermore, the prevalence of 3% was seen among patients practicing good personal hygiene, while, 4% was seen among patients living in an unhygienic condition (Table 2).

The bivariate and multivariate logistic regression analyses for the variables associated with risk factors of *Schistosomiasis* were presented in (Table 3). The crude odds ratio (COR) and confidence interval (CI) were found to be [COR(CI 95%): 0.879 (0.296-2.605)] among male patients. The results also revealed [COR(CI 95%): 0.768 (0.191-3.095)] among adolescents (10-19 years), and [COR(CI 95%): 0.538 (0.114-2.543)] among young adults (20-24 years). Also, [COR(CI 95%): 1.106(0.280-4.373)] was seen among patients from families with low socioeconomic status, and [COR(CI 95%): 0.700 (0.132-3.724)] in those from middle class families. Furthermore, the study recorded [COR(CI 95%): 0.035(0.007-0.162)] among patients swimming in river and other water bodies. Similarly, [COR(CI 95%): 0.576 (0.194-1.713)] was seen among those who have access to clean drinking water. The study also revealed [COR(CI 95%): 1.216(0.392-3.772)] and [COR(CI 95%): 0.342(0.112-1.046)] among those living in good environmental sanitary condition, and those practicing good personal hygiene respectively (Table 3).

Table 1: Prevalence of *Schistosomiasis* in relation to gender and age

Variables	Positive	Negative	Total	Prevalence (%)
Sex:				
Male	6	87	93	3.00
Female	8	99	107	4.00
Age:				
Children (0-9 years)	0.00	0.00	0.00	0.00
Adolescents (10-19 years)	7	95	102	3.50
Young adults (20-24years)	4	38	42	2.00
Adults (25-64years)	3	53	56	1.50
Elderly (65years and above)	0.00	0.00	0.00	0.00

Table 2: Prevalence of *Schistosomiasis* in relation to the risk factors

Variables	Positive	Negative	Total	Prevalence (%)
Socioeconomic status:				
Low class	8	118	126	4.00
Middle class	4	28	32	2.00
Upper class	2	40	42	1.00
Swimming in a river:				
Yes	8	68	76	4.00
No	6	118	124	3.00
Access to clean drinking water:				
Yes	6	68	74	3.00
No	8	118	126	4.00
Proper environmental sanitation:				
Yes	5	75	80	2.50
No	9	111	120	4.50

Good personal hygiene				
Yes	6	38	44	3.00
No	8	148	156	4.00

Table 3: Bivariate and multivariate logistic regression analyses for the variables associated with risk factors for *Schistosomiasis*

Variables	Frequencies			COR (95% CI)	AOR (95% CI)
	Positive (%)	Negative (%)	Total (%)		
Sex:					
Male	6(3.00)	87(43.50)	93(46.50)	0.879 (0.296-2.605)	
Female	8(4.00)	99(49.50)	107(53.50)	1	
Age:					
Children (0-9 years)	0	0	0		
Adolescents (10-19 years)	7(3.5)	95(47.50)	102(51.00)	0.768 (0.191-3.095)	
Young adults (20-24years)	4(2.00)	38(19.00)	42(21.00)	0.538 (0.114-2.543)	
Adults (25-64years)	3(1.50)	53(26.50)	56(28.00)	1	
Elderly (65years and above)	0	0	0		
Socioeconomic status:					
Low class	8(4.00)	118(59.00)	126(63.00)	1.106(0.280-4.373)	
Middle class	4(2.00)	28(14.00)	32(18.00)	0.700 (0.132-3.724)	
Upper class	2(1.00)	40(20.00)	42(21.00)	1	
Swimming in a river:					
Yes	8(4.00)	68(34.00)	76(38.00)	0.035(0.007-0.162)*	
No	6(3.00)	118(59.00)	124(62)	1	
Access to clean drinking water:					
Yes	6(3.00)	68(34.00)	74(37.00)	0.576 (0.194-1.713)	
No	8(4.00)	118(59.00)	126(63.00)	1	
Proper environmental sanitation:					
Yes	5(2.50)	75(37.50)	80(40.00)	1.216(0.392-3.772)	
No	9(4.50)	111(55.50)	120(60.00)	1	
Good personal hygiene					
Yes	6(3.00)	38(19.00)	44(22.00)	0.342(0.112-1.046)	
No	8(4.00)	148(74.00)	156(78.00)	1	

P value = 0.05 CL = 95%, "*" there is significant difference, "CRD" crude odds ratio, "AOR" adjusted odds ratio "CI" confidence interval, "%" percentage

3.2. Discussion

The current study revealed a *Schistosomiasis* prevalence of 7% in Katagum Local Government Area, Bauchi State. This finding aligns with previous study by Bassey and Umar (2004) who reported a similar prevalence of 6% in Yobe State, which may be attributed to the geographical proximity and shared environmental and socioeconomic factors between the two states. Both regions likely face similar water contact patterns, especially with communities relying on open water sources for domestic and agricultural use, thus contributing to comparable infection rates.

In contrast, Duwa *et al.,* (2009) reported a significantly higher prevalence of 44.2% in Minjibir Local Government, Kano State, Evans *et al*., (2013) reported a prevalence of 18.7% in both Plateau and Nasarawa States, Okoli and Odaibo (1999) reported a prevalence of 17.4% in Oyo State, Voke *et al*., (2014) documented a prevalence of 15.5% in Ebonyi State, and Nale *et al*., (2003) reported a prevalence of 11.5% in Adamawa State. These stark differences may be explained by the rural nature of the communities and more widespread water-contact activities, such as irrigation farming, fishing, and bathing in untreated water bodies. Additionally, differences in sanitation infrastructure and access to healthcare services among the study areas may have contributed to these disparities. Also, increased exposure to infested water bodies, possibly due to distinct ecological conditions that favor the proliferation of the snail intermediate hosts or differences in the effectiveness of control measures among the places, and differences in public health interventions could also account for the observed variation.

The observed differences in *Schistosomiasis* prevalence across these studies could be attributed to several factors. Variations in the geographic and climatic conditions across the different regions may influence the presence and distribution of the intermediate host snails, thereby impacting transmission rates. Water contact patterns also play a significant role, with areas heavily reliant on rivers and lakes for agricultural and domestic purposes showing higher rates of infection. Furthermore, disparities in public health interventions, including access to clean water, sanitation, and mass drug administration programs, are likely to contribute to these differences.

The similarities in prevalence between Bauchi and neighboring states, such as Yobe, may be due to shared socioeconomic challenges, including limited healthcare access and poor sanitation. Conversely, higher prevalence rates in regions such as Kano and Plateau may be indicative of more intense water-related activities, ecological conditions favorable to *Schistosomiasis* transmission, or less effective control measures.

In contrast to the current study, where the prevalence of *Schistosomiasis* was found to be 3% among males and 4% among females, several studies have reported higher infection rates in males than in females. For instance, Ivoke *et al*., (2014), Abdullahi *et al*., (2009), Bigwan et al. (2012), and Duwa et al. (2009) documented a higher prevalence of *Schistosomiasis* among males. This variation could be attributed to different environmental, behavioral, or occupational risk factors that differ by location and study population, influencing the exposure rates between sexes.

In contrast to the findings of the current study, which found a *Schistosomiasis* prevalence of 3% among males and 4% among females, several previous studies have reported higher infection rates in males. Ivoke *et al*., (2014), Abdullahi *et al*., (2009), Bigwan *et al*., (2012), and Duwa *et al*., (2009) documented a significantly higher prevalence of *Schistosomiasis* in males compared to females. This discrepancy in sex-based prevalence may be attributed to varying environmental, behavioral, and occupational factors that differ by location and study population, influencing the exposure rates between sexes.

Differences in local environmental conditions, such as proximity to water bodies harboring *Schistosoma*-infected snails, can contribute to sex-based prevalence variations. In many areas, males are more likely to engage in activities that increase their exposure to contaminated water, such as fishing or farming. In contrast, females' activities and roles, particularly in rural settings, might limit their exposure. However, in some regions, females may be involved in domestic chores like washing clothes or fetching water from infected water sources, increasing their risk of contracting *Schistosomiasis*. These behavioral differences may explain why previous studies found higher prevalence in males, while the current study identified a higher rate among females.

Also, occupational differences also play a role in determining *Schistosomiasis* risk. In rural areas, males are often engaged in occupations that involve regular contact with freshwater bodies, such as farming, fishing, and irrigation-related work, which may expose them to the parasite. In contrast, if the study population consists of a demographic where women are more frequently involved in water-related domestic activities, they might be at greater risk. This could explain the higher prevalence in females observed in our study.

The results of the current study showed that *Schistosomiasis* infection was absent in both children (0–9 years) and elderly individuals (65 years and above). This is noteworthy as it may suggest that the risk of infection in these age groups is either very low or non-existent in the study area. This finding aligns with previous reports that highlight lower prevalence rates in these age brackets, possibly due to limited exposure to contaminated water sources or immune-related factors associated with age.

Among the adolescent group (10–19 years), 3.5% were found to be positive for *Schistosomiasis*. This group had the highest infection rate compared to other age categories. This pattern is consistent with the findings of Ugochukwu *et al*., (2013), who reported a high number of *Schistosomiasis* cases in participants aged 10–19 years. Adolescents in this age group are likely more exposed to contaminated water bodies due to activities such as swimming or bathing in rivers, which are common in many rural settings. This age-related exposure pattern could explain the elevated infection rate observed.

In contrast, young adults (20–24 years) and adults (25–64 years) had lower prevalence rates, with 2% young adults and 1.5% adults testing positive, respectively. The decrease in prevalence among these older age groups may be attributed to changes in daily activities, with reduced contact with water bodies as they take on more occupational or domestic responsibilities that limit exposure. Additionally, acquired immunity from prior infections may play a role in the lower prevalence rates seen in older individuals.

Public health interventions, such as health education and preventive measures, on adolescents, who appear to be at higher risk of *Schistosomiasis* infection in the study area could immensely help in mitigating the danger of the infection.

The findings of this study underscore the significant influence of socioeconomic status, environmental conditions, and personal hygiene on the transmission of *Schistosomiasis* in Azare Katagum Local Government, Bauchi State. The data revealed marked differences in infection prevalence among patients from various socioeconomic backgrounds. Specifically, individuals from lower socioeconomic classes exhibited higher infection rates compared to those from middle and upper classes. This result aligns with previous research by Sady *et al*. (2013), Ugochukwu *et al*. (2013), and Al-Delaimy *et al*. (2014), all of whom identified socioeconomic disparities as critical risk factors for *Schistosomiasis*.

The study further identified swimming in rivers as a major risk factor for *Schistosomiasis* transmission. Patients who engaged in this activity had significantly higher infection rates compared to those who did not, consistent with earlier findings by Huang and Manderson (1992), which emphasized water contact activities as a dominant mode of transmission in endemic areas.

Access to clean drinking water and adequate sanitation emerged as protective factors. Patients without access to clean water had higher infection rates compared to those with access, reinforcing the importance of water quality and sanitation in preventing *Schistosomiasis*, as supported by previous studies. Similarly, individuals living in poor sanitary conditions were more prone to infection than those in cleaner environments. Additionally, personal hygiene was a key determinant, as patients practicing good hygiene had lower infection rates than those with poor hygiene, a finding that echoes the conclusions of Sady *et al*. (2013) and other scholars.

From a statistical perspective, the crude odds ratios for most variables examined did not reach statistical significance, with the exception of swimming in rivers and other water bodies. Patients who swam in these water bodies were 29 times more likely to contract the infection compared to those who did not engage in such activities. The presence of other variables did not significantly influence the risk of developing the infection in this population.

4. Conclusion

The study revealed a *Schistosomiasis* prevalence of 7% in Azare Katagum Local Government, Bauchi State, with significant variations in prevalence across regions due to socioeconomic and environmental factors. Lower socioeconomic classes were more affected, likely due to poor living conditions and lack of healthcare access. Similarly, adolescents aged 10–19 showed the highest prevalence due to higher exposure to contaminated water through recreational activities. While males traditionally showed higher infection rates, this study found slightly higher prevalence among females due to their water-related domestic activities. The study found a strong link between swimming in rivers and infection rates, with swimmers being 29 times more likely to contract the disease. Implementing community education on the dangers of water contact in infested areas and providing alternative safe water sources for domestic use are highly crucial in addressing this issue.

Authors' Contributions

Auwal Magaji performed the experiments and drafted the first manuscript. Zinat Mahmud paraphrased the manuscript and checked it for plagiarism. While Wada Gataji did grammar check and referencing.

Conflict of interest

The authors declare no conflict of interest.

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