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Original Article

Impact assessment of Schistosomiasis in Bauchi and transmission potential among School-Age Children treated with Praziquantel in Nasarawa Community, Nigeria

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ABSTRACT

Schistosomiasis, also known as bilharzia or snail fever, is one of the leading neglected tropical diseases affecting impoverished communities and causing severe morbidity. This study assessed the cure rate and transmission potential of *Schistosoma haematobium* infection among school-aged children treated with praziquantel in selected communities in Bauchi and Nasarawa States, Nigeria. A cross-sectional study was conducted between August 2024 and January 2025 involving 1,406 children aged 5–14 years from three Local Government Areas in Bauchi State and selected communities in Nasarawa State. Participants were recruited through systematic random sampling, and sociodemographic information was collected using structured questionnaires. Urine samples were collected in sterile universal containers and analysed using the syringe filtration technique. Data was analysed using chi-square and t-tests, with statistical significance set at $p < 0.05$ using SPSS version 23. In Bauchi State, 1,368 urine samples were examined, of which 144 tested positive for infection, giving an overall prevalence of 10.45%. Males recorded a higher prevalence (11.20%) than females (9.61%). The highest prevalence (18.13%) was observed among children aged 13–14 years. Following praziquantel treatment, the overall cure rate was 73.00%, whilst the prevalence reduction rate was 54.20%. In Nasarawa State, males showed a higher proportion of viable eggs (89.00%) compared with females (11.00%). Children aged 8–10 years recorded the highest number of viable *S. haematobium* eggs, indicating active transmission within the communities. The findings suggest that, despite ongoing school-based schistosomiasis control programmes, transmission persists in both states, and the impact of praziquantel-based interventions remains limited. Integrated control measures, including improved sanitation, health education, access to safe water, and snail control strategies, are recommended to achieve the sustainable elimination of schistosomiasis in Nigeria.

Keywords: Schistosomiasis, Preziquantel, Prevalence, Egg Viability and Impact Assessments.

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INTRODUCTION

Schistosomiasis, also known as bilharzia or snail fever, is one of the leading neglected tropical diseases (NTDs) that can affect people of all ages, irrespective of gender, religious belief, or socio-economic background, provided there is contact with freshwater bodies contaminated with schistosome larvae (cercariae). Schistosomiasis, as one of the NTDs, has been targeted by the World Health Organization for elimination as a public health problem by 2030, defined as a prevalence of less than 1% for heavy-intensity infections [1]. Globally, schistosomiasis is caused by dioecious blood flukes (digenetic trematodes) of the genus *Schistosoma* [2]. The parasite is transmitted through specific freshwater molluscan intermediate hosts, whilst humans of all age groups serve as definitive hosts [3]. It is the most prevalent NTD in sub-Saharan Africa [4,5,6] and remains a major public health problem in several tropical and subtropical countries. The burden of schistosomiasis is further exacerbated in low-income countries where access to clean water and adequate sanitation facilities is limited [7].

The five medically important species responsible for schistosomiasis worldwide are *Schistosoma haematobium*, *S. mansoni*, *S. japonicum*, *S. mekongi*, *S. guineensis*, and *S. intercalatum* [8,9]. Among these, the three principal species infecting humans are *Schistosoma haematobium*, *Schistosoma mansoni*, and *Schistosoma japonicum* [4]. These three species account for approximately 99% of human schistosomiasis infections [10], with the first two species being predominant and widely distributed across Africa [11], whilst *S. japonicum* is restricted to China, Indonesia, and parts of the Philippines [12].

Approximately 90% of schistosomiasis infections occur in African countries, where the disease causes considerable morbidity and may be fatal in some regions [13]. Globally, schistosomiasis places nearly one billion people at risk, with approximately 250 million individuals infected across 74 countries [14]. The life cycle of *Schistosoma* parasites involves complex interactions between aquatic snails, which serve as intermediate hosts, and mammals, which act as definitive hosts. Schistosomiasis ranks second only to malaria as a cause of morbidity and mortality in Africa, South America, the Caribbean, the Middle East, and parts of Asia, with prevalence varying across regions [1].

Nigeria bears the highest burden of schistosomiasis globally, with over 25 million reported cases, predominantly urogenital schistosomiasis (UgS) [15,16]. The disease was first documented in present-day Borno State, Nigeria, in 1881, and has since spread extensively across the country, although prevalence varies between districts [17,18]. Despite widespread praziquantel distribution programmes aimed at reducing morbidity, the prevalence of schistosomiasis in Nigeria may continue to increase due to poverty, inadequate healthcare infrastructure, and low levels of education [19].

In endemic regions, school-aged children are particularly vulnerable to schistosomiasis because of their frequent

involvement in water-related activities such as swimming, bathing, and fishing, which expose them to cercariae-infested water. The persistence of infection within this age group has been attributed to repeated exposure and behavioural practices associated with their daily activities [20].

Therefore, this study aims to assess the cure rate (CR) in Bauchi State and the transmission potential in communities within Nasarawa State among school-aged children treated with praziquantel as part of schistosomiasis elimination efforts.

MATERIALS AND METHODS

Study Area

This study was conduct Submitted: January 2026; Accepted: April 2026; Published: May 2026ed in three (3) LGAs (Toro, Bogoro, and Bauchi) of Bauchi State and three (3) communities of Nasarawa State. Nasarawa State is located in the north-central part of Nigeria within the Guinea savannah vegetation zone of Nigeria. Nasarawa State lies between latitude 7° 45' and 9° 25' N of the equator and between longitude 7° 42' and 9° 37' E of the Greenwich Meridian. It shares boundaries with Kaduna in the North, Plateau in the East, Taraba and Benue in the South, while Kogi and the Federal Capital Territory flank it in the West. The state has a total land area of 27,137.8 square kilometres and a total population of about 1,826,883 according to the 2006 population estimate.

Bauchi is a state in northern Nigeria, established in 1976 when the former North-Eastern State was broken up. The state occupies a total land area of 49,119 sq. km, representing about 5.3% of Nigeria's total land area, and has a total population of 4,653,066 according to the 2006 census. The state is located between Latitude 9° 3' and 12° 3' North and Longitude 8° 50' and 11° East. It is one of the northern states with two distinct vegetation zones, namely the Sahel and Sudan savannah. The state has 20 LGAs and is bordered by seven states: Kano and Jigawa to the north, Taraba and Plateau to the south, Gombe and Yobe to the east, and Kaduna to the west.

Fig.1: Map of Bauchi State showing the study LGAs

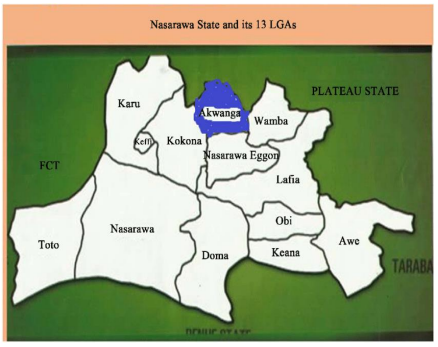

Fig.2: Map of Nasarawa state showing the study LGAs

Sample size

The required sample size for this study was determined using Cochran's formula, and the proportion of urinary schistosomiasis was assumed from a previous study (Bara and Balogun 2021) at Kirfi LGA of Bauchi state.

Cochran's formula is written as $n=z^2 pq/e^2$

n=sample size
z is the confidence level (Z=1.96 for 95%)
e is the desired margin of error (0.05)
P=proportion of urinary schistosomiasis in the population from previous study=27%
q=1-p
$n = (1.96x1.96)\ (0.27)\ (0.73)/0.05^2$
n=302
Therefore, the required size for this study was 302. However, because it is a supplementary study, the sample size was determined by the parent study, whereby all of the study participants were included

Study Design

A cross-sectional study was conducted between August 2024 and January 2025 to assess the impact of schistosomiasis on school-aged children in Bauchi State and the viability of *S. haematobium* eggs in Nasarawa State among children treated with praziquantel. This study compared the 50 samples taken from each of the 5 communities in the study area at the baseline survey before the mass drug administration (MDA) of praziquantel, with 30 samples taken from each of the 15 communities after the mass drug administration of praziquantel from 2017 to 2023, to test the efficacy of praziquantel in the study areas. The treatment of all SAC across all LGAs after the baseline survey, rather than only in sampled communities or infected subjects, was consistent with the WHO prevalence-based approach. For high prevalence (≥50%), annual treatment for school-aged children (SAC) is recommended, with consideration for adult treatment. For moderate prevalence (10-50%), SAC treatment is recommended every two years; for low prevalence (<10%), SAC treatment every three years is advised. However, the prevalence at the baseline of this study was 120(15.94%), which falls under the category of moderate prevalence that requires treatment for all SAC every two years.
Additionally, egg viability of *Schistosoma haematobium* was assessed in three communities (Katarnza, Andu, and Goni) in Nasarawa State, with 42-51 samples per community, to evaluate egg viability and transmission potential among school-aged children treated with praziquantel.

Study Populations

A total of 1,406 school-aged children, aged 5–14 years, were randomly selected and enrolled for the study using the WHO protocol (2013) to assess the efficacy of the anthelminthic drug PZQ against schistosomiasis in three LGAs (Toro, Bogoro, and Bauchi) of Bauchi State and two LGAs (Kokona and Akwanga) of Nasarawa State. A total of 753 SAC were sampled at the baseline survey, 1,406 at the impact assessment, and 143 for egg viability in Nasarawa State.
Exclusion and inclusion criteria of communities were considered in the comparison of baseline and impact assessment prevalence; likewise, the cure rate (CR)

Questionnaire

"Structured questionnaires, designed specifically for this study, were administered to obtain information on participants' socio-demographic characteristics, praziquantel intake, and knowledge of schistosomiasis. Each questionnaire was assigned a unique number for every participant, and its completion was verified.

Sample Collection and Examination for *Schistosoma haematobium* Eggs

Urine sample collection was carried out between 10 a.m. and 2 p.m. on the day, which coincided well with the circadian

rhythm of egg excretion of *S. haematobium* and also when metabolic activity was relatively high [15, 21]. Samples were obtained in a sterilised, wide-mouthed, tightly capped plastic container. Samples were transported in ice packs to the College of Science Malikya Laboratory of Bauchi State immediately after collection for analysis. In the laboratory, the urine filtration technique, as recommended by the WHO for the detection of *S. haematobium* eggs in urine, was used [22] Ten millilitres (10 mL) of the urine sample was aspirated into a syringe after agitating the urine in the sample bottle to stir the eggs, and it was gently forced through a 12µ pore-size polycarbonate membrane filter placed in a filter holder. The remnant of the urine was removed by forcing air through the filter membrane using an empty syringe. The filter holder was unscrewed, and the filter membrane was removed with the aid of forceps, placed on a microscope slide, and covered with a coverslip. A drop of iodine was then added to make the eggs clearer and viewed at ×40 magnification using a light microscope to identify the ova, which are characterised by a terminal spine. Egg intensity of infection was classified as light (<50 eggs/10 ml of urine) or heavy (≥50 eggs/10 ml) in accordance with the current World Health Organisation classification [1].

Egg viability was assessed at the Nasarawa State University Medical Centre Parasitology Laboratory for participants sampled in Nasarawa State, using the same procedure recommended by the WHO. All positive samples were subjected to egg viability testing by adding a drop of water to the positive samples and re-examined under the microscope for viable egg (ova) counts. All viable eggs on each slide were hatched to live miracidia.

Data Analysis

Data was entered into a Microsoft Excel spreadsheet and then exported to SPSS (version 23). Descriptive statistics, such as frequency, percentage, and mean values, were used to visualise the data. Inferential statistics, such as the chi-square test, were used to test for differences in the prevalence of *S. haematobium* infection. Statistical significance was considered at a 95% Confidence Level (CL) with a P-value of 0.05. The intensity of the infection was calculated by taking the average intensity (sum/count), and the intensity was classified into light (<50 eggs/10 mL of urine) and heavy infection (≥50 eggs/10 mL of urine). The prevalence reduction rate was calculated as: prevalence before treatment/after treatment prevalence before treatment ×100.

Cure rate = No of children excreting no *S.haematobium* egg/ the No of children with confirmed cases at baseline ×100

RESULTS

Baseline and Impact Assessment Prevalence

Prevalence of schistosomiasis at baseline and impact assessment in 3 LGAs. Of the 753 school-aged children who volunteered for the baseline survey and 1406 for the impact assessment in the 3 LGAs (Bauchi, Toro, and Bogoro), the overall prevalence was 120 (15.94%) and 144(10.24%), respectively. The prevalence increased drastically in Toro LGA from 14 (5.49%) to 56 (11.48%), which may be due to an increase in sample size. Differences in parasite prevalence across the LGAs were significant ($p<0.05$) except for Toro, which is statistically insignificant ($p>0.05$) (Table 1).

Table 1: Baseline and Impact Assessment Prevalence of Schistosomiasis in the Study LGAs

LGA	Baseline	Baseline Positive	Baseline Prevalence (%)	**Impact**	Impact Positive	Impact Prevalence (%)	χ^2	p-value	Significant Difference
Bauchi	249	38	15.26	459	41	8.93	10.88	0.001	Yes (Decrease)
Toro	255	14	5.49	488	56	11.48	0.59	0.441	No
Bogoro	249	68	27.31	459	47	10.24	46.92	<0.001	Yes (Decrease)
Total	**753**	**120**	15.94	**1406**	**144**	10.24	36.41	**<0.0001**	

Demographic Characteristics of Impact Assessment by LGA (N = 1,406)

A total of 1,406 school-aged children were surveyed across the three LGAs (Bauchi, Bogoro, and Toro). Males constituted 52.6% (n=740) and females 47.4% (n=666) of the sample. The sex distribution was fairly balanced, with male proportions ranging from 50.0% in Toro to 54.5% in Bauchi. The largest sample was from Toro (n=488), while Bauchi and Bogoro each contributed 459 children. Regarding age distribution, the 8–10 years group was the largest (35.3%, n=496), followed by 5–7 years (30.3%, n=426), 11–12 years (18.9%, n=266), and 13–14 years (15.5%, n=218). Toro had the highest proportion of younger children (71.3% aged 5–10 years) (Table 2)

Prevalence and intensity of *S.haematobium* among different age groups in the study population.

The highest prevalence of infection by age group was 21(7.89%) among participants who were between 11-12 years while those age group between 5-7 years had the lowest prevalence 26(6.10%). Differences in parasite infection were statistically insignificant ($p>0.05$) among the age groups. The highest number of light infection 28(75.68%) occurred in the 8-10 years old. The same age group had the highest number of subjects with heavy infection 9(24.32%) and mean intensity of 39.19 eggs/10ml of urine. Those aged 13-14 years had the lowest number of light infection 10(71.43%) and heavy infection 4(28.57%) with a mean intensity of 18.00 eggs/10ml of urine. There was no significant difference ($p>0.05$) in parasite intensity among the age groups (Table 3)

The prevalence and intensity of *S. haematobium* infection among the study population with respect to gender.

The prevalence of infection between the genders was 58(7.84%) in males and 40(6.01%) in females. There was no significant difference ($p>0.05$) in the prevalence of infection by gender. Light intensity (<50eggs/10ml of urine) was higher (87.50%) in females than in males (74.14%), while more (25.86%) males had heavy infection (>50 eggs/10ml of urine) than the females who had 5(14.28%) of the infection. Mean intensities of 43.45 and 18.43were observed in males and females respectively. There was no significant difference in the intensity with respect to the gender of the participant ($p>0.05$) (Table 4)

Table 2: Demographic Characteristics of Participants in Impact Assessment (N = 1,406)

LGA	Total	Male n (%)	Female n (%)	Age 5–7 n (%)	Age 8–10 n (%)	Age 11–12 n (%)	Age 13–14 n (%)
Bauchi	459	250(54.5)	209 (45.5)	115 (25.1)	162 (35.3)	97 (21.1)	85 (18.5)
Bogoro	459	246 (53.6)	213 (46.4)	141 (30.7)	156 (34.0)	83 (18.1)	79 (17.2)
Toro	488	244 (50.0)	244 (50.0)	170 (34.8)	178 (36.5)	86 (17.6)	54 (11.1)
Total	1406	740 (52.6)	666 (47.4)	426 (30.3)	496 (35.3)	266 (18.9)	218 (15.5)

Table 3: Prevalence and Intensity of *S. haematobium* by Age Group

Age (years)	Examined	Infected n (%)	Light Infection n (%)	Heavy Infection n (%)	Mean Intensity (eggs/10 ml urine)
5–7	426	26 (6.10)	25 (96.15)	1 (3.85)	41.15
8–10	496	37 (7.46)	28 (75.68)	9 (24.32)	39.19
11–12	266	21 (7.89)	15 (71.43)	6 (28.57)	23.10
13–14	218	14 (6.42)	10 (71.43)	4 (28.57)	18.00
Total	1406	98 (7.00)	78 (79.59)	20 (20.41)	33.23

$\chi^2 = 3.82$, $p = 0.281$ (prevalence)
$p = 0.097$ (intensity)

Table 4: Prevalence and Intensity of *S. haematobium* by Gender

Gender	Examined	Infected n (%)	Light Infection n (%)	Heavy Infection n (%)	Mean Intensity
Male	740	58 (7.84)	43 (74.14)	15 (25.86)	43.45
Female	666	40 (6.01)	35 (87.50)	5 (12.50)	18.43
Total	1406	98 (7.00)	78 (79.59)	20 (20.41)	33.23

$\chi^2 = 2.15$, $p = 0.142$
Intensity $p = 0.071$

Comparison of Baseline and Impact Assessment of Schistosomiasis

Table 5 shows a change in prevalence from the baseline survey to Impact Assessments. Out of the 753 participants examined at the baseline survey, 120 participants tested positive with a prevalence of 15.94%, and of the 452 participants examined at the impact assessment, 33 participants tested positive with a prevalence of 7.30% there was a change in prevalence from 120(15.94%) to 33(7.30%) and a prevalence reduction rate of (54.20%). No participants tested positive at Digan yaya and JSSDYelwa at both the baseline and impact assessments. In contrast, Yabran Kofai, Banram South, and Lafia Sara showed a 100% reduction in prevalence, whereas the Lame community showed an increase in disease prevalence (Table 5)

The efficacy of praziquantel and the cure rate (CR).

Of the 120 participants who tested positive at baseline before the MDA, 32 tested positive at the impact assessments, while 88 tested negative, yielding a cure rate of 73.00%. No participant was cured at Narbordo and Takabundo communities, and Yabran, Lafiyan Sara, and Banram South had (100%) cured rate, while the Lame community showed an emergence of disease (Table 6)

Egg Viability of *S. haematobium* by Age Group.

Out of the 51 participants examined, there was an overall prevalence of 10(19.60), with a total of 100 viable eggs and 92 no viable eggs, respectively. Age group 13-14 years had the highest prevalence, while 5-7 years had the least prevalence 3 (27.27) and 1(11.11) respectively. In terms of egg viability, 8-10 years had the highest number of viable eggs (39) of viable eggs while 11-12 years had the highest number of no viable eggs (36) across the age group (Table 7)

Table 5: A Reduction in prevalence from Baseline to Impact Assessment in 15 communities to ascertain the PZQ efficacy

Community	No Examined		Prevalence (%)		
	Baseline	Impact	Baseline	Impact	Reduction rate (%)
Bishirin Fulani	51	31	4(7.84)	2(6.45)	17.73
Digan yaya	49	30	0(0.00)	0(0.00)	0.00
Kangere	50	30	8(16.00)	1(3.33)	79.40
Miri	52	31	11(21.15)	7(22.58)	6.76
Rafin makaranta	47	30	15(31.91)	8(26.67)	16.42
Lame	50	30	0(0.00)	1(3.33)	0.00
Takabundu	50	30	1(2.00)	1(3.33)	66.50
Toro	50	30	3(6.00)	2(6.67)	11.17
Gumau	50	30	9(18.00)	6(20.00)	11.11
Nabordo	55	30	1(1.82)	1(3.33)	82.96
Lafiyan sara	50	30	17(34.00)	0(0.00)	100.00
Bogoro central	49	30	40(81.63)	4(13.33)	83.67
JSSD/yelwa	50	30	0(0.00)	0(0.00)	0.00
Yabran kufai	50	30	9(18.00)	0(0.00)	100.00
Banram south	50	30	2(4.00)	0(0.00)	100.00
Total	753	452	120(15.94)	33(7.30)	54.20

Table 6 shows the % difference and cure rate from baseline to impact assessment.

Community	Baseline	Impact	Difference	% Difference	Remark
Bishirin Fulani	4	2	2	50.00	possible cure rate
Digan yaya	0	0	0	0.00	Not infected
Kangere	8	1	7	88.00	possible cure rate
Miri	11	7	4	36.00	possible cure rate
Rafin Makaranta	15	8	7	47.00	possible cure rate
Lame	0	1	0	0.00	An emergence
Takabundu	1	1	0	0.00	There was no cure
Toro	3	2	1	33.00	possible cure rate
Gumau	9	6	3	33.00	possible cure rate
Nabordo	1	1	0	0.00	There was no cure
Lafiyan sara	17	0	17	100.00	possible cure rate
Bogoro central	40	4	36	90.00	possible cure rate
JSSD/Yelwa	0	0	0	0.00	Not infected
Yabran	9	0	9	100.00	possible cure rate
Banram South	2	0	2	100.00	possible cure rate
Total	120	32	88	73.00	

CR = No of children excreting no schistosome eggs after treatment /No of children with confirmed infection before treatment × 10

Table 7: Egg viability of *Schistosoma haematobium* in the Andu community of Nasarawa state by age group

			Egg viability		
Age group	No Examined	No Infected (%)	Viable	No viable	p-value
5-7	9	1(11.11)	17	7	0.684
8-10	14	3(21.43)	39	32	
11-12	17	3(17.65)	24	36	
13-14	11	3(27.27)	20	17	
Total	51	10(19.60)	100	92	

DISCUSSION

Schistosomiasis remains a major neglected tropical disease and a persistent public health concern in sub-Saharan Africa, including Nigeria. The baseline prevalence of 15.94% recorded in this study clearly confirms that the disease is endemic in the study area and falls within the moderate-risk category as defined by [1]. This level of endemicity suggests sustained transmission within the population, likely driven by continuous exposure to infested water sources and inadequate environmental sanitation. This finding is consistent with reports from Maiduguri (14.5%) and Anambra State (15.7%) [23], indicating comparable transmission dynamics across different ecological zones in Nigeria. The general decline in prevalence following intervention further demonstrates the responsiveness of the disease to control efforts, particularly chemotherapy.

However, the prevalence observed in this study contrasts sharply with significantly higher rates reported in other regions of Nigeria, such as Ogun State (58.10%), Kwara State (58.70%), and Benue State (55.00%) [15, 25, 26]. These marked differences may be attributed to variations in ecological and socio-environmental factors, including proximity to freshwater bodies, levels of hygiene and sanitation, and the availability of safe water. In areas with higher prevalence, transmission is often intensified by frequent human-water contact activities such as fishing, irrigation, and domestic usage. The demographic characteristics further emphasise that school-aged children, particularly those within active and exploratory age groups, are disproportionately exposed, thereby sustaining transmission cycles.

The significant reduction in prevalence from 15.94% to 10.24% following intervention provides strong evidence for the effectiveness of mass drug administration (MDA) programmes in reducing disease burden. This observation aligns with findings from previous studies [27], which demonstrated that repeated chemotherapy significantly lowers the prevalence and intensity of infection. The

pattern of decline across LGAs suggests that intervention coverage was generally effective. Nevertheless, the persistence of infection despite intervention underscores the limitation of chemotherapy alone in interrupting transmission.

In contrast, the increase in prevalence observed in Toro LGA, although statistically insignificant, deviates from the overall declining trend. This anomaly may be attributed to several factors, including increased sample size during post-intervention assessment, behavioural patterns leading to repeated exposure, and possible gaps in treatment coverage. Reinfection is a well-documented challenge in schistosomiasis control, particularly in communities with persistent environmental contamination. Similar fluctuations have been reported in longitudinal studies [28], highlighting the dynamic nature of transmission in endemic settings.

The predominance of *Schistosoma haematobium* over *Schistosoma mansoni* observed in this study is consistent with findings from northern Nigeria [24], where urinary schistosomiasis is more prevalent due to ecological suitability for *Bulinus* snail hosts. However, this contrasts with reports from East Africa, where *Schistosoma mansoni* predominates [29]. Such differences are largely influenced by environmental conditions, including water pH, temperature, and vegetation, which determine the distribution of intermediate host snails.

Age-related patterns observed in this study reveal a higher prevalence among children aged 8–12 years, which is consistent with findings by [30] and Senghor [31]. This age group is typically more active and frequently engages in water-related recreational and domestic activities, increasing their risk of exposure. However, this contrasts with findings by [32], who reported a higher prevalence among younger children. Such discrepancies may reflect differences in MDA coverage, as younger children are sometimes excluded from treatment programmes.

Gender-based analysis revealed a higher prevalence among males, which aligns with findings by [33]. This may be explained by increased male involvement in outdoor activities such as swimming and fishing. However, contrasting findings have been reported by [15,34], where females exhibited higher infection rates due to domestic water contact activities. These differences underscore the influence of sociocultural and behavioural factors on exposure risk.

The observed prevalence reduction rate of 54.20% and cure rate of 73.0% indicate a substantial impact of praziquantel treatment. These findings are comparable to [1]reports but remain lower than cure rates exceeding 85–90% reported elsewhere [35]. The variation in treatment outcomes across communities suggests differences in drug efficacy, compliance, and reinfection rates. The persistence of infection in some communities highlights the challenge of achieving complete elimination through chemotherapy alone.

CONCLUSION

Schistosomiasis remains endemic in the study area despite reductions in prevalence following mass drug administration with praziquantel,

confirming the effectiveness of the intervention. However, persistent infections, evidence of reinfection, and the presence of viable eggs indicate ongoing transmission and suggest that chemotherapy alone is insufficient for disease elimination. Higher infection rates among school-aged children and the predominance of *Schistosoma haematobium* highlight the influence of environmental and behavioural factors on transmission dynamics. These findings underscore the need for integrated control strategies, including improved sanitation, access to safe water, health education, and sustained treatment coverage, to achieve effective and sustainable schistosomiasis control.

Declarations

Authors Contribution

YP conceptualised and designed the study. AGA and YP participated in field work, laboratory work and data collection. EJO performed data analysis and interpreted the data. YP prepared the first draft of the manuscript, reviewed by AGA, ORJ, and YAB. All authors contributed to the development of the final manuscript and approved its submission.

Disclosure of Conflict of Interest

None.

Ethics Approval and Informed Consent

The ethical clearance with reference number FMC/KF/HREC/02723/24 for this study was obtained from the Federal Medical Centre Keffi (FMCK) Health Research Ethics Committee. All participants were duly informed of the objective of the study and the protocol for sample collection. Consent forms for the children were signed by the head teachers of all schools visited. Participation was voluntary for all participants.

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REFERENCES

1. World Health Organization. (2020). Ending the neglect to achieve the Sustainable Development Goals: A roadmap for neglected tropical diseases 2021–2030
2. Atalabi, T. E., Adoh, S. D., & Eze, K. M. (2018). The current epidemiological status of urogenital schistosomiasis among primary school pupils in Katsina State, Nigeria. *PLoS Neglected Tropical Diseases,* 12(7), e0006636.
3. UChendu O., Oladoyin V., Idowu M., Adeyera O., Olabisi O., Oluwatosin O., and Leigh G. (2017). Urinary schistosomiasis among vulnerable children in a rehabilitation home in Ibadan, Oyo state, Nigeria. BMC Infect. Dis. ;17(1):1–7. doi: 10.1186/s12879-017-2591-6.
4. Colley, D. G., Bustinduy, A. L., Secor, W. E., & King, C. H. (2014). Human schistosomiasis. *The Lancet,* 383(9936), 2253–2264.
5. Lai, Y. S., Biedermann, P., Ekpo, U. F., Garba, A., Mathieu, E., Midzi, N., Mwinzi, P., N'Goran, E. K., Raso, G., Assaré, R. K., Sacko, M., Talla, I., Tchuenté, L. A. T., Touré, S., Winkler, M. S., Utzinger, J., & Vounatsou, P. (2015). Spatial

distribution of schistosomiasis. *Advances in Parasitology,* 87, 1–81.
6. McManus, D. P., Dunne, D. W., Sacko, M., Utzinger, J., Vennervald, B. J., & Zhou, X. N. (2018). Schistosomiasis biology. *Nature Reviews Disease Primers,* 4, 1–19.
7. Hotez, P. J., Fenwick, A., Savioli, L., & Molyneux, D. H. (2007). Rescuing the bottom billion through control of neglected tropical diseases. *The Lancet*, 373, 1570–1575.
8. Abe, E. M., Guan, W., & Guo, Y. H. (2018). Differentiating snail intermediate hosts of Schistosoma spp. using molecular approaches: Fundamental to successful integrated control mechanism in Africa. *Infectious Diseases of Poverty*, 7, 1–13. https://doi.org/10.1186/s40249-018-0401-z
9. Hirose, Y., Hirai, H., & Agatsuma, T. (2007). Hybridisation of schistosomes. *Parasitology International*, 56, 1–7.
10. Pinto-Almeida, A., Mendes, T., & de Oliveira, R. N. (2016). Morphological characteristics of Schistosoma mansoni praziquantel-resistant and -susceptible strains in the presence of praziquantel. *Frontiers in Microbiology,* 7, 594. https://doi.org/10.3389/fmicb.2016.00594
11. Merrifield, M., Hotez, P. J., Beaumier, C. M., Gillespie, P. M., Strych, U., & Bottazzi, M. E. (2016). Advancing vaccines for schistosomiasis. *PLoS Neglected Tropical Diseases*, 10, e0004411
12. Gordon, C. A., Kurscheid, J., & Williams, G. M. (2019). Asian schistosomiasis: Current status and prospects. *Advances in Parasitology*, 105, 1–44.
13. Aula, O. P., & McManus, D. P. (2021). Schistosomiasis with a focus on Africa. *Tropical Medicine and Infectious Disease*, 6, 109
14. Sow, S., Kone, B., & Toure, S. (2023). Global schistosomiasis burden. *Global Health Journal,* 7, 1–10.
15. Chitsulo, L., Engels, D., Montresor, A. and Savioli, L. (2000). The global status of schistosomiasis and its control. *Acta Tropica*, 77: 41–51.
16. Ekpo, U. F., Laja-Deile, A., Oluwole, A. S., Sam-Wobo, S. O., & Mafiana, C. F. (2011). Urinary schistosomiasis among preschool children in a rural community near Abeokuta, Nigeria. *Parasites & Vectors*, 3, 1–5.
17. Cowper, S. G., Highton, R. B., & Knight, G. W. (1963). The distribution of schistosomiasis in Nigeria. *Annals of Tropical Medicine & Parasitology,* 57, 307–322.
18. Ezeh, C. O., Onyekwelu, K. C., & Akinwale, O. P. (2019). Urinary schistosomiasis in Nigeria: A 50-year review. *Parasite*, 26, 19.
19. Ajakaye, O. G., Akinwale, O. P., Ajayi, M. B., & Adeneye, A. K. (2016). Prevalence and risk factors of urinary schistosomiasis in Nigeria. *African Journal of Infectious Diseases,* 10(2), 67–74.
20. Amuga, G. A., Nebe, O. J., Nduka, F. O., Njepuome, N., Dakul, D. A., Isiyaku, S., Ngige, E., Jibrin, S., Jacob, S. M., Nwoye, I. A., Nwankwo, U., Urude, R., Aliyu, S. M., Garba, A., Adamani, W., Nwosu, C. O., Anagbogu, I. A., Dixon, R., Clark, A., & Adeoye, G. O. (2020). Schistosomiasis: Epidemiological

factors enhancing transmission in Nigeria. *Global Research Journal of Public Health Epidemiology*, 8(7), 23–32.

21. Manyangadze, T., Chimbari, M. J., Gebreslasie, M., Ceccato, P. & Mukaratirwa, S. (2016). *Modelling the spatial and seasonal distribution of suitable habitats of schistosomiasis intermediate host snails using Maxent in Ndumo area, KwaZulu-Natal Province, South Africa*. *Parasites & Vectors*, 9: 572.
22. Ngasala, B., Juma, H. & Mwaiswelo, R. O. (2020). *The usefulness of indirect diagnostic tests for Schistosoma haematobium infection after repeated rounds of mass treatment with praziquantel in Mpwapwa and Chakechake districts in Tanzania*. *International Journal of Infectious Diseases*, 90, 132–137.
23. Dawaki, S., Al-Mekhlafi, H. M., Ithoi, I., Ibrahim, J., Abdulsalam, A. M., Ahmed, A., Sady, H., Atroosh, W. M., Al-Areeqi, M. A., & Elyana, F. N. (2016). Prevalence and risk factors of schistosomiasis among Hausa communities in Kano State, Nigeria. *Revista do Instituto de Medicina Tropical de São Paulo,* 58, 54.
24. Joseph, M., Gaji, B., Muhammad, T., Baba, M., & Thilza, I. (2010). Incidence of schistosomiasis in primary school pupils with particular reference to *Schistosoma haematobium* in Maiduguri. *Researcher*, 2(3), 31–36.
25. Bolaji, O., Elkanah, F., Ojo, J., Ojurongbe, O., & Adeyeba, O. (2015). Prevalence and intensity of *Schistosoma haematobium* among school children in Ajase-Ipo, Kwara State, Nigeria. *Asian Journal of Biomedical and Pharmaceutical Sciences*, 5(43), 1–6.
26. Amuta, E., & Houmsou, R. (2014). Prevalence, intensity of infection and risk factors of urinary schistosomiasis in pre-school and school-aged children in Guma Local Government Area, Nigeria. *Asian Pacific Journal of Tropical Medicine*, 7, 34–39.
27. Ugbomoiko, U. S., Ofoezie, I. E., Okoye, I. C., & Heukelbach, J. (2010). Factors associated with urinary schistosomiasis in two peri-urban communities in South-Western Nigeria. *Annals of Tropical Medicine & Parasitology*, 104, 409–419.
28. Stothard, J. R., Campbell, S. J., Osei-Atweneboana, M. Y., Durant, T., Stanton, M. C., Biritwum, N.-K., Rollinson, D., Eloundou Ombede, D. R. & Tchuem-Tchuenté, L.-A. (2017). Towards interruption of schistosomiasis transmission in sub-Saharan Africa: Developing an appropriate environmental surveillance framework to guide and support "end game" interventions. *Infectious Diseases of Poverty*, 6: 10.
29. Steinmann, P., Keiser, J., Bos, R., Tanner, M. & Utzinger, J. (2006). Schistosomiasis and water resources development: Systematic review, meta-analysis, and estimates of people at risk. *The Lancet Infectious Diseases*, 6(7): 411–425. https://doi.org/10.1016/S1473-3099(06)70521-7
30. Oluwole, A. S., Adeniran, A. A., Mogaji, H. O., Olabinke, D. B., Abe, E. M., & Bankole, S. O. (2018).

Prevalence, intensity, and spatial co-distribution of schistosomiasis and soil-transmitted helminths infections in Ogun State, Nigeria. *Parasitology.* 7, 1–10.

31. Senghor, B., Diaw, O. T., Doucouré, S., Sylla, S. N., & Sène, M. (2019). Transmission dynamics of schistosomiasis. *Parasite Epidemiology and Control*, 5, 1–9.
32. Gbalégba, N'Guessan G. C., Silué, K. D., Ba, O., Ba, H., Tian-Bi, N. T. Y., Yapi, G. Y., Kaba, A., Koné, B., Utzinger, J. & Koudou, B. G. (2017). Prevalence and seasonal transmission of *Schistosoma haematobium* infection among school-aged children in Kaedi town, southern Mauritania. *Parasites & Vectors*, 10(1): 353.
33. Kabiru, M., Ikeh, E. I., Aziah, I., Julia, O., Fabiyi, J. P., & Mohamed, R. A. (2013). Prevalence of Schistosoma haematobium in Sokoto State,
36.

Nigeria. *International Journal of Tropical Medicine and Public Health*, 2(1), 12–21.

34. Akinboye, D. O., Ajisebutu, J. U., Fawole, O., Agbolade, O. M., & Akinboye, O. O. (2011). Urinary schistosomiasis, water contact frequency and infectivity among secondary school students in Ibadan, Nigeria. *Nigerian Journal of Parasitology.* 4, 454–456

35. Utzinger, J., Raso, G., Brooker, S., De Savigny, D., Tanner, M., Ørnbjerg, N., Singer, B. H. and N'Goran, E. K. (2009). Schistosomiasis and neglected tropical diseases: Towards integrated and sustainable control and a word of caution. *Parasitology*, 136(13): 1859–1874. https://doi.org/10.1017/S0031182009991600