EPIDEMIOLOGY OF SCHISTOSOMIASIS IN KOROKPAN COMMUNITY PAIKORO LGA, NIGER STATE, NIGERIA

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ABSTRACT

This study examined the prevalence of schistosomiasis in Korokpan community, its intermediate host and associated risk factors. Six hundred and twenty-three (396 urine and 227 stool) samples were collected randomly from the students who consented after obtaining some vital sociodemographic characteristics and associated risk factors using a questionnaire. The stool samples were processed using formol ether concentration techniques while the urine samples were processed by ordinary centrifugal sedimentation technique. Snails were sampled from October 2021 to January 2022. They were identified according to shell morphology and the rates of schistosome cercarial shedding recorded. Also, the physic-chemical parameters of the fresh water were determined using standard methods. The study showed an overall prevalence of schistosomiasis in the study area to be 44.78% with 57.58% urinary schistosomiasis and 22.47% intestinal schistosomiasis. The infection rate was significantly higher in males (47.32%) compared to the females (34.17%). The result indicates that there is an increase in prevalence with increase in age. Age group 11 -15 years had the highest rate (53.77%) of infection, followed by 16-20 years age group with 32.04% rate of infection. The results of this present research also showed that aquatic snails are present in the study area with variation in the number of snails sampled monthly. Two different types of snail species intermediate host were encountered Bulinus globosus and Biomphalaria pfeifferi with Bulinus globosus more abundant than Biomphalaria pfeifferi. The mean of the selected physio-chemical parameters of water bodies were found to be within the range that can support snail population. This study therefore, calls for effective snails control programme and public awareness on the role of snails in transmitting animal trematode in the area.

KEYWORD: Physico Chemical, Prevalence, , Schistosomiasis, Snails

1.0 INTRODUCTION

Schistosomiasis or bilharziasis (Fitsarin Jini/ Tsargiya) is a Neglected Tropical Disease (NTD), endemic in Africa and is reported to be second to malaria in terms of socioeconomic and health impact in tropics (Inobaya *et al.*, 2014). It is a parasitic disease caused by parasites of the genus *Schistosoma* (Chen *et al.*, 2020). Among the species of *Schistosoma*, *S. mansoni*, *S. haematobium*, and *S. japonicum* are the major causes of human schistosomiasis globally (Chuah *et al.*, 2019). However, *Schistosoma mansoni* and *S. haematobium* are widely distributed and the dominant cause of human schistosomiasis in Africa (WHO, 2019).

Molluscs serve as intermediate hosts to schistosomiasis (Chen *et al.*, 2020). People generally become infected when they comes in contact with infected river harbouring cercariae-shedding snail. The infective larvae mechanically penetrate their skin migrates via the venous system to the portal vein of the intestine or the bladder where they eventually mature and lay eggs that scar tissues of the organs, which eventually results to disease condition (Angaye, 2016). Essentially, the disease is grouped into two: urogenital schistosomiasis and intestinal schistosomiasis based on the organs affected (Njunda *et al.*, 2017). Approximately 90% of the cases occur in Africa of which nearly two-thirds are caused by *S. haematobium*. Nigeria has the highest prevalence among the 75 countries in which the disease is endemic (Uchendu *et al.*, 2017; WHO, 2019). Intermediate host of schistosomiasis are distributed in many habitats as they can be adapted in wide range of environments. It diversity, distribution and abundance is determined by many factors that includes pH, water temperature, nutritive content of the water body, dissolved oxygen, physical nature of the substratum, calcium ion and depth (Alhassan *et al.*, 2016).

Schistosomiasis is one of the most prevalent endemic parasitic infections in Nigeria and has serious social and developmental impact on humans, most especially children showing signs of anemia, abdominal pain, reduced growth rate, learning difficulties, etc. (Ugochukwu *et al.*, 2013). Korokpan is surrounded by water body and most of their activities is in line with water e.g fishing and farming and that's one of the predisposing factor of schistosomiasis. The prevention and control of schistosomiasis has become crucial and resource demanding through implementation of health programs. Thus, generation of data on the disease prevalence would be very essential. To understand the transmission, control, and eventual elimination of schistosomiasis, accurate identification of schistosome species infecting intermediate host snails is imperative. Therefore, this study examined the prevalence of schistosomiasis in Korokpan community, its intermediate host and associated risk factors.

2. MATERIALS AND METHODS

2.1 Study Area

A cross-sectional community-based study was conducted among primary school children in Korokpan community of Paikoro LGA, Niger State.

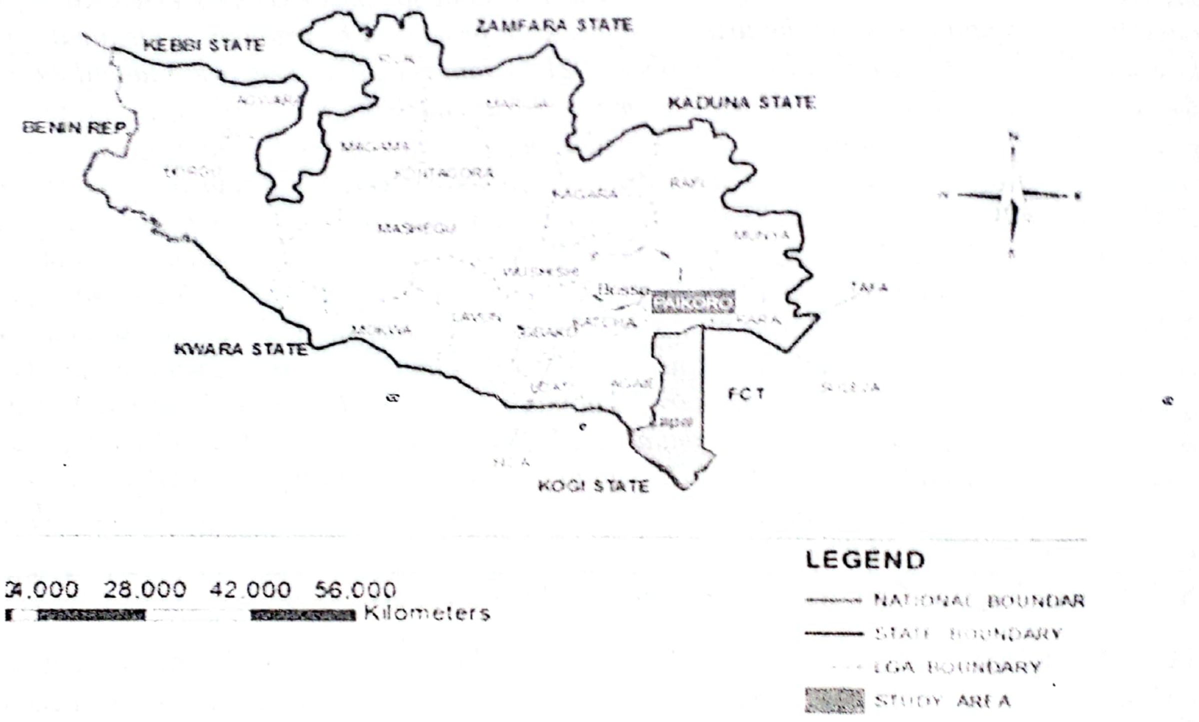

Figure 1: Map of Niger State Showing Paikoro LGA

2.2 Study Population

A total of 623 individuals who agree voluntarily to participate in this study were used for this study. Their stool and urine samples were collected and used for this study. This was done according to the method describe by Ojo *et al.* (2021). A pre-validated questionnaire was applied to the participants in order to collect demographic data, socio-economical background, behavioural risks and environmental sanitation and living conditions of the people (Dawaki *et al.*, 2016).

2.3 Sample Collection and Parasitological Examination

Stool and urine samples were collected from each participant, between 9am and 2pm, into 100 ml clean containers with wide mouth and screw-cap. Stool samples were examined by direct microscopy, formalin ether sedimentation and Kato Katz methods for the presence of *S. mansoni* eggs as described by Dawaki *et al.* (2016). To determine the worm burden, egg counts were taken and recorded as eggs per gram of faeces (EPG) for each positive sample and the intensity of infections were graded as heavy (400 EPG), moderate (100–399 EPG) or light (1–99 EPG) (Ojo *et al.*, 2021).

Similarly, urine samples were examined for haematuria. To achieve this, ten (10) milliliters of urine was transferred to the test tubes and centrifuged at 3000g for 5 minutes using bench centrifuge. For identification of *Schistosoma* eggs, after centrifugation, the supernatant was discarded and 10 μL the urine sediments were examined for the eggs of *Schistosoma* using ×10 objective nose of light microscope. The number of eggs was counted on several fields of the preparation with ≥ 50 eggs/10 mL of urine considered heavy infection according to the method described by Ojo *et al.* (2021).

2.4 Snail abundance, identification and determination of infestation rates

Snails were collected in selected river/pond using a scoop net between the hours of 8.00 am and 9.00 am at monthly intervals. Collected snails from each sampling site were placed in 50 ml plastic containers and transferred to the laboratory (Senghor *et al.*, 2015). The sampled snails were rinsed with tap water, sorted and classified according to shell morphology using the field identification keys described by Senghor *et al.* (2015). Snail abundance was determined by calculating the total number of snails collected per month. Each snail was tested by placing in glass tube with 10 ml of filtered water and exposed to direct sunlight or to electric light for 30 to 40 min to induce cercarial shedding. The schistosome cercariae issued by infested snails were then checked under a dissecting microscope and identified (Senghor *et al.*, 2015). The ratio of the snail number shedding *Schistosoma* spp cercariae and the total number of snails tested were represented the infestation rate.

2.5 Physico-chemical Analysis

Water temperature was determined with common mercury-in-glass thermometer (-10-1100C range), pH was determined with Jenway 3305 pH meter model at room temperature while Total Hardness (mg/L), Dissolved Oxygen (mg/L) and Biological Oxygen Demand (BOD) were determined using Winkler's method as reported by Adebola *et al.* (2015).

2.6 Data Analysis

Data collected from the field study and those generated in laboratory studies was processed into means and standard deviation using Microsoft Office Excel 2010. The species composition, relative abundance and physico-chemical properties of the intermediate snail host was represented in percentages and Bar charts. Chi-square analysis using Statistical packages for social Scientists-version 20(SPSS-20.0) was used to test for statistical differences between the distributions of schistosomiasis infection by age and gender. All decisions on statistical comparison of means were taken at $p<0.05$ level of significance.

3.0 RESULTS

3.1 Prevalence of schistosomiasis among children in Korokpan Community

Out of the 396 urine samples examined, 228(57.58%) were positive for *S. haematobium* as shown in Table 1. Also, out of the 227 stool samples examined, 51(22.47%) were positive for *S. mansoni* (Table 2). The overall prevalence showed that out of 623 samples examined, 279(44.78%) were positive for schistosomiasis (*S. haematobium* and *S. mansoni*). The result therefore showed a high prevalence of schistosomiasis (*S. haematobium* and *S. mansoni*) among children in Korokpan community paikoro LGA, Niger State.

Table 1: Prevalence of *S. haematobium* in the study population

Sample	No. Examined	No. Positive	Percentage Positive (%)
Urine	396	228	57.58

Table 2: Prevalence of *S. mansoni* in the study population

Sample	No. Examined	No. Positive	Percentage Positive (%)
Stool	227	51	22.47

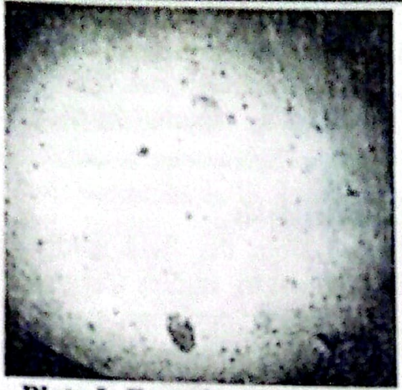

Plate I: Egg of schistosomes

3.2 Prevalence of schistosomiasis in relation to Gender

Table 3 shows the prevalence of schistosomiasis in relation to gender of the school children in the study area. The infection rate was significantly higher ($p < 0.05$) among males (47.32%) than among females (34.17%). *S. haematobium* was higher in males (59.94%) than females (46.38%). Similarly, *S. mansoni* was higher (23.86%) among male students than 17.65% in females.

Table 3: Prevalence of schistosomiasis in relation to Gender

Sample	Urine			Stool			Overall prevalence
	No. Examined	No. Positive	Percentage Positive (%)	No. Examined	No. Positive	Percentage Positive (%)	
Male	327	196	**59.94**	176	42	**23.86**	**47.32**
Female	69	32	**46.38**	51	9	**17.65**	**34.17**
TOTAL	396	228	57.58	227	51	22.47	44.78

X^2= 16.321; df=1; P=0.005

3.3 Prevalence of schistosomiasis in relation to Age Group

The result of the prevalence of schistosomiasis in relation to age groups is presented in Table 4. The result indicates that there is an increase in prevalence with increase in age. Age group 11 -15 years had the highest rate (53.77%) of infection, followed by 16-20 years age group with 32.04% rate of infection. The lowest rate of infection was however recorded in the age group 0-5 years. Chi-square analysis therefore showed that there was significant difference in the prevalence of schistosomiasis according to age of students examined at $p<0.05$.

Table 4: Overall prevalence of schistosomiasis in relation to Age Group

Age Group	No. Examined	No. Positive	Percentage Positive (%)
0-5	12	1	8.33
6-10	32	6	18.75
11-15	398	214	53.77
16-20	181	58	32.04
TOTAL	**623**	**279**	**44.78**

X^2= 23.542; df=3; P= 0.005

3.4 Risk factors associated with schistosomiasis infection

Table 5 shows that infection rate was higher (45.75%) among students whose normal source of drinking water is stream rain and well than those whose source of drinking water is pipe (43.41%). Participants who do not have toilet in their houses had higher risk of acquiring the infection (48.98%), while those with toilets in their houses had less risk of infection (37.55%). With regard to family size, children from large family had a higher rate of infection (50.13%) than those with ≤10 family members (36.59%). Also, children who make contact with water for domestic purposes had the highest rate on infection (60.12%) followed by those who swim in the river (39.04%). Moreso participants who do not wear shoe/slippers when going outside had a higher rate of infection (48.72%) than those who wear shoe/slippers when going outside (43.41).

Table 5: Risk factors associated with schistosomiasis infection

Variables	No. Examined	No. Positive	Percentage Positive (%)
Source of drinking water			
Safe source (pipe)	258	112	43.41
Unsafe source (stream, rain, well,..etc)	365	167	45.75
Presence of toilet in house			
NO	394	193	48.98
YES	229	86	37.55
Household monthly income			
≥ NGN32000	261	96	36.78
< NGN32000	362	183	50.55
Family size			
≤10 members	246	90	36.59
> 10 members	377	189	50.13
Reasons for water contact			
Swimming	187	73	39.04
Domestic purposes	321	193	60.12
Fishing	101	12	11.88
Waste disposal	14	1	7.14
Do you wear shoe/slippers when you go outside?			
YES	389	165	42.41
NO	234	114	48.72

3.5 Distribution of snail intermediate host of schistosomiasis in the study area

Two different types of species snail intermediate host were encountered *Bulinus globosus* and *Biomphalaria pfeifferi* in the study area as presented in table 6. The overall snail counts for the whole period of sampling showed that *Bulinus globosus* was the most abundant snail species (219) in the area, while *Biomphalaria pfeifferi* was relatively less abundant (78). Out of the snails collected (297) only (34.01%) encountered were infected with cercariae. Also table 6 shows the number of different species identified by site of collection, site A had the highest number of snail (155) collected while the least number of snails (142) were collected in site B. There was no significant difference between the snail species sampled and the sampling sites (P>0.05).

Table 6: Distribution of snail intermediate host of schistosomiasis in the study area

Sampling site	Snail species		Site total	No. Infected (%)
	Bulinus globosus	*Biomphalaria pfeifferi*		
Site A	121	34	155	36.13
Site B	98	44	142	31.69
Total	**219**	**78**	**297**	**34.01**

X^2= 2.126; df =1; P=0.05

Table 7: Prevalence of snails collected according to months during the study

Sampling Months	No of snails collected	No. Infected	Infectivity rate (%)
October	83	28	33.73
November	76	29	38.16
December	71	26	36.62
January	67	18	26.87
Total	297	101	34.01

$X^2 = 12.126$; df=3; P=0.05

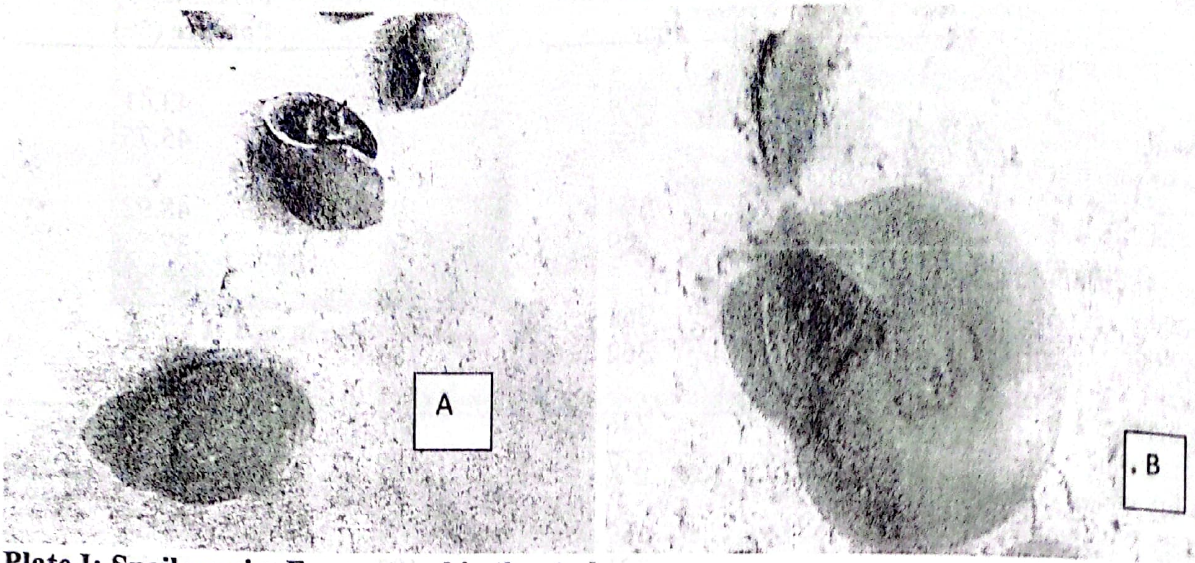

Plate I: Snail species Encountered in the study

A: *Bulinus globosus* **B: *Biomphalaria pfeifferi***

3.6 Physic-chemical parameters of the fresh water body in Korokpan Community

Table 8 shows the result of the physic-chemical parameters of the fresh water in the study area. The pH was slightly acidic in the months of November, December and January (6.93, 6.78 and 6.44), but neutral in the month of October (7.1). Water temperature was lower in the months of December and January (22.3⁰C and 23.4⁰C) and highest in the month of October (29.9⁰C). Dissolved oxygen was lowest in the month of October (6.15mg/l) but highest in the months of December and January (7.3mg/l). The mean±standard deviation values of these physico-chemical parameters are shown in the table 4.7.

Table 8: Physic-chemical parameters of the fresh water body in Korokpan Community

Month / Parameter	OCT	NOV	DEC	JAN	Mean±SD
pH	7.1	6.93	6.78	6.44	6.81±0.28
Temp (⁰C)	29.9	24.1	22.3	23.4	24.93±3.40
DO (mg/l))	6.15	6.7	7.3	7.3	6.86±0.55
Turbidity	8.8	8.6	9.3	10.5	9.3±0.85
BOD (mg/l)	4.6	5.3	4.9	5.1	4.98±0.3

4.0 DISCUSSION

Schistosomiasis remains a public health concern in various developing countries including Nigeria. School age children are among the high risk groups for *S. haematobium* and *S. mansoni* infections. The study showed an overall prevalence of schistosomiasis in the study area to be 44.78% with 57.58% urinary schistosomiasis and 22.47% intestinal schistosomiasis. The result obtained in this study is lower compare to the findings of Abubakar *et al.* (2015) who recorded 61.4% of *S. haematobium* among resident of Wasai Dam in Minjibir Local Government area, Kano State, Nigeria. The findings of this study is however higher than that reported by Adamu *et al.* (2019) who recorded (20%) of *S. haematobium* among

Secondary School Students in Kaduna State, Nigeria, Umar *et al.* (2017) 18.7% of *S. haematobium* among primary school children in Kebbi State, Nigeria and Dawaki *et al.* (2016) who recorded overall prevalence of schistosomiasis to be 17.8% with no significant difference in the prevalence of urogenital (8.3%) and intestinal schistosomiasis (8.9%) among hausa communities in Kano State, Nigeria.

The high prevalence rate of urinary Schistosomiasis recorded in this present study may be as a result of high exposure and dependence of these school children on sources of water other than the pipe borne water due to its non-availability. These water bodies are sources of water supply for most of their domestic and recreational use. Paikoro on most occasion is known to suffer in sufficient water supply and as such most water used for domestic activities are obtained from streams, dams and burrow pits supplied by the males after school hours and as such have increased contact with infected water bodies.

This study also revealed a statistically significant higher prevalence in males compared to the females which agrees with the findings of Bigwan *et al.* (2012) among secondary school boarding students in potiskum metropolis, Yobe State, Northeastern Nigeria, Abubakar *et al.* (2015) among resident of Wasai Dam in Minjibir Local Government area, Kano State, Nigeria, Adamu *et al.* (2019) among Secondary School Students in Kaduna State, Nigeria. The reason for the high prevalence in males than females could be attributed to the facts that males are more exposed to infected water as a result of their contact activities (Adamu *et al.*, 2019). The males often engaged in activities such as swimming, fishing, and irrigation especially during holidays or during their outing days more than their female counterpart. This practice exposes the boys more to risk of infection through contact with the infective stage (cercaria) of the parasite in contaminated water. So also, there are some socio-cultural beliefs that restrain females from swimming in the locally available rivers and ponds (Abubakar *et al.*, 2015). The low prevalence observed in females could be attributed religious and moral principles that results in the sheltered and reserved lifestyles of the women and thus brings them in less frequent contact with water bodies potentially harbouring the helminth (Adamu *et al.*, 2019).

The result indicates that there is an increase in prevalence with increase in age. Age group 11 -15 years had the highest rate (53.77%) of infection, followed by 16-20 years age group with 32.04% rate of infection. The result reveals that as age increases the infection rate increases there by showing a significant differences between age and the prevalence of the infection ($p < 0.05$).This findings agrees with Usman *et al.* (2019) and Ojo *et al.* (2021). The increase in the infection rate in this study as age increases may be attributed to more contaminated water contact over time among the students as the engage in activities such as irrigation farming, fishing and swimming.

The results of this present research also showed that aquatic snails are present in the study area. Even though statistical analysis showed no significant difference in terms of monthly snail distribution, it was observed from this study that variation existed in the number of snails sampled monthly. This is similar to the findings of Usman *et al.* (2019) who also recorded monthly variations (between March – November) in the number of snails in Kwanar Areh Dam in Rimi L.G.A. of Katsina State. This means that irrespective of the sampling month, variation in number of snails may exist. The resulting variations in the number of snails collected monthly might therefore, be due to changes in climatic and other environmental factors. According to the report of Izah and Angaye (2016), environmental parameters have influence on the density and population dynamics of freshwater snails. Most of the snail species recorded in this study was collected in the month of October when there was less abundant rainfall on average in the study area. Ngele *et al.* (2012) also made similar observations in their study carried out in Abia State, Nigeria, which showed the highest number of snails collected when there was no heavy rainfall. This result is therefore contrary to the findings of Usman *et al.* (2019) and Taofiq *et al.* (2017) who recorded a decrease in population of snails between the months of July and October. This may be attributed to the negative effect of that heavy rainfall on the survival of the snails (Taofiq *et al.*, 2017). The reduction in snail populations at the end of rainy season also agrees with the report of Ejehu *et al.* (2017) which linked it to flushing away of snails from their habitat by increased water flow.

Two different types of snail species intermediate host were encountered *Bulinus globosus* and *Biomphalaria pfeifferi.* This is similar to the findings of Abdulhamid *et al.* (2018) and Usman *et al.* (2019) that identified *Bulinus globosus* with other species in Kwanar Areh Dam in Rimi L.G.A. of Katsina State. *B. globosus* is known from the literature to be the intermediate host of *S. haematobium*. Thus, there is high possibility and tendency for transmission of urinary schistosomiasis around the study area, as the specific vector for such disease is present. The *Bulinus* snails were found in shallow waters around the edges of the river where some water plants including water lilies (Nymphaeaceae) are situated. This is in agreement to the findings of Malann *et al.* (2017) in the municipal Area Council, FCT, Abuja, Nigeria.

The number of *Biomphalaria pfeifferi* recorded in this present study was less as compare *Bulinus globosus* species of snails. This accounts for the low occurrence of *S. haematobium* in the study area. According to Nkwoji and Edokpayi (2013) the abundance and diversity of living organisms in aquatic environment usually varies with the variation of physico-chemical parameters and this can be the sole reason for the variation in abundance of this intermediate host both in season and between the sites study. Also it can be due to the effect of domestic and industrial wastes in the study river (Malann *et al.*, 2017).

The mean of the selected physio-chemical parameters of water bodies were found to be within the range that can support snail population (Sharma *et al.*, 2013). WHO (2013) reported that, the optimal temperature for snail reproduction is 22^{0}C - 26^{0}C and the higher the temperature, the lower the dissolve oxygen. The lower dissolve oxygen of less than 1 % caused suffocates of snail. Also snails prefer alkaline pH but it seems it has no effect on snail's population when considered along. The values recorded in this study are in consonance with those recorded by other researchers such as Alhassan *et al.* (2016) and Usman *et al.* (2017) in Kaduna and Bauchi States respectively. Low populations of snails were found in water bodies with low dissolved oxygen and high temperature or even absent in some cases. Sharma *et al.* (2013) state that dissolved oxygen in water bodies plays an important role in snail breeding, even if all other parameters are within the normal range. However, the World Health Organization (2013) reported that, at the tail end of dry season, the oxygen tension falls below 1 % and snails tend to suffocate.

5. CONCLUSION

The outcome of this study revealed that there is high prevalence of schistosomiasis among school children in Korokpan community of Paikoro Local Government Area, Niger State, Nigeria. However, urinary schistosomiasis was higher than intestinal schistosomiasis in the study area. It was also observed that aquatic snails are present in the study area with variation in the number of snails sampled monthly. Two different types of snail species intermediate host were encountered *Bulinus globosus* and *Biomphalaria pfeifferi* with *Bulinus globosus* more abundant than *Biomphalaria pfeifferi*. The mean of the selected physio-chemical parameters of water bodies were found to be within the range that can support snail population. Also the effect of some physico chemical parameters such as temperature, pH and Dissolve oxygen as well as other factors such as vegetations that surrounded the water bodies which lead to high density of snail population. This study therefore, calls for effective snails control programme and public awareness on the role of snails in transmitting animal trematode in the area. Besides mass drug administration, school and community based health education regarding good personal hygiene and sanitary practices is imperative among these communities in order to significantly reduce the transmission and morbidity of schistosomiasis

Recommendation

The Study needs Government Policy in Eradication of the disease in Paikoro Local Government Area of Niger State,

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