ORIGINAL ARTICLE

Vectorial Infectivity Screening and Epidemiology of Schistosomiasis among inhabitants of Zango Kataf Local Government Area, Southern Kaduna, Nigeria

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ABSTRACT

Background: Schistosomiasis is a major public health problem in developing countries like Nigeria. This epidemiological study is therefore aimed to determine its transmission status in Zokwa, Kaduna State Nigeria. Methodology: A cross sectional study was conducted from April-September, 2015 among 567 participants from Zokwa community. Fecal and Urine samples were examined using the formalin-ether sedimentation and filtration method. Demographic and risks factors were assessed using a structured questionnaire. Results: The overall prevalence of schistosomiasis was 0% for both Urinary and Intestinal Schistosomiasis. Demographic revealed 287 (50.6%) males and 280 (49.4%) females, people of age bracket (≤20years), 209(36.9%) as students, 327(57.7%) and 21(3.7%) used well water and stream water for domestic use, 281(49.5%) were involved in washing and 35(6.2%)in swimming,248(43.7%) practice open field defecation while128 (22.5%) used water closest. Snail vectors for schistosomiasis were observed absent in screened water bodies during the study period. Retrospective data revealed more males 67(13.4%) than females 58 (10.0%) had gastrointestinal parasite, 6(0.56%) had Schistosoma Mansoni infection recorded in 1 female (0.17%) and 5 males (1.0%). Fasciola sp. 1(0.17%) and Hookworm 56(5.1%) recorded least and highest infection rate. The highest and least helminthic infection rates were recorded in the Months of September 22(26.83%), October 21(24.45%) and March 12(10.53%). There was significant association ($p < 0.05$) between sex and intestinal helminth infections. Conclusion: The study revealed there is no active transmission of schistosomiasis in Zokwa community in Nigeria. Continuous mass drug administration, health education and community mobilization will serve as important control strategies to attain eradication status.

Keywords: Epidemiology, Schistosomiasis, Bulinus sp., Biomphalaria sp., Prevalence, Zango Kataf

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INTRODUCTION

Schistosomiasis is one of the most prevalent Neglected Tropical Diseases (NTDs) which ranks second to malaria as a parasitic disease. It is a major public health concern in about 77 developing countries domiciled in the tropics and subtropics [16]. It affects more than 1.4 billion people worldwide [15] and infects over 240 million people in about 78 countries, primarily in Africa.

Nigeria has the greatest number of cases of schistosomiasis worldwide with about 29 million infected people, among which 16 million are children, and about 101 million people are at risk of acquiring the infection [16]. Its prevalence and morbidity is highest among schoolchildren, adolescents and young adults [18], particularly affecting people involved with agricultural and fishing occupations, women doing domestic chores in infested water, washing clothes, are also at risk. Inadequate hygiene and play habits make children especially, vulnerable to infection [17].

The enormous morbidity associated with schistosomiasis which places it next to malaria in terms of public health significance re-emphasizes the need for a coordinated and sustainable means for the control of the disease. Therefore, the transmission of schistosomiasis and consequent risk of human infection is usually focal [2], as the specific geographical distribution and of severe morbidity can be restricted to a particular location.

Incidence of schistosomiasis in Nigeria and surveys reporting the prevalence in some towns and communities has been documented [1-3, 5, 7, 8, 14]. The status of its occurrence, distribution and the snail intermediate hosts in Zangon-Kataf Local Government Area is not known to have been documented to the best of our knowledge and this could be a focal point for the transmission of the disease. This work provides baseline information on the transmission status of the disease in the study area which could be the basis for designing and implementing control strategies if need be and thereby contribute to existing knowledge.

MATERIALS AND METHODS

Study Area

The study was conducted among dwellers in Zokwa, Zangon-Kataf L.G.A of Kaduna state. It lies between longitude 8◦05′00″E and 8◦40′00″E and latitude 9◦32'30″N and 10◦10′00″N on a total land area of 2668km2 (Figures 3.1 and 3.2). Vegetation is savannah type with tall and scattered trees, that is wooded vegetation, and tropical climate is dominated by high temperature and high humidity. The main activities of the population among others, is agriculture, with predominantly rice cultivation, vegetable growing and cultivation of millet. Two general hospitals are situated in Zangon-kataf local Government area, Zonkwa and Zango town, together with private clinics in almost all the villages.

Cross-Sectional Study

Sample size

Sample size was determined using the sample size determination formula according to Naing et al., [19].

$$n = \frac{z^2 pq}{d^2}$$

Where n = the desired sample size; z= 1.96 which is a constant for data that assumes a normal distribution at 95% confidence

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interval; p= 50%, known prevalence of the disease in the population expressed as a proportion of 1; d=0.05, being the level at which significance difference is determined; and q= (1-p) = 0.5.

The values of the variables indicated above were substituted in the formula and the sample size was obtained as follows:

$$n = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2} = 384$$

This was the minimum sample size that could be taken.

Ethical Statement and Clearance

Consent for this study was obtained from each village head who issued a letter of introduction to permit collection of urine and stool samples from the people. Ethical clearance for this study was obtained from Research Ethics Committee of Ahmadu Bello University, Zaria and the General Hospital in Zokwa, Kaduna State.

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Collection of urine and stool samples

Labelled wide-mouthed sample bottles were given out to the selected individual for the study. Labels corresponded to the number of the individual on the questionnaire and were instructed on how to obtain their urine and faecal sample without contamination. Structured questionnaires were administered to gather some data on socio-demography and exposure to certain risk factors to participants who consented to the study. The questionnaire was administered to each of the individuals, through oral interview, to obtain information from them on the following: village, age, sex, occupation, water contact activities in existing water bodies, source of water and type of toilet system used. From each consented subject, 10mL urine and a lump of stool sample was collected in a wide screw-capped sample bottle. All the samples were taken for examination at the. The sample identification number and time of collection were noted on the stool and urine sample bottles for each individual recruited in the study. Urine samples were collected the following morning preserved immediately with formalin and kept in a black polythene bag. They were transported to the Parasitology laboratory unit of General Hospital at Zonkwa, for processing and examination. The questionnaires were matched with the stool and urine samples collected and taken to the laboratory for analysis and examination.

Laboratory analysis of urine samples

Urine samples were examined both macroscopically and microscopically. Urine sample were analyzed using simple sedimentation by centrifugation method as described by [4]. Samples were allowed to settle for 30 minutes in the laboratory and the supernatant was reduced to about 10ml each. The samples were shaken thoroughly, transferred into centrifuge tubes and were centrifuged at 2000rpm for 5minutes. Supernatant was discarded and the sediment was transferred onto clean glass slide by means of Pasteur pipette. Cover slip was applied on the wet mount. The wet mount was examined for identification of characteristic terminal-spined eggs of Schistosoma haematobium using 10× and 40× objectives of the light microscope [4].

Laboratory analysis of stool samples

Formol-ether sedimentation technique method was used to analyse the stool samples [4]. Samples were mixed with 5%

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formalin and sieved to remove the debris. The filtrate was emptied into centrifuge tube and centrifuged at 2000rpm for 5minutes. The supernatant was then decanted to recover the sediment and a drop of the sediment was pipetted and placed on a clean glass slide. A cover slip was placed over the drop of sediment and viewed under microscope at x10 and x40 magnification for *Schistosoma mansoni* eggs.

Collection of Intermediate Snail Hosts from Water Bodies

Water bodies (rivers and streams) in Zango, Zonkwa and Kamantan, were screened for snail intermediate host for Bulinus and Biomphalaria species.

Retrospective Study

Patient's records obtained from the Medical record unit of St Lois hospital and general hospital, being the major hospitals in Zonkwa, the Zangon-Kataf Local Government headquarters were used for the retrospective study. Stool and urine tests carried out between May 2013 to April 2014 were checked and documented. The parasites encountered in such tests were recorded according to the sex of the patients and the month in which the test was carried out.

Statistical Analysis

Version 7 of the Epi-info for Windows software package was used for the data analysis. Chi square and Odds Ratio analysis was used to determine associations between risk factors and prevalence. T-test was used to obtain the differences between variables that were independent.

RESULTS

Cross-sectional Study

A total number of 567 stool and urine samples were collected and examined. None was positive for Schistosoma mansoni(stool) and Schistosoma haematobium (urine). The sex structure of the study population was made up of 287 (50.6%) males and 280 (49.4%) females (figure 4). The age structure was skewed to the right with a higher proportion of the population belonging to the younger age bracket (≤20years) as shown in figure 4.2. Of the categories of occupations considered in the study population, the highest numbers of 209 (36.9%) persons were students and the lowest number of 31(5.5%) persons was recorded among the armed forces (Figure 5). The sources of water for domestic use had the highest number of 327(57.7%) persons that used well water while the lowest number of 21(3.7%) persons used stream water (Figure 6). Water contact activities that predispose persons to infection with schistosomes are fishing, swimming, washing and farming, in and around the water bodies that could harbor the intermediate snail hosts. Among these activities, the highest numbers of 281(49.5%) persons were involved in washing and the lowest numbers of 35 (6.2%) persons were involved in swimming (Figure 7). For the type of toilet used, the highest number of 248(43.7%) persons used open field while the lowest number of 128 (22.5%) persons used water closest (Figure 8).

Retrospective Study

A total of 1081 patient's records were reviewed from May 2013 to April 2014 from whom stools samples were obtained and examined for gastric intestinal parasites. Out of 1081 patients, 499 patients were male and 582 patients were female. Of the 499 males examined, 67 (13.4%) and 58

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(10.0%) of the 582 females were infected with at least one gastrointestinal parasite (Figure 10). Of these, 56 cases had protozoan infections at 5.18% prevalence and 68 cases had helminth infection at 6.29% prevalence. Among those infected with protozoa, 26 cases at 5.21% prevalence were male and 30 cases at 5.15% prevalence were female (Figure 11). While those infected with helminth, 41 cases at 8.22% prevalence were male and 27 cases at 4.64% prevalence were female. For Schistosoma species, 6 cases of S.mansoni infection were recorded at 0.56% prevalence, with 1 female at 0.17% prevalence and 5 male at 1.0% prevalence. The highest number of cases (56) was of those who had hookworm at 5.1% prevalence, of which 31 cases were male and 25 cases were female at 6.21 % and 4.30% prevalence respectively. The parasite with the list occurrence in the reviewed records was Fasciola species with 1 case at 0.17% prevalence (Figure 12).

The cases of gastrointestinal helminths infection were spread throughout the year. The highest number of infected cases were 22 (26.83%) recorded in the months of September and 21 cases were recorded in the month of October (Figure 10). The least number of infected cases occurred in March with the prevalence of 10.53%. In protozoan infections, the parasite with the highest monthly infection was Giardia lamblia for the months of September and October (Figure 12). While the list monthly infection was Fasciola species in the month of March.

Although there was association between sex and gastrointestinal parasites infections as well as between sex and protozoa infections but the association was only significant ($p < 0.05$) between sex and intestinal helminth infections (Table 1).

DISCUSSION

The zero prevalence of both urinary and intestinal Schistosomiasis recorded in this study may not necessarily be the complete absence of Schistosoma infections in the study area, but that the prevalence at the time of study was too low to be captured by the sample size obtained. However, the negative parasitological result was further augmented by the non- availability of the snail intermediate hosts (Bulinus and Biomphalaria species) in the water bodies screened within the study area. The negative prevalence recorded could be due to the literacy level, occupation type and water source type utilization by members of the community. Majority of the people are literate, as most are students (209: 36.9%), civil servants (65: 11.5), Business owners(85: 15.0%) and military officers(34: 5.5%), thereby equipped with necessary hygienic and preventive information concerning the disease. Only 25.2%(143) constitutes farmers, in which fishermen, rice farmers and irrigation farmers are seldom found within the study areas which are major occupation that predisposes people to the disease. Most people within the study area utilises well water(327: 57.7%), tap(97: 17.1%), borehole(122: 21.5) for domestic purpose, only 21% (3.7) uses rivers and streams for washing clothes. These are responsible for reduced or minimized exposure to vectors of this disease. This implies that there might be no active transmission of schistosomiasis in the study area and that if there are any infected persons, the infection may have been acquired elsewhere outside the study area where active

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transmission was occurring. This study contradict the findings of Igwe [10] who reported prevalence of 26.6% for schistosomiasis in Kachia Local Government Area and Damen et al. [6] reported a prevalence of 19% for schistosomiasis among students in Jema'a Local Government Area. The study areas reported by [6], [10], are neighboring communities that share borders with Zangon-Kataf Local Government Area, the study area. This indicates that active transmission of schistosomiasis may be occurring in the surrounding communities and these neighboring communities to the study area are particularly noted for rice and irrigation farming which support snail breeding. Since irrigation farming was seldomly practiced in the study area, the large proportion of farmers recorded in this study were clearly not at risk for infection with schistosomiasis. The observed low proportion of persons that used streams(3.1%) for source of water along with the low water contact activity for those who engaged in swimming(6.2%) and fishing in streams(7.1%) which did not support snail breeding lend credence to the negative parasitological result obtained in the study population.

The absence of the snail intermediate hosts in the study area could be due to the absence of stagnant water bodies sufficient to support the breeding of the snail intermediate hosts during the period of the study. It could also be due to study sampling period as this study was carried out only across the rainy months. There was no dam in any of the rivers in the study area at the period of the study. This means that even if snails are introduced, breeding may not be sustained as the snails are flushed out of the rivers by the strong water currents that result from the heavy rainfall during rainy season. Since the physicochemical parameters of the water bodies were not studied, and no record of a previous study on this subject was encountered, it is difficult to attribute the absence of the snail intermediate host to unfavourable physicochemical conditions of the water bodies.

The 12 months retrospective analysis of the hospital records carried out for intestinal parasitic infections in the study area consisted of helminths (12.9%) and protozoa (10.4%) infections. Helminthic infection showed positive association with gender ($P<0.05$) but not with age, more infection rate recorded in males (41) than females (27). This could be as a result of male involvement in various activities such as farming, fishing, swimming etc that increased their chances of being infected. The low prevalence (0.56%) of *S. mansoni* infection observed in both males and females could have been from individuals that might have acquired the infection outside the study area and consulted the hospital in the study area when they became ill. It could also be due to the fact that a considerable proportion of the population within the study area have water closet toilet facility, uses well water more for domestic chores, thereby reducing their chances of spreading and contacting the disease. Although there was limited information on the records kept of the individuals attended to in these hospitals, there was one case of a male infected with *S. mansoni* whose name and residential address was complete. The address was traced but it was discovered that he resided at Kaduna and only visited the permanent home residence during the Christmas period in December. He fell ill and was admitted in the hospital, after a few days he was discharged. He thereafter travelled back to Kaduna where he

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was employed. This case gave support to the supposition earlier made of the absence of active transmission of schistosomiasis in the study area.

Intestinal parasites other than *S. mansoni* recorded in the retrospective study namely hookworm (59: 5.46%), Ascaris lumbricoides (8: 0.74%), Fasciola sp. (1: 0.09%), Giardia lamblia (48: 4.4%) and Balantidium coli (3: 0.28%) are parasites commonly reported elsewhere in Nigeria [13]. However, Balantidium coli which is a normal parasite of pigs is zoonotic. The recorded prevalence of Balantidium coli could be associated with piggery, a common practice in Southern Kaduna State made up of Kachia, Jabba, Jema'a and Zangon-Kataf Local Government Areas where piggery is widely practiced with a renowned pig market at Kafanchan, the Jema'a Local Government Area headquarters. Retrospective data revealed intestinal schistosomiasis showed low prevalence (0.56%) with one or more intestinal parasites. This further support the suggestion and argument that the prevalence of Schistosomiasis within the study area have been reduced to level that is most likely to be at the point of elimination and support the result obtained in this study. These results are similar to the findings of Okpala et al., [13] who reported 0.67% in Jos and Goselleet al., [9] reported 4.6% in Jos as well. The most common helminth parasite was hookworm, followed by Giardia. lamblia. The presence of the Hookworm could be attributed to poor sanitation as a considerable proportion of the population within the study area still practice open defecation (248: 43.7%) in the environment as infection is acquired when the filariform larva penetrates the skin that comes in contact with the contaminated soil. Infection with Giardia lamblia is attributed to poor hygiene which causes food and water contamination with faeces containing the parasite cysts. Higher infection rate was observed among the males (13.43%) than the females (9.97%) in all the identified parasites. Plausible reason for this observation could be the sustained vicious cycle of environmental contamination that harbours the infective stages of these parasites and the consequent exposure of the males to the same environment.

Conclusions

The zero prevalence indicated for both urinary and intestinal schistosomiasis in Zangon-Kataf Local Government Area of Kaduna State might be due to the study sample size and study duration as study only reflected sampling done during one season alone which is the rainy season, which in turn could affect sustainability of infected snails and thereby affect the transmission process. Also the effect of anthropogenic risk factors on the prevalence of schistosomiasis was not analyzable as zero prevalence is indicated for both forms of the disease in the study area. This indicates the absence of active transmission of schistosomiasis in the study area as Bulinus and Biomphalaria species which are the snail intermediate hosts of urinary and intestinal schistosomiasis were found absent in water bodies within the study area. The low prevalence of 0.56% of intestinal schistosomiasis in the retrospective study is an indication that infected persons acquire the infection elsewhere outside the study area where active transmission occurs. Therefore further studies within the study area should include a detailed monitoring of the disease prevalence with a larger sample size observed in

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different seasons of the year and also screening of water bodies within the study area for intermediate snail hosts should be carried out over a longer period of time across both season, so as to confirm or disprove their non-existence in the study area

STATEMENTS & DECLARATIONS

Conflicts of Interests: The authors declare there are no conflicts of interest

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Ethics Approval: Studies was carried out in conformity with the Helsinki Declaration 1975 as amended and also ethical approval was obtained from the Research Ethic committee, Ahmadu Bello University, Zaria and General Hospital Zango Kataf, Kaduna State prior to the commencement of the study. Also, necessary approvals and consents were gotten from the Village traditional ruler and consenting participants before the commencement of study.Consent to Publish: Not Applicable

Data Availability Statement: All data generated or analysed during this study are included in this manuscript and available upon request from the corresponding author.

Authors' Contribution: Material preparation, data collection and formal analysis: [Suleiman Zakari]; Supervision, Review and editing of manuscript:[Mbanu Gloria E.]; Conceptualization and Project Supervision: [Ezekiel Kogi], Project administration and Methodology: [Usiwoghene Ishiekwene]; Original draft preparation: [Hajara Zakari] and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript."

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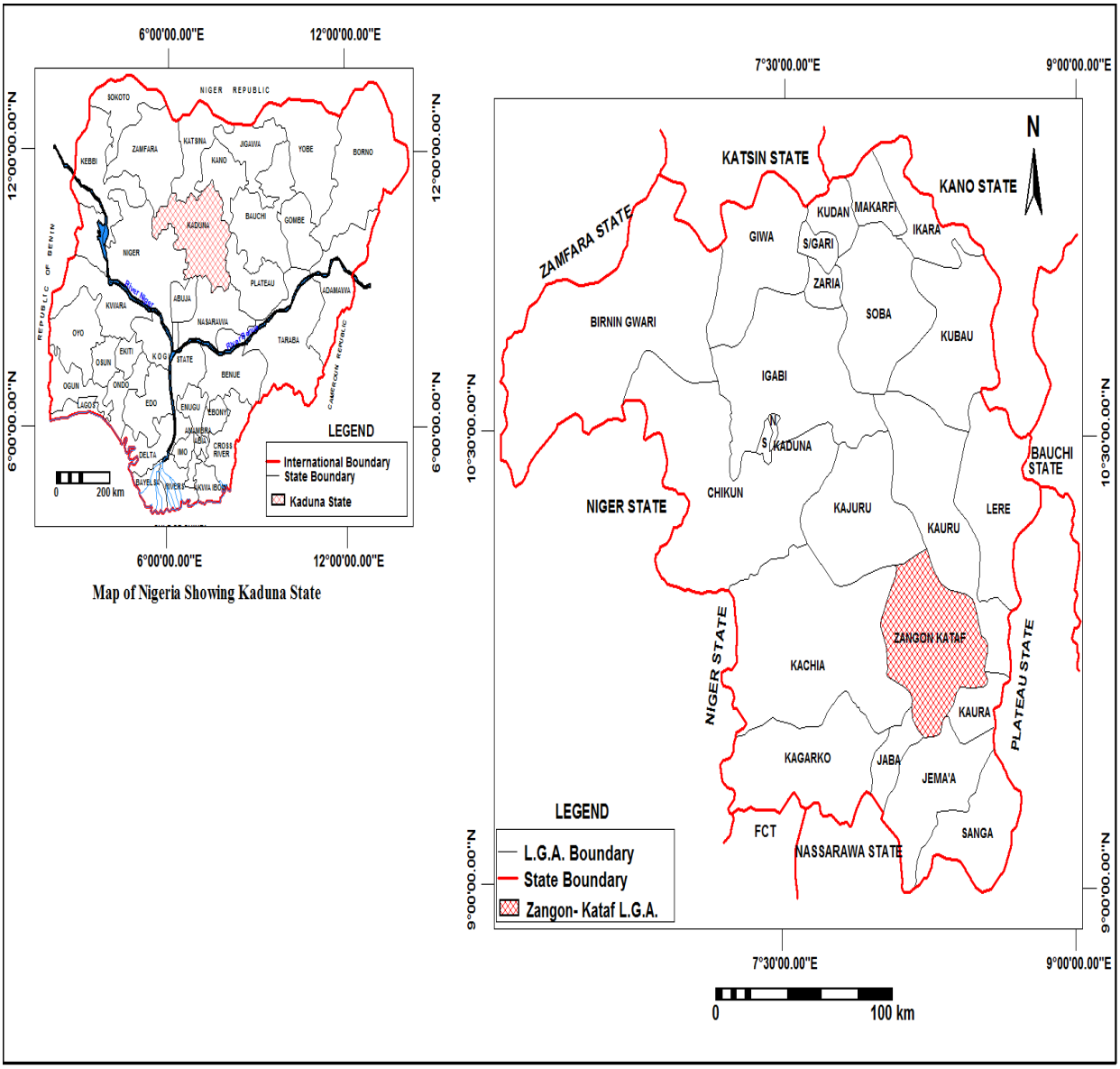
TABLES AND FIGURES



Map of Nigeria Showing Kaduna State

Fig.2:Kaduna State Showing Zangon-Kataf

Source: Modified from Administrative map of Nigeria

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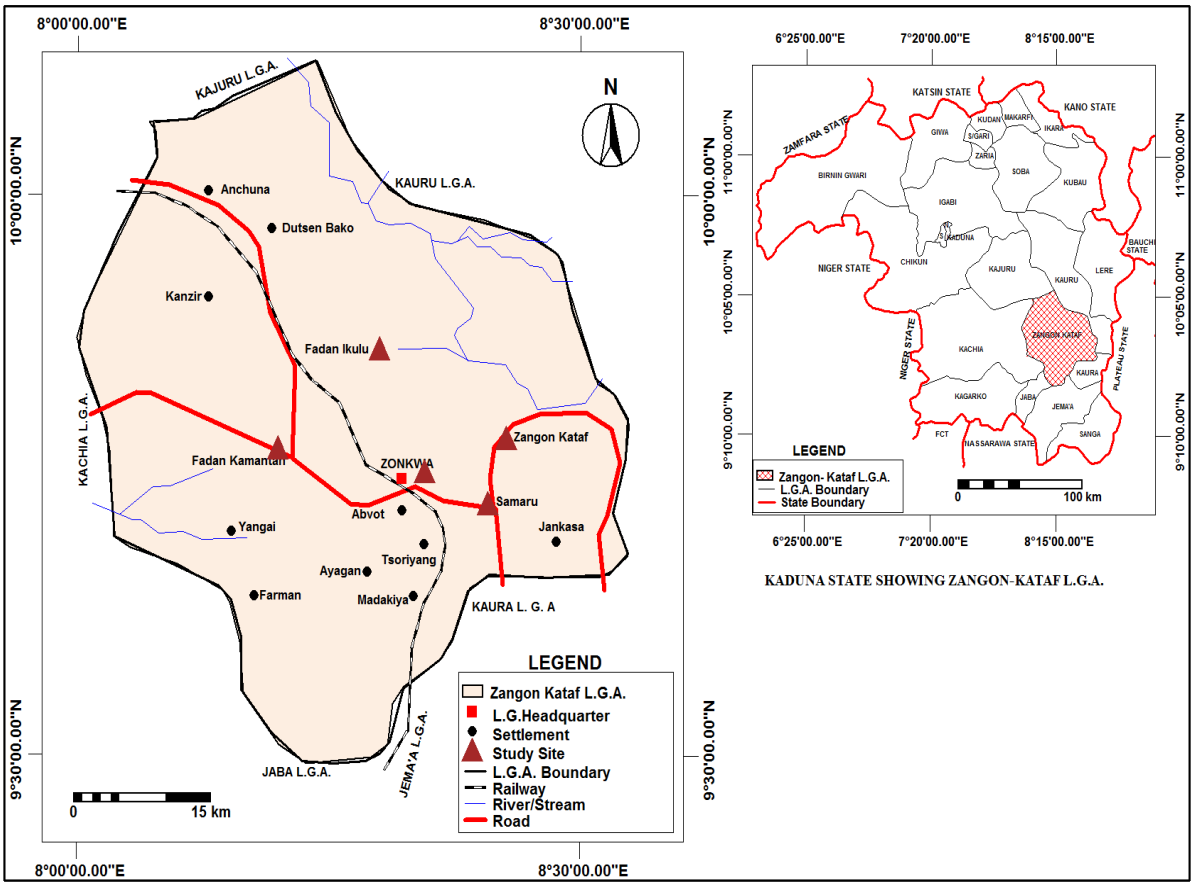

KADUNA STATE SHOWING ZANGON-KATAF L.G.A.

FIG. 3: ZANGON-KATAF L.G.A. SHOWING THE STUDY SITES
Source: Modified from Administrative map of Kduna State

Table 1: Retrospective prevalence of gastrointestinal parasitic infections in patients attending major hospitals in Zangon-kataf Local government area from May 2013 April 2014

	Gender	No. Examined	No. Negative	No. Positive	Prevalence	P-value	Odds ratio	95%Cl
Protozoa	Male	499	473	26	5.21	0.967NS*	1.01	0.57-1.79
	Female	582	552	30	5.15			
Helminths	Male	499	458	41	8.22	0.016S*	1.84	1.09-3.13
	Female	582	555	27	4.64			
Total	Male	499	432	67	13.43	0.076NS*	1.40	0.95-2.05
	Female	582	534	58	9.97			

*NS = Association is not significant (p <0.5)
*N = Association is significant (p < 0.5)

Table 2: Monthly prevalence of individual gastrointestinal parasitic infections based on sex among patients in Zangon-Kataf Local Government Area

Month	Sex (n)	HW	AL	SM	FS	GL	BC
May	Male(74)	0	1(1.35)	0	0	0	0
	Female(95)	2(2.11)	1(1.05)	0	0	0	0
June	Male(59)	2(3.39)	2(3.39)	0	0	0	0
	Female(44)	0	0	0	0	0	0
July	Male(37)	2(5.41)	1(2.71)	0	0	0	0
	Female(41)	1(2.44)	0	1(2.44)	0	0	0
Aug.	Male(64)	3(4.35)	0	0	0	0	0
	Female(92)	1(1.09)	0	0	0	0	0
Sept.	Male(46)	2(4.35)	1(2.17)	0	0	12(28.26)	2(4.35)
	Female(36)	0	0	0	0	11(30.56)	1(2.78)
Oct.	Male(59)	3(5.09)	0	0	0	9(6.95)	0
	Female(63)	2(3.17)	0	0	0	12(20.64)	0
Nov.	Male(40)	4(10.00)	1(2.50)	1(2.50)	0	1(2.50)	0
	Female(48)	6(12.50)	0	0	0	3(6.25)	0

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Dec.	Male(24)	4(16.67)	1(4.17)	1(4.17)	0.00	0	0
	Female(38)	2(5.26)	0	0.00	1(2.63)	0	0
Jan.	Male(23)	3(13.04)	0	0	0	0	0
	Female(36)	5(13.89)	0	0	0	0	0
Feb.	Male(22)	4(18.18)	0	1(4.55)	0	0	0
	Female(33)	4(12.12)	0	0	0	0	0
March	Male(11)	1(9.09)	0	2(5.00)	0	0	0
	Female(08)	1(12.50)	0	0	0	0	0
April	Male(40)	3(7.50)	0	2(5.00)	0	0	0
	Female(48)	4(8.33)	0	0	0	0	0
Total	Male(499)	31(6.21)	7(1.40)	5(1.00)	0	22(4.41)	2(0.40)
	Female(582)	28(4.81)	1(0.17)	1(0.17)	1(0.17)	26(4.47)	1(0.17)
Grand Total	(1081)	59(5.46)	8(0.74)	6(0.56)	1(0.09)	48(4.44)	3(0.28)

Keys: *n* =Number Examined; HW=Hookworm; *AL= Ascaris lumbricoides*; *SM= Schistosoma mansoni*; *FS= Fasciola* species; *GL= Giardia lamblia* and *BC= Balantidium coli.*

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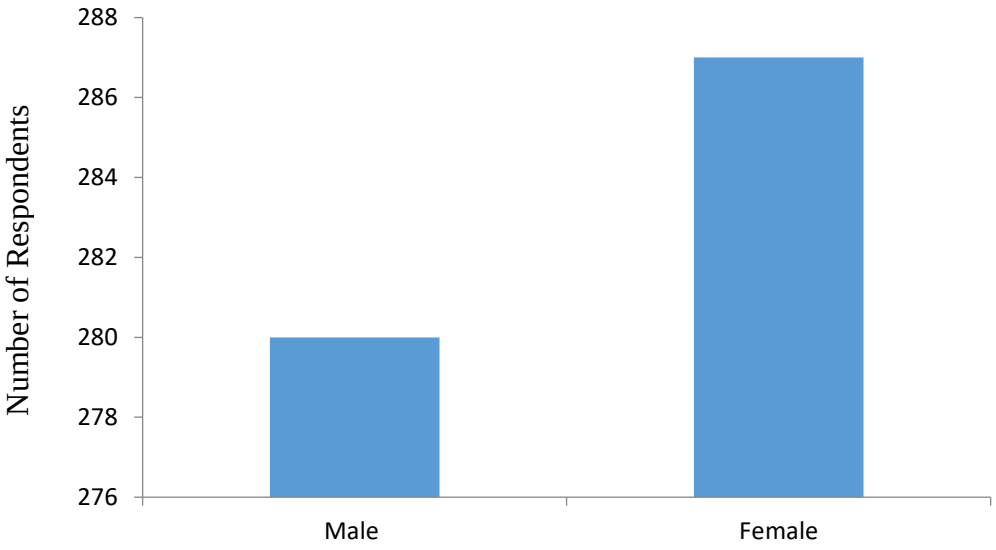

Figure 4: The sex composition of the sample population of Zangon-Kataf Local Government Area, Kaduna State.

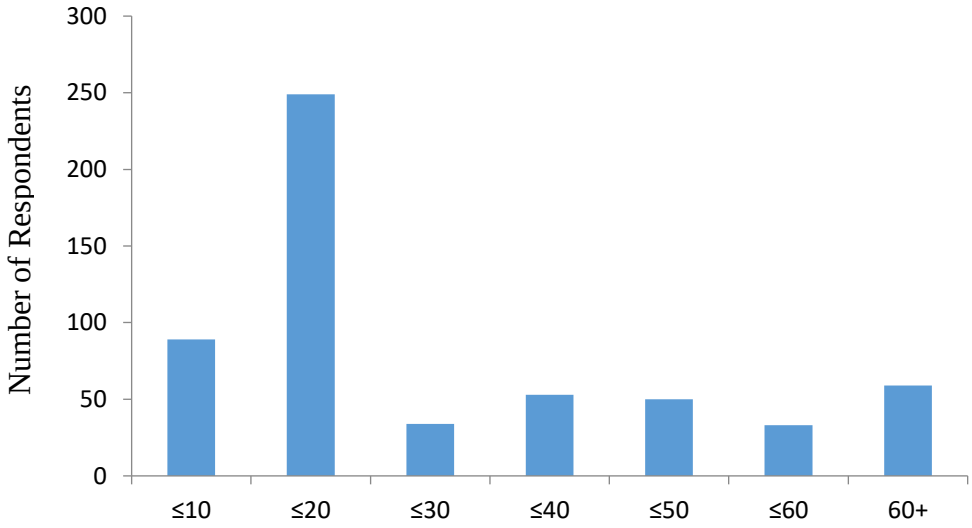

Figure 5: The age composition of the sample population of Zangon-Kataf Local Government Area, Kaduna State.

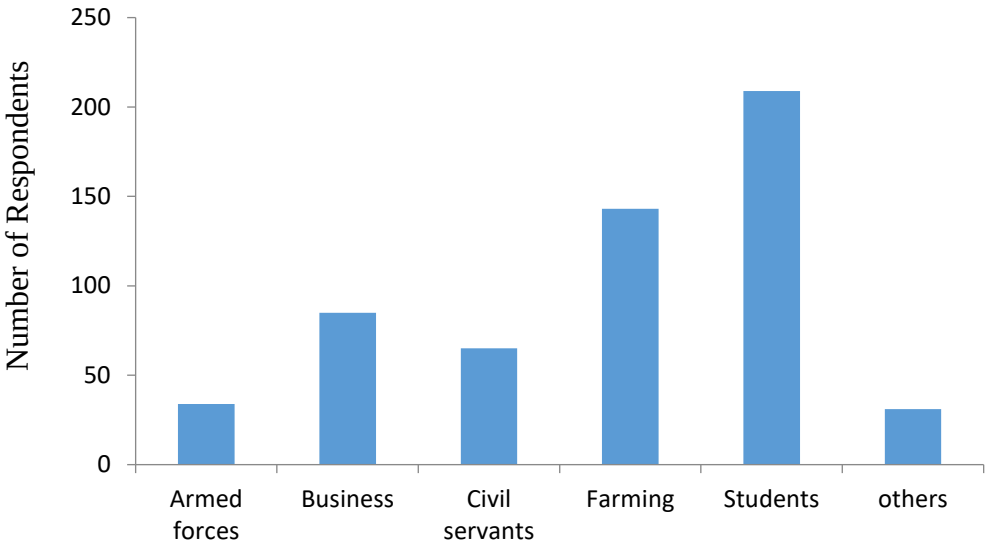

Figure 6: The occupational composition of the sample population of Zangon-Kataf Local Government Area, Kaduna State.

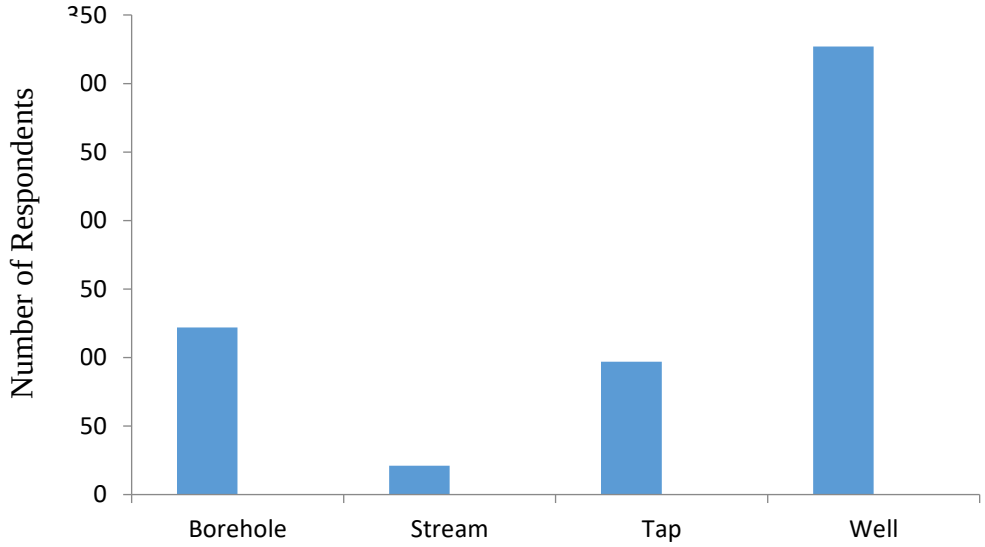

Figure 7: The sources of water available to the sample population of Zangon-Kataf Local Government Area, Kaduna State.

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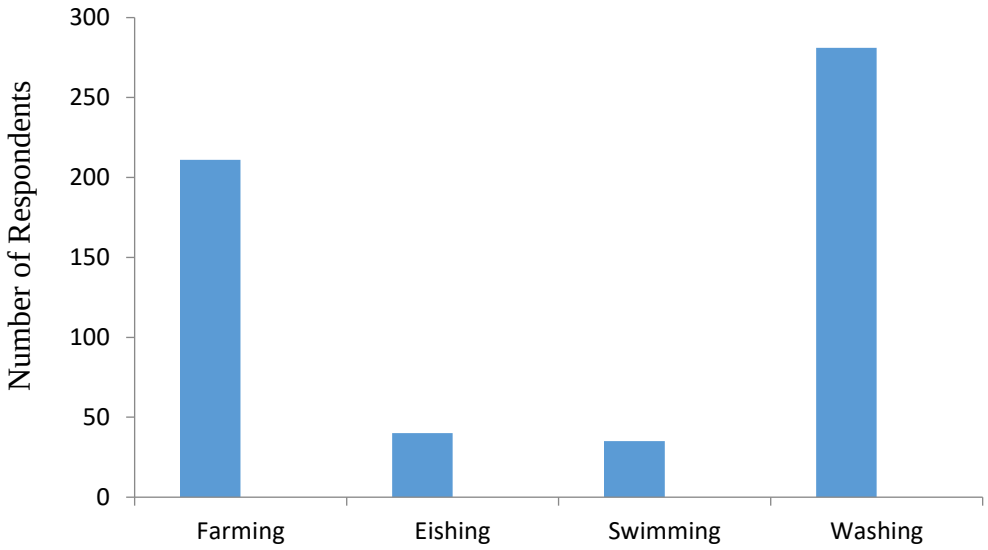

Figure 8: The Water Contact Activities engaged by the sample population of Zangon-Kataf Local Government Area, Kaduna State.

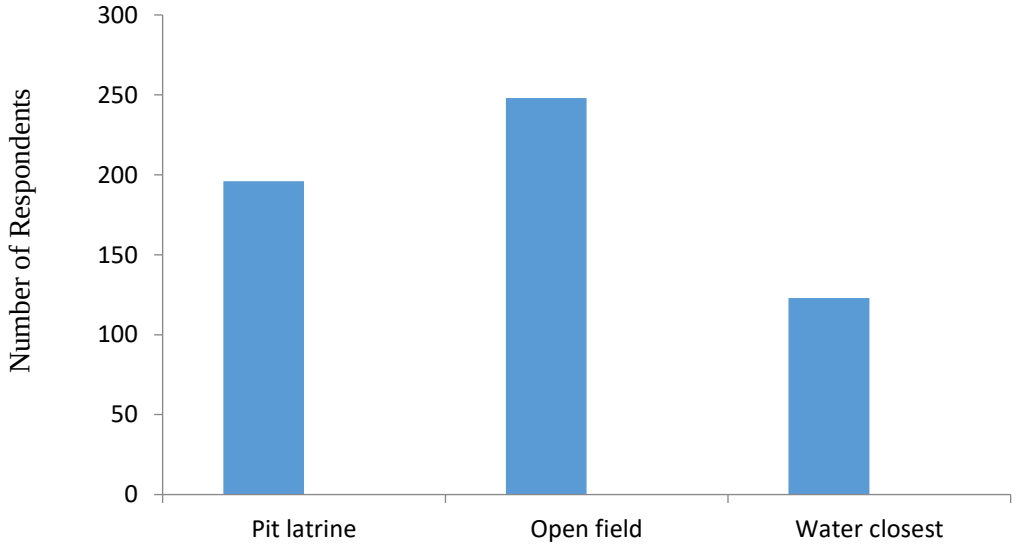

Figure 9: Types of toilet used by the sample population of Zangon-Kataf Local Government Area, Kaduna State.

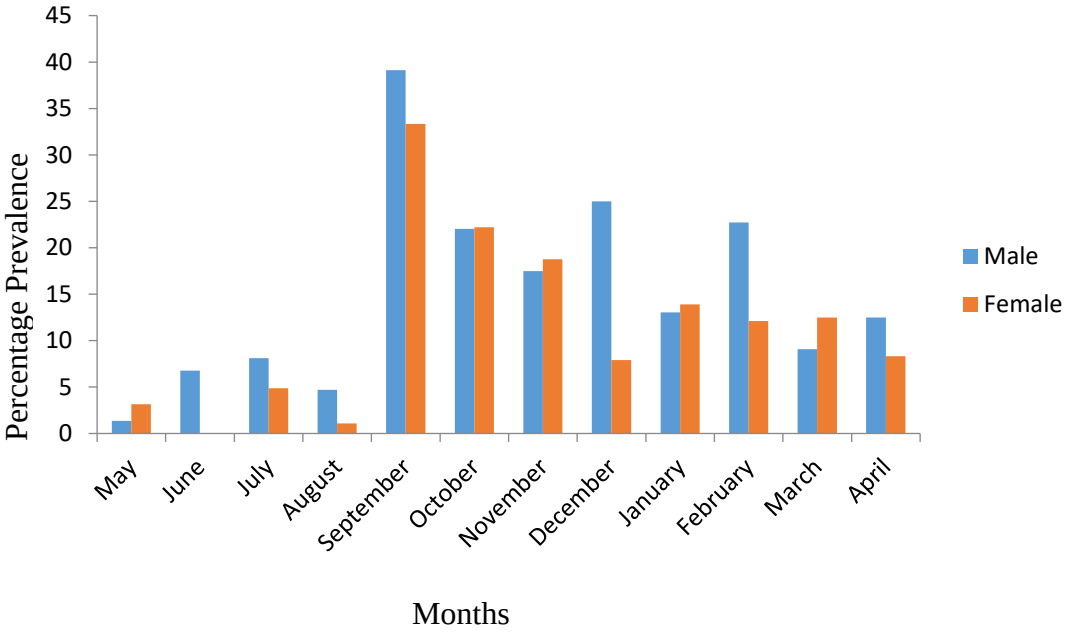

Figure 10: The Monthly prevalence of gastrointestinal infection based on sex in patients attending major Hospitals in Zangon-Kataf LGA from May 2013 to April 2014.

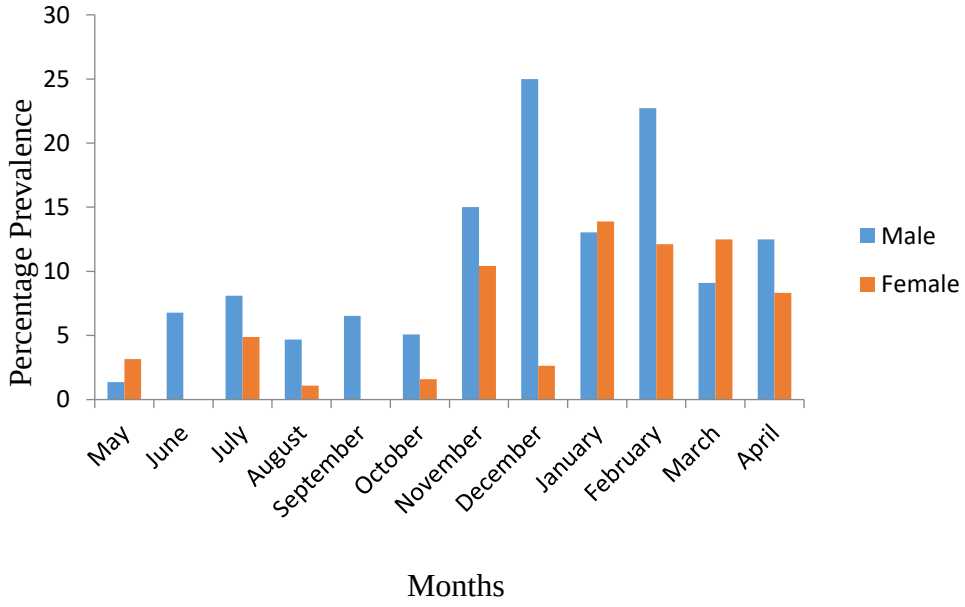

Figure 11: The monthly prevalence of helminth infection based on sex in patients attending major Hospitals in Zangon-Kataf LGA from May 2013 to April 2014.

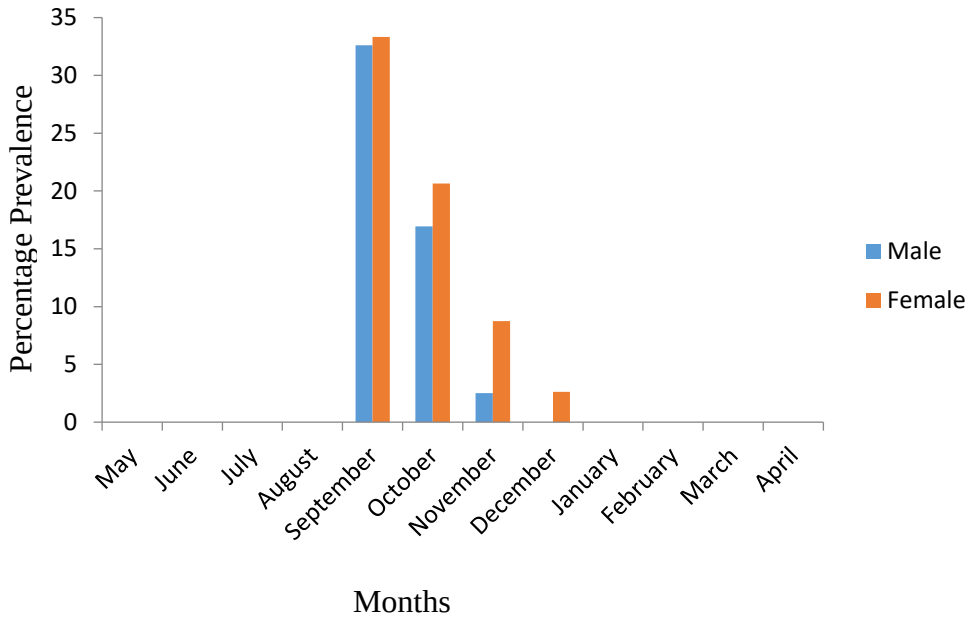

Figure 12: The monthly prevalence of protozoa infection based on sex in patients attending major hospitals in Zangon-Kataf LGA from May 2013 to April 2014.

APPENDICES

QUESTIONNAIRE ON PREVALENCE OF INTESTINAL AND URINARY SCHISTOSOMIASIS IN ZANGON-KATAF LOCAL GOVERNMENT AREA, KADUNA STATE.

1. Date of Collection: .....
2. Serial No: .....
3. Village: .....
4. Name of School: .....
5. Level of School: Primary( ) Secondary ( )
6. Class: .....
7. Health Educational Curriculum Activities on infections: Yes ( ) No ( )
8. Name of student: .....
9. Sex: Male ( ) Female ( )
10. Age (in years): .....
11. Parents Educational background: Tertiary ( ) Secondary ( )

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Primary ( ) Illiterate ( )
12. Parents Occupation: Business ( ) Civil Servant ( )
Farming ( ) Armed Forces ( )
Others ( )
13. Sources of Water: Borehole ( ) Reservoir ( )
Tap ( ) Well ( )

14. Water contact activity: Farming ( ) Fishing ( )
Swimming ( ) Washing ( )
15. Type of toilet used: Pit latrine ( ) Open field( )
Water closet( )

16. Knowledge of Schistosomiasis: Yes ( ) No( )

17. Blood in Urine? Yes ( ) No ( )

18. Blood in Stool? Yes ( ) No ( )

19. Result of Urine Examination: .....

20. Result of Stool Examination: .....

The age composition of the sample population of Zangon-Kataf Local Government Area, Kaduna State

Age	Number of respondents (%)	Number Positive for Stool	Number Positive for Urine
1-10	89 (15.7)	0	0
11-20	249 (43.9)	0	0
21-30	34 (5.9)	0	0
31-40	53 (9.3)	0	0
41-50	50 (8.8)	0	0
51-60	33 (5.8)	0	0
60+	59 (10.4)	0	0

The sex composition of the sample population of Zangon-Kataf Local Government Area, Kaduna State

Sex	Number of Respondents (%)	Number positive for urine	Number positive for stool
Males	280 (49.0)	0	0
Females	287 (50.7)	0	0

The occupation composition of the sample population of Zangon-Kataf Local Government Area, Kaduna State

Occupation	Number of respondents (%)	Number positive for stool	Number positive for urine
Armed forces	34 (5.5)	0	0
Business	85 (15.0)	0	0
Civil servants	65 (11.5)	0	0
Farming	143 (25.2)	0	0
Students	209 (36.9)	0	0
Others	31 (5.5)	0	0

The sources of water available to the sample population of Zangon-Kataf Local Government Area, Kaduna State

Sources of water	Number of respondents (%)	Number positive for stool	Number positive for urine
Borehole	122 (21.5)	0	0
Stream	21 (3.7)	0	0
Tap	97 (17.11)	0	0
Well	327 (57.7)	0	0

The Water Contact Activities engaged by the sample population of Zangon-Kataf Local Government Area, Kaduna State

Water contact activities	Number examined (%)	Number positive for stool	Number positive for urine
Farming	211 (37.2)	0	0

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Fishing	40 (7.1)	0	0
Swimming	35 (6.2)	0	0
Washing	281 (28.1)	0	0

Types of toilet used by the sample population of Zangon-Kataf Local Government Area, Kaduna State

Type of toilet used	Number of respondents (%)	Number positive for stool	Number positive for urine
Pit latrine	196 (34.5)	0	0
Open field	248 (43.7)	0	0
Water	128 (22.5)	0	0

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