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Full Length Research Article

A STUDY ON THE ASPECTS OF EPIDEMIOLOGY OF URINARY AND INTESTINAL SCHISTOSOMIASIS IN BAUCHI STATE, NIGERIA

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ABSTRACT
A twelve-month epidemio-ecological study on the prevalence of schistosomiasis was conducted in Bauchi State, from January to December, 2016. Two thousand 2000 samples each of faeces and urine were collected and examined microscopically for schistosome eggs. The urine samples were examined using sedimentation method while the faecal samples were examined using formol-ether concentration technique. Twenty eight 28 (1.40%) of the entire volunteers urine samples collected had eggs of *S.haematobium* 3(0.15%) had eggs of *S. mansoni* in their faecal samples. The infection rates in different month by *S.mansoni* species, infection rate in different sexes and infection rate in individuals from different senatorial zone by schistosomiasis were not statistically significant while the infection rates in different month by *S.heamatobium* species, infection rate in different age groups, infection rate in individuals using different water source, infection rate in individuals using different types of toilet facilities and the infection rate in individuals in different occupational groups were all statistically significant at ($p<0.05$). Though there was low prevalence of the disease in the study area, there is need to intensified integrated control measures to reduce or complete eradicate the disease.

Keywords: Epidemiology, Urinary/Intestinal Schistosomiasis, Bauchi State, Nigeria

INTRODUCTION

Schistosomiasis also known as bilharzias or snail fever or katayama fever is a water-based parasitic disease caused by a blood fluke, which remains one of the most prevalent parasitic infections worldwide. In tropical countries, schistosomiasis is second only to malaria among parasitic diseases with the greatest economic impact (Carter Center, 2008). Over 243 million people in 78 countries in the world are affected by the disease, occurring mostly in the tropical and subtropical areas, especially in poor communities without access to safe drinking water and adequate sanitation (Thetiot-Laurent *et al.,* 2013;WHO, 2014).. It is estimated that at least 90% of those requiring treatment for Schistosomiasis live in Africa. The disease occurs in all 36 state of Nigeria including the Federal Capital Territory. Nigeria is an endemic area with an estimated 11 million people infected (Larotki and Davis, 1981; Ekpo and Mafiana, 2004). Chitsul *et al,* (2000) estimated that 101.28 million people are at risk of infection in Nigeria while 25.83 million people are actually infected. Five species of schistosome infect humans *S. haematobium, S. mansoni, S. japanicum, S. mekongi and S. intercalatum. S. intercalatum* is parasite of cattle in West Africa, also occasionally causes the disease in human. All *Schistosoma species* affect intestine and liver with the exception of *Schistosoma haematobium* that affect urinary tracts. Chronic schistosomiasis also causes physical growth and cognitive delays in children (WHO, 1989). The disease is spread by contact with water that contains the parasites. These parasites are released from freshwater snails that have been infected. The disease is especially common among children in developing countries as they are more likely to play in infected water. Other high risk groups include farmers, fishermen and people using infected water for their daily chores. Diagnosis is by finding the eggs of the parasite in a person's urine in case of *S. haematobium* or stool in the case of other *Schistosoma species*. It can also be confirmed by finding antibodies against the disease in the blood (WHO, 2014). Therefore, the study is carried out to determine the prevalence of the parasite (schistosomiasis) and other factors that influence the transmission of the parasite as well as providing information that can be utilized in designing a suitable programme for the effective control of the diseases in Bauchi state. Schistosomiasis, also known as bilharzias or snail fever or katayama fever, is a water-based parasitic disease caused by a blood fluke, which remains one of the most prevalent parasitic infections worldwide. In tropical countries, schistosomiasis is second only to malaria among parasitic diseases with the greatest economic impact (Carter Center, 2008). Over 243 million people in 78 countries in the world are affected by the disease, occurring mostly in the tropical and subtropical areas, especially in poor communities without access to safe drinking water and adequate sanitation (Thetiot-Laurent *et al.,* 2013;WHO, 2014).. It is estimated that at least 90% of those requiring treatment for Schistosomiasis live in Africa. The disease occurs in all 36 state of Nigeria including the Federal Capital Territory. Nigeria is an endemic area with an estimated 11 million people infected (Larotki and Davis, 1981; Ekpo and Mafiana, 2004). Chitsul *et al,* (2000) estimated that 101.28 million people are at risk of infection in Nigeria while 25.83 million people are actually infected. Five species of schistosome infect humans *S. haematobium, S. mansoni, S. japanicum, S. mekongi and S. intercalatum. S. intercalatum* is parasite of cattle in West Africa, also occasionally causes the disease in human. All *Schistosoma species* affect intestine and liver with the exception of *Schistosoma haematobium* that affect urinary tracts. Chronic schistosomiasis also causes physical growth and cognitive delays in children

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MATERIALS AND METHODS

Study Area

The study was conducted in Bauchi State Nigeria. Bauchi is a State in northern Nigeria and was established in 1976 when the former North-Eastern State was broken up. The state occupies a total land 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 2006 census. The state is located between latitudes 9º3' and 12º3' North and longitude 8º50' and 11º East, and also is one of the northern States that have two distinctive vegetation namely Sudan and Sahel savannah.

The State has three Senatorial Zone (North, Central and South) and 20 Local Government Areas Council which are Bauchi, Tafawa Balewa, Dass, Toro, Bogoro, Kirfi and Alkaleri in the South; Ningi, Warji, Ganjuwa, Dambam, Darazo and Misau in the central; and Giade, Shira, Jama'are, Katagum, Itas/Gadau, Zaki and Gamawa in the North. The State is also 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. In addition to rainfall, the state has a number of rivers. These include the Gongola and Jama'a rivers. The State also has a number of dams for irrigation and other purposes. These include Gubi and Tilde Fulani dams and Lake Maladumba.

Sampling Techniques

Sample Selection

Nine Local Government Areas were randomly selected, three from each senatorial zone. A sample size of 2000 was determined using the formula described by Krejcie and Morgan, (1970) and Benneth *et al*. (1991). Sedimentation method and formol-ether concentration techniques method were used for urine and stool samples respectively.

Administration of Questionnaires

Questionnaires were distributed to all participants to obtain their information on the following: age, sex, occupation, sources of water supply and toilet facilities, after which two containers were given to all participants for stool and urine sample.

Examination of Urine Samples

The urine samples were allowed to sediment for a while in the laboratory and the supernatant were discarded, leaving only the residue at the bottom of the sample containers. Pasteur pipette was used to take one drop to a clean and grease-free slide and covered gently with a cover slip without the formation of air bubbles. The slide was then mounted on the microscope stage and examined with *x*10 and *x*40 objective lenses for *S.haematobium* ova as described by CDC, (2013).

Examination of Stool Samples

The stool samples were processed using formol-ether concentration technique for identification of S*chistosoma* egg according Cheesbrough (1998) and Ochei and Kolhathar (2007). An applicator stick was used to put 1g of each stool sample into a centrifuge tube containing 7cm^3 of 10% formol saline. This was emulsified and filtered through a coffee filter into another centrifuge tube. To the faecal suspension, 3cm^3 of diethyl ether was added and covered using a stopper and shaken vigorously before centrifuging at 3000 revolutions per minute for 3 minutes. After the centrifugation, four distinct layers were formed sediment, formol saline, faecal debris and ether at the topmost. The faecal debris were dislodged with an applicator stick and the upper 3 layers poured off without disturbing the sediment and examined for the eggs of the parasites. A drop of the deposit was pipette onto a clean microscope slide and covered with a clean cover slip to avoid air bubbles and over floating. The slides were mounted on the microscope stage and examined with x 10 and x40 objective lens for schistosomes.

Ethical Clearance:

Permission was sought from the Bauchi state government (MOH/GEN/S/1409/1) and selected local government chairman before proceeding to carry out the research as well as consent of the participants.

Data Analysis:-

The data collected were subjected to Chi-square test as the relationships between two variables were compared and simple percentage. $p<0.0$ was used determined the level of significance.

RESULTS

A total of 2000 stool and urine samples each were collected and examined for schistosome egg. Out of these only 31 (1.55%) were infected by the parasites. Three 3(0.15%) out of the total stool sample collected were infected with *S. mansoni* egg and twenty eight 28 (1.4%) out of the urine samples examined were infected with *S. haematobium* egg. The infection rates with *S.mansoni* in relation to months test statistically significant while there was no significant difference for *S.heamatobium* infection (Tables 1 & 2).

Table 3 show the number of samples collected and the prevalence rate in each senatorial zone. The samples collected in each zone were 800, 600 and 600 in Bauchi South, Central and Bauchi North respectively and the infection rate of each zone are 14(2%), 12(2%) and 5(0.8%) respectively. The prevalence rate of the parasite in three senatorial zone of the state were significantly different ($p>0.05$).Table 4 shows the prevalence rate of the parasite in different age group among the study population. Of all the ages examined 11-20 year age group recorded the highest prevalence rate when compared with other age groups, followed by 21-30, 31-40, 4-10 with prevalence of22 (3.7%), 5 (1.3%), 3(0.9%) and1(0.2%) respectively while no infection was recorded in the age group 41 and above. Statistical analysis showed a significant difference between the age group.

Table 5 shows that out of the sample examined 1,408 were males and 592 were female. Twenty three 23(1.15%) males and 8(0.4%) females were infected with schistosome eggs. The prevalence rate in relation to sex was not significantly different. The prevalence of the parasite in relation to different occupational groups during the study namely; students, farmers, civil servants and others indicated that students had the highest prevalence rate of 21(2.2%) followed by farmers 8(2.7%), others 2(0.9%) and no civil servant were infected during the study as shown in table 6. Also the prevalence rate of the parasite in the different occupational groups was statistically significant.

Table 7 shows the prevalence of the parasite among the participants with different sources of water. The available sources were pipe-borne water, Borehole, pool/pond, River/Stream and drawn well. Individuals whose sources of water supply for domestic use were streams recorded highest prevalence 11(20.8%) followed by pool/pond 7(8.3 %), drawn well 5(1.1%), Borehole 5(0.49%), and pipe bond water had the least 3(0.75%). The difference in the infection rate of the groups was statistically significant. Individuals visiting the bush to defecate recorded highest prevalence 21 (7%) followed by pit latrine 6(0.5%), then individual using anywhere (available alternative such bush, pit latrine, water bodies, etc.) to defecate 3(4.2%) and those who used water closet had the lowest prevalence of 1(0.2%) with a statistically significant difference as shown in table 8.

Table 1: Prevalence of *S.Mansoni* in the Study Population

Month	No Examined	No Infected Prevalence (%)	Observed (O)
January	130	0	0.0
February	152	0	0.0
March	127	0	0.0
April	182	1	0.6
May	98	0	0.0
June	206	0	0.0
July	188	0	0.0
August	234	2	0.9
September	145	0	0.0
October	112	0	0.0
November	209	0	0.0
December	217	0	0.0
Total	**2000**	**3**	**0.15**

X^2 calculated = 12.08; X^2 tabulated = 19.68, df= 11, p>0.05

Table 2: Prevalence of *S.Haematobium*in the Study Area

Month	No Examined	No Infected Prevalence (%)	Observed (O)
January	130	0	0.0
February	152	0	0.0
March	127	0	0.0
April	182	0	0.0
May	98	1	1.0
June	206	0	0.0
July	188	2	1.1
August	234	9	3.8
September	145	10	6.9
October	112	2	1.8
November	209	4	1.9
December	217	0	0.0
Total	**2000**	**28**	

X^2 calculated = 57.05; X^2 tabulated = 19.68, df= 11, p>0.05

Table 3: Prevalence of the Parasite in Three Senatorial Zone of the State

Senatorial Zone	No Examined	No Infected	Prevalence (%)
Bauchi South	800	14	1.8
Bauchi Central	600	12	2.0
Bauchi North	600	5	0.8
Total	**2000**	**31**	**1.55**

X^2 calculated = 3.03; X^2 tabulated = 5.991, df= 2, p>0.05

Table 4: Prevalence Rate of the Parasite in Different Age Group among the Study Population

Age	No Examined	No Infected	prevalence %
4-10	432	1	0.2
11-20	597	22	3.7
21-30	378	5	1.3
31-40	319	3	0.9
41 ABOVE	274	0	0.0
Total	**2000**	**31**	**1.55**

X^2 calculated = 27.97; X^2 tabulated = 9.488, df= 4, p>0.05

Table 5: Prevalence of in Relation to Sex in the Study Population

Sex	No Examined	No Infected	Prevalence (%)
Male	1408	23	1.6
Female	592	8	1.4
Total	**2000**	**31**	**1.55**

X^2 calculated = 0.22; X^2 tabulated = 0.29, df= 1, p>0.05

Table 6: Prevalence of the Parasite in Relation to Different Occupational Groups in Bauchi State

Occupation	No Examined	No Infected	prevalence %
Pupils	968	21	2.17
Civil Servants	478	0	0
Farmers	300	8	2.67
Others	254	2	0.79
Total	**2000**	**31**	**1.55**

Table 7: Prevalence of the Parasite in Relation to Source of Water

Source of Water	No Examined	No Infected	prevalence %
Pipe borne	400	3	0.75
Pool/pond	84	7	8.3
Borehole	1011	5	0.49
River/stream	53	11	20.8
Drawn well	452	5	1.1
Total	**2000**	**31**	**1.55**

X^2 calculated = 163.07; X^2 tabulated = 7.815, df= 4, p>0.05

Table 8: Prevalence of the Parasites Based on Type of Toilet Facility Used

Toilet facility	No Examined	No Infected	Prevalence (%)
W.C Toilet	531	1	0.19
Bucket	0	0	0
Pit latrine	1097	6	0.55
Bush	300	21	7
Anywhere	72	3	4.17
Total	**2000**	**31**	**1.55**

X^2 calculated = 11.03; X^2 tabulated = 7.815, df= 4, p>0.05

DISCUSSION

The overall prevalence of 31(1.55%) was recorded which included, 28 (90.3%) *S. haematobium* and 3 (9.7%) *S. mansoni* respectively. This indicates low endemicity of the parasite in the study area. These observation is contrary to the earlier reports made by some researchers in the study area and neighboring states such as Usman *et al.* (2016), Daniel *et al.* (2015) Duwa *et al*. (2009), Biu, *et al*. (2009) and Ahmed *et al.(*2015) in Bauchi, Gombe, Kano, Borno and Jigawa states respectively because they recorded higher than the present study. Similarly lower prevalence rate had been reported as observed in the present study by some researchers such as Belonwu (2007), Dawet, *et al*. (2012) and Bigwan *et al.* (2012) in Bauchi, Yobe and Plateau states respectively. The low prevalence of the parasite recorded in this study is probably due to the fact that most of the participants are students and civil servants who live in urban areas that has improved water supply. The infection rate in three senatorial zone of the state shows that of the three senatorial zones examined, Bauchi Central had the highest prevalence rate followed by Bauchi south while Bauchi north had the least with 12(2%), 14(1.8%) and 5(0.8%) respectively. This pattern of infection of individuals in different location in the same study area had been recorded earlier Chidi *et al.* (2006) and Uneke *et al*. (2007). The major factors that might be responsible for the high prevalence in Bauchi central senatorial zone could be low literacy level, poor sanitation absence of basic amenities such as water, indiscriminate disposal of human wastes and high water contact activities.

The infection rate of the parasite in relation to age in this study revealed that, the age group of 11-20 years had the highest infection rate with the parasite than individuals in other age groups. This finding is consistent with Usman *et al*. (2016), Abdullahi and Saidu (2011), Dawet, *et al.* (2009), Biu *et al.* (2009) and Faruk *et al.* (2009) in Bauchi, Niger, Minjibir, Konduga and Danjarima, respectively. The low prevalence observed in the least age group and older group could be attributed to the fact that at early age children are only accompany their older ones to the open water bodies but are not actively involved in activities that take place at the water contact sites because of their age and fear of drowning as observed by Ogachukwu and Patience (2013). The rise in prevalence with age could be attributed to exposure factor. Consequently, at the older age group no one was infected with the parasite, this may be due to the awareness or early treatment of the infection at this age. In this study also, males were more infected with the parasite than their female counterpart. This is in agreement with earlier reports of Usman *et al*. (2016), El-Mahamood and Daughari (2008), Abdullahi and Saidu (2011) and Faruk *et al.* (2009) in Bauchi, Misau, Niger and Danjarima respectively. However, Olusanya and Odiomu (1984) as well as Edungbola *et al*. (1988) stated that females mature earlier and are therefore restricted socially compared to males to swim naked in the stream, this is one of the major reason why male were more infected then their counterpart female. Similarly Egwunyenga *et al*. (1994) and Arinola, (1995) had made such observations in Bauchi and Ibadan respectively.

However, it was also observed that occupation of the individuals in the study area played an important role as it had an effect on the infection rate of those screened. The pattern of infection among the four occupational groups indicated that farmers were more infected than individuals in other occupational groups followed by students/pupils. This observation of the prevalence of schistosomiasis is in agreement with the reports of Egwunyenga *et al.* (1994) and Anosike *et al*. (1992). The higher infection rate in farmers and students/pupils could be attributed to their frequent contact with water bodies as the farmers use the water from infested streams for their recreational, occupational and domestic activities and students/pupils visit the streams frequently for bathing, swimming or playing. However, world health organization expert committee (2002) report showed that, the main groups at risk are school age children, specific occupational group (fishermen, irrigation workers, farmers) and women and other groups using infected water for domestic purposes. These categories of people therefore have greater exposure to infection as well as constitute the main sources of infesting other water bodies through which other groups may be infected. And also different sources of water supply played another major important role as individuals whose sources of their water supply were open water bodies, were more infected than those whose sources were the other alternatives (bore holes and pipe borne). This observation agrees with the records of Okpala *et al.* (2004) and Nwosu *et al.* (2005). The high prevalence rate could be due to the fact that the infected individuals were exposed to streams

harbouring the infective stage of the parasite. Though some individuals in other groups that used bore holes and pipe-borne water, were infected, it could be that these people visited infested streams for one or more water contact activities and got exposed to the infective stage of the parasite.

The types of toilet facilities available to the inhabitants of the study area also had effect on the prevalence of the parasite as members of the group that utilized bush as their toilet facilities were more infected than those who used water closet system (W.C.S) and pit toilets. This observation is in agreement with the work of Okpala *et al*. (2004). The higher prevalence rate in the individuals using bush to defecate can be attributed to the inhabitants in such areas getting exposed in one way or the other to water bodies harbouring the infective stage of the parasites cercariae in the vicinity of the bushes they utilized. Other sources of exposure may be through bathing in the water bodies, wading through the water, defecating within the water bodies or even drinking the infested water.

Conclusion

In this study, there was low prevalence of the parasite as only 31(1.55%) out of 4000 samples (2000 each of urine & stools) examined were positive with *Schistosoma* eggs (28 *S. haematobium* and 3 *S. mansoni*). However, there is need for constant surveillance, diagnosis and treatment of the disease in order to reduce or if possible to eliminate the disease from the study area. Safe drinking water and recreation centers to reduce water contact activities and public awareness on the effect and mode of transmission of the parasite are all recommended for complete elimination of the parasite in the area.

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