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### Intestinal schistosomiasis among some inhabitants of Bassa Local Government Area of Plateau State, Central Nigeria



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#### ABSTRACT

Human schistosomiasis is endemic and still remains a public health problem in Nigeria. Most reported cases of the disease have focused mainly on the urinary form with the intestinal form less reported. Thus, 600 fresh stool samples from consenting individuals in Bassa Local Government Area of Plateau State, an endemic foci of schistosomiasis, were collected and assayed for the presence of *Schistosoma mansoni* eggs by the saline thick stool smear technique. Prevalence of infection between ages and gender was tested using chi-square while one-way analysis of variance was used in analyzing data relating to the occupation. Association between infection and occupation was assessed by the independent student *t*-test. Infection was significantly higher in younger than older individuals ( $p < 0.05$ ). There were no significant differences in infection between gender. However, there was a significant association between infection and occupation of volunteers ( $p < 0.05$ ). Freshwater snails occurring in the area were sampled using a scoop net and a pair of forceps. Three snail species, namely *Bulinus globosus*, *Biomphalaria pfeifferi*, and *Lymnaea natalensis* were encountered. *Bulinus* and *Biomphalaria* snails shed schistosome cercariae while *Lymnaea* snails were not infected. Intestinal schistosomiasis is, therefore, also endemic in Bassa Local Government Area. Interventions by way of chemotherapy and mass awareness by Government and other Health Care givers are recommended to forestall the spread of infection to other areas and curb the socio-economic and public health consequences.

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#### Highlights:

- The status of intestinal schistosomiasis among some inhabitants of Bassa Local Government Area of Plateau State, North Central Nigeria, where such information is currently lacking is presented.
- Result suggests that intestinal schistosomiasis is also endemic just like the urinary form of the disease in Plateau State.

- Mass public enlightenment, as well as chemotherapy, is suggested as intervention measures in order to forestall the spread of the infection to other areas.

#### 1. Introduction

Human schistosomiasis existing in two major forms; the urinary and intestinal have been known since antiquity. The disease is the second most common

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parasitic disease of man. An alarming 201 million cases (mainly urinary schistosomiasis) were estimated to occur in Africa accounting for more than 97% of the number of infections worldwide (Steinman et al., 2006). Nigeria is one of the highly endemic countries with an estimated 11 million people infected with the disease (WHO, 2000). The disease is, therefore, of major public health importance.

Factors like human migration, infrastructural development projects in agriculture, hydro-electricity, and road projects continue to extend the disease to new areas as these projects increase the natural habitats of the snail intermediate hosts. Thus, there is a continued increase in the prevalence, as well as the pattern of distribution of the scourge globally.

In Nigeria, the vast majority of reports in literature tend to focus on the urinary form of the disease, suggesting that it is probably more endemic in the country (Balla et al., 2015; Biu et al., 2009; Chidozie and Danian, 2005; Dakul et al., 2001; Morenikeji and Idowo, 2011; Musa et al., 2010; Ofoeze et al., 1997; Sarkin-Fada et al., 2009; Ukwandu and Bukbuk, 1996). Earlier, Ogunnowo (1990) had shown that intestinal schistosomiasis was of low endemicity in Nigeria. Since *Schistosoma mansoni*, the causative agent of intestinal schistosomiasis is known to be more virulent than *Schistosoma haematobium*, more information regarding its occurrence and distribution in different parts of Nigeria is desirable. There is, however, the dearth of requisite information for most parts of Nigeria, including Plateau State. Therefore, we report here the status of intestinal schistosomiasis among inhabitants of Bassa Local Government Area of Plateau State, Central Nigeria.

## 2. Materials and methods

### 2.1. The study area

Bassa Local Government Area occupies a land mass of approximately 2,540 km<sup>2</sup> situated on latitude 8°41'–9°10' N and longitude 9°8'–9°16' E. The area is rocky and falls within the Guinea Savannah vegetation zone of Nigeria. The area has numerous freshwater habitats like ponds, dams, streams, man-made lakes, and irrigation channels. The area is predominantly rural with inadequate social amenities. Thus, inhabitants often depend on various streams, ponds, and open wells for water. Owing to the scarcity of proper latrines, defecation and urination are often in the open or sometimes in running water.

### 2.2. Ethical clearance

Prior to sample collections, ethical clearance was obtained from the Health Department of Bassa Local Government Area, Plateau State for permission to conduct the study. Following approval, sample collection commenced with the administration of questionnaires.

### 2.3. Administration of questionnaires

Structured questionnaires were administered to 600 people randomly selected in the Local Government Area so as to obtain information on age, gender, occupation, and source of water. Volunteers who could write, filled the questionnaires by themselves while interviews were conducted for those who could not write.

### 2.4. Water contact activities

After a preliminary survey to identify sites frequented by the inhabitants was undertaken, three sites (two streams and a dam) were selected for water contact study. Observations were carried out fortnightly between 6.00 am and 6.00 pm on each sampling occasion. The number of persons, approximate age, gender, type, and duration of activity were recorded.

### 2.5. Stool collections and treatment

Stool samples were collected from 600 volunteers, who were randomly selected among the inhabitants, in wide-mouthed/screw-capped plastic containers and fixed in 10% formal saline solution. Each sample was appropriately labeled indicating serial number, age, and gender of volunteers. Fecal samples were then brought to the laboratory of the Department of Biological Sciences, Abubakar Tafawa Balewa University, Bauchi, Nigeria and examined by the saline thick stool smear technique.

### 2.6. Snail survey and cercarial infectivity

A snail survey using long handle metal scoop net and pairs of plastic forceps was conducted in some of the freshwater habitats in the area. Snails captured were brought to the laboratory and examined for infection by the shedding method as described by Madsen (1985). Cercariae harvested, as well as snails captured, were identified on the basis of morphological characteristics in accordance with standard keys of Frandsen and Christensen (1984) and Brown (1994), respectively.

### 2.7. Statistical analysis

Prevalence of schistosomes with respect to age and gender was analyzed by use of a chi-square test ( $X^2$ ), while one-way analysis of variance was employed in analyzing data with respect to occupation. The  $p$ -value level of significance was assigned at  $p < 0.05$ . The association between infection and occupation was assessed with student independent  $t$ -test. All analyses were done using the SPSS/PC<sup>+</sup> computer software version 21.

### 3. Results

Of the 600 stool specimens examined, 95 (15.8%) were positive for *S. mansoni* eggs. The age and gender-related prevalence of infection are shown in Table 1. This indicates that infection was higher among age group 5–10 years and the least prevalence was recorded among those aged 45–50 years.

No infection was recorded among older persons aged 50 years and beyond. Thus, infection was observed to be significantly higher in lower age groups than older individuals ( $p < 0.05$ ). More females, 56 (16.5%) were infected with schistosomes than males 39 (15.0%) in the study area. This seeming difference was, however, statistically insignificant ( $p > 0.05$ ).

The prevalence of infection in relation to the occupation of volunteers is indicated in Table 2. Primary school pupils and students at the junior secondary schools were more infected, followed by farmers/fishermen, while government workers were the least infected. These differences were statistically significant ( $p < 0.05$ ). There was also a significant association between farming/fishing activity and infectivity.

Analysis of water contact activities of respondents presented in Table 3 showed that those engaged in washing/laundry were significantly more infected followed by farmers/fishermen and those who swam or

**Table 1.** Prevalence of intestinal schistosomiasis in relation to age and gender of some residents of Bassa Local Government Area of Plateau State, North Central Nigeria.

Age group(years)	Gender					
	Males			Females		
	No. exam.	No. +ve	Prev (%)	No. exam.	No. +ve	Prev (%)
5–10	18	8	44.4	17	5	28.6
10–15	21	3	14.3	15	6	41.8
15–20	48	13	27.1	36	8	22.2
20–25	38	8	21.1	31	6	19.4
25–30	20	1	5.0	52	8	15.4
30–35	20	2	10.0	51	8	15.7
35–40	32	2	6.3	35	5	15.3
40–45	20	2	10.0	46	6	13.0
45–50	21	1	4.6	45	4	8.9
50 and above	25	0	0.0	12	0	0.0
Total	260	39	15.0	340	56	16.5

**Table 2.** Prevalence of intestinal schistosomiasis in relation to the occupation of volunteers in Bassa, Local Government Area of Plateau State, North Central Nigeria.

Occupation	No. exam	No. infected	Prevalence (%)
Farmers/Fishermen	56	15	26.7
Civil servant	189	16	8.5
Traders	58	4	6.9
Students	92	29	31.5
Pupils	55	23	41.8
Unemployed housewives	121	16	13.2
Applicants/Pensioners	29	4	13.8
Total	600	93	15.5

bathed in that descending order ( $p < 0.05$ ). Those who fetched water for commercial purposes for building constructions were not infected.

Data on the snail survey revealed three freshwater snail species, including *Biomphalaria pfeifferi*, *Bulinus globosus*, and *Lymnaea natalensis*. The total number of snails recovered, as well as those carrying patent infection are presented in Table 4. On the whole, more *B. globosus* occurred with corresponding higher numbers of infected individuals (43.9%) than *B. pfeifferi* with only 17.2% of them infected. *Lymnaea natalensis* was the least occurring snail recovered but did not shed cercaria.

#### 4. Discussion

This investigation has shown that intestinal or mesenteric schistosomiasis is endemic in Bassa Local Government Area of Plateau State, North Central Nigeria. Although, the level of endemicity was low in comparison with reports from other parts of Plateau State (Akunfongwe et al., 1996), as well as other parts of Nigeria (Adamu and Musa, 1998; Balla et al., 2015; Chidozie and Danian, 2005; Morenikeji and Idowu, 2011; Pugh and Gilles, 1978). This low endemicity is nevertheless noteworthy, since *S. mansoni* is known to be more virulent than *S. haematobium*. This, coupled with the fact that water conservation schemes for diverse purposes are on the increase in the area, such water bodies will continue to enhance local transmission with future consequences. Therefore,

infection is likely to be on the increase with its attendant socio-economic effects unless mitigated.

The age disparity in prevalence of infection observed in sampled population of Bassa Local Government Area in this study, where infection was more in children appears to be consistent with many reports from elsewhere in Nigeria (Adeoye and Akabogu, 1996; Agere et al., 2009; Balla et al., 2015; Dakul et al., 2001; Pugh and Gilles, 1978). Aside from factors of immunity, younger people are more prone to water-related activities like playing, bathing, and swimming in open water, as well as swimming than older people. Thus, they tend to have more frequent contact with infested water with the schistosome cercariae, with a higher degree of exposure for a longer period of time, thereby enhancing acquisition of infection.

It is interesting that more females were infected than males with intestinal schistosomes in the study area. The general trend of cases of intestinal schistosomiasis reported from other parts of Nigeria showed a higher prevalence of infection among males owing to more frequent water contact and longer exposure time in those infested waters than females. The reason for the current observed disparity is not clear. However, it may be linked with an observation during the study of more women seen engaged in washing of domestic utensils and/or clothes in ponds and rivers than men, thereby bringing them in frequent contact with cercariae-infested water. Women in the study area have also been observed executing tasks like building and farming which are activities exclusively

**Table 3.** Prevalence of intestinal schistosomiasis in relation to water contact activities of volunteers in Bassa Local Government Area, Plateau State, North Central Nigeria.

Water contact activities	No. exam	No. infected	Prevalence(%)
Bathing/Swimming	208	39	18.8
Water for commercial purposes	3	0	0
Water for domestic use	203	36	17.7
Washing/Laundry	51	31	60.8
Farming/Fishing	73	27	36.9
No. contact with water body	62	9	14.5

**Table 4.** Snail species encountered in some freshwater bodies in parts of Bassa Local Government Area, Plateau state, Nigeria.

Habitat type	Snail species encountered					
	<i>B. globosus</i>		<i>B. pfeifferi</i>		<i>L. natalensis</i>	
	No. recovered	No. infected (%)	No. recovered	No. infected (%)	No. recovered	No. infected (%)
Rukuba Dam	957	468 (48.9)	311	52 (16.7)	121	0 (0)
River Karami	116	19 (16.4)	102	5 (4.9)	107	0 (0)
River Nigell	121	37 (30.6)	145	39 (26.9)	93	0 (0)
Total	1,194	524 (43.9)	558	96 (17.2)	321	0 (0)



for men elsewhere. This could have also contributed to the situation at hand by forcing them into frequent contact with the infested water.

The findings of this study in which children in the primary and junior secondary schools, as well as farmers/fishermen were the most infected closely agrees with those of earlier workers (Agere et al., 2009; Biu et al., 2009; Dakul et al., 2001; Sarkin-Fada et al., 2009; Ukwandu and Bukbuk, 1996). Essentially, rural children in or out of school derive pleasure in bathing, swimming, or just playing in water bodies around their homes/schools which may harbor infested snail intermediate hosts of schistosome parasites. Such activities are increased, especially during the hot season when there is dire need to cool off the body. For this reason, children become exposed to infection. Similarly, dictates of occupation necessitate close and prolonged contact with infested water sometimes by farmers and fishermen alike; thus predisposing them to high infections.

Not all cases of infection with *S. mansoni* recorded in this study had been acquired locally. This is because interactions with soldiers having the infection and live in barracks located within the study area revealed that they could have acquired the infection before they were transferred to the area. Similarly, some Fulani inhabitants interviewed reported to have migrated from some other areas where they could have had the infections. These are undoubtedly typical examples of how human migration aid in the spread of schistosomiasis.

## 5. Conclusion

It is evident from this study that intestinal schistosomiasis exists in Bassa Local Government Area of Plateau State, Central Nigeria. Therefore, there is a need for an urgent intervention by Government and other health care givers to forestall its spread. A mass educational enlightenment campaign by both Plateau State Ministry of Health and the Primary Health Care Department of Bassa Local Government coupled with chemotherapy, as well as provision of safe water supply will no doubt reduce transmission of schistosomiasis in the area.

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