

Urinary Schistosomiasis in the Niger-Benue Basin of Kogi State, Nigeria

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Abstract: A survey to determine the prevalence and intensity of urinary schistosomiasis among primary and postprimary schools children in four Local Government Areas (LGAs) namely, Ibaji, Idah, Lokoja and Ofu in Kogi State was carried out between January, 2002 and December 2005. About 26 (16 primary and 10 postprimary) schools were randomly selected from the four LGAs. A total of 1,104 urine samples were collected and analysed using parasitological and reagent strip (screening) techniques. Of this figure, 206 (18.7; 95% CI: 0.164-0.210) were infected with the parasite. An overall geometric mean intensity of 118.2 eggs/10 mL urine was recorded. Prevalence of infection was significantly higher in males (19.4%) than in females (16.5%, $p < 0.001$) but there was no significant difference ($p > 0.05$) in intensity of infection between the two sexes. About 76.7% of infected children excreted > 50 eggs/10 mL urine; 58.3% were males and 18.4% were females. Primary school children had the higher prevalence (21.5%) than those in postprimary schools (14.5%, $p < 0.05$). The peak prevalence of infection was 22.7 and 20.8% among the primary and postprimary school children were recorded in 10-14 and > 20 year age groups, respectively. Ibaji LGA exhibited the highest overall prevalence of infection (40.1; 95% CI: 0.345-0.457). Hence, children of 10-14 year age group contributed more to the transmission of the disease in the Niger-Benue basin than those of any other age groups.

Key words: Schistosomiasis, Niger-Benue basin, school children, parasitological, screening techniques prevalence

INTRODUCTION

Schistosomiasis is a major disease of public health importance and has been ranked second only to malaria as a source of human morbidity caused by parasitic agent (Lucas and Gilles, 1973; WHO, 1974; Roger, 1986; Remme *et al.*, 1993; Fajewonyomi and Afolabi, 1994; Ogbe, 2002). Currently, 200 million people are infected world-wide with 120 million with symptoms and 20 million with severe illness (Ross *et al.*, 2002) with varying pathological presentations. Some 400 million more people are at risk of becoming infected (WHO, 1984) and an estimated 80% of the most severely affected individuals is now concentrated in Africa (Ogbe, 2002). Schistosomiasis principally affects people engaged in agriculture or fishing but in many areas a large population of children are infected by the age of fifteen (Opoku, 1974; WHO, 1990; Ogbe, 1995).

Schistosomiasis is one of the important health problems in Nigeria (Ejezie *et al.*, 1989; Ozumba *et al.*,

1989; Adewunmi *et al.*, 1991), primarily rural in distribution but urban schistosomiasis is also becoming important in Nigeria (Odaibo *et al.*, 2004). The overall prevalence of *Schistosoma haematobium* infections ranges from 13.5-21.2% in Nigeria (Pugh and Gilles, 1978; Udonsi, 1990; Uko *et al.* 1993; Amali, 1993; Egwuyenga *et al.*, 1994; Okoli and Odaibo, 1999) and even higher prevalence rates of infection for riverine, rural settings in Nigeria have been reported (Cline *et al.*, 1989; Agi and Okafor, 2005). In Nigeria, 11 million cases of the disease have been reported (Iarotski and Davis, 1981) but published data on the epidemiology is scanty (Amali, 1993).

The only two available reports on urinary schistosomiasis in the then Benue State when Kogi State was yet to be carved out of the former were those of (Blair, 1956) and Amali (1989) and recently the research of Ejima and Odaibo (2007) on urinary schistosomiasis in Ibaji LGA of Kogi State. This study presents the first comprehensive investigation on the status of schistosomiasis in the Niger-Benue basin of Kogi State, Nigeria.

MATERIALS AND METHODS

Study area: Kogi State is situated in the savannah region between longitude 05°20"-08°00" East and latitude 05°30"-08°50" North with the State capital at Lokoja, located at the confluence of the two major Rivers in Nigeria, River Niger and River Benue. The state is bordered to the East by Benue State and to the South by Edo, Enugu and Ondo States and to the North by Niger and Nasarawa States and to the West by Kwara and Ekiti States. The state is made up of twenty-one Local Government Areas (LGAs) (Fig. 1). The study site is precisely located between longitude 06°30"-07°00" East and latitude 06°30"-08°00" North. There are two main seasons, dry and wet seasons. The wet season begins in March and stops towards the end of October. The ranges in mean monthly minimum and maximum temperatures during wet and dry seasons in the region were 21.9-26.5 and 30.7-36.7°C, respectively. The topography of Ibaji Local Government Area (LGA) is such that clay particles are deposited in the lower horizons thus rendering this area clayey and water waterlogged during wet season.

The alluvial plain of this part of River Niger valley is made of highly fertile soils but specialized systems of agriculture are required because of seasonal flooding. A number of manmade freshwater bodies are available in the LGA particularly in Ejule-Ojebe due to the excavation activities of the defunct Lower-Benue River Basin Development Project (LBRBDP) in the village.

The population distance of Local Government Headquarters from the state capital and number of primary and post-primary schools of the communities studied are shown in Table 1. The communities depend mainly on Rivers Niger and Benue and their tributaries as sources of water for both agricultural and domestic purposes since pipe borne water is limited to a few places in urban areas. The study was conducted between 2001 and 2005 in four Local Government Areas (LGAs) namely Ibaji, Idah, Lokoja and Ofu of Kogi State. A total of 26 (16 primary and 10 postprimary) schools within about 100 km² area of the valleys of River Niger and River Benue from these four Local Government Areas (LGAs) were randomly selected and surveyed. During the pilot study, before the collection of urine samples, all the stakeholders namely

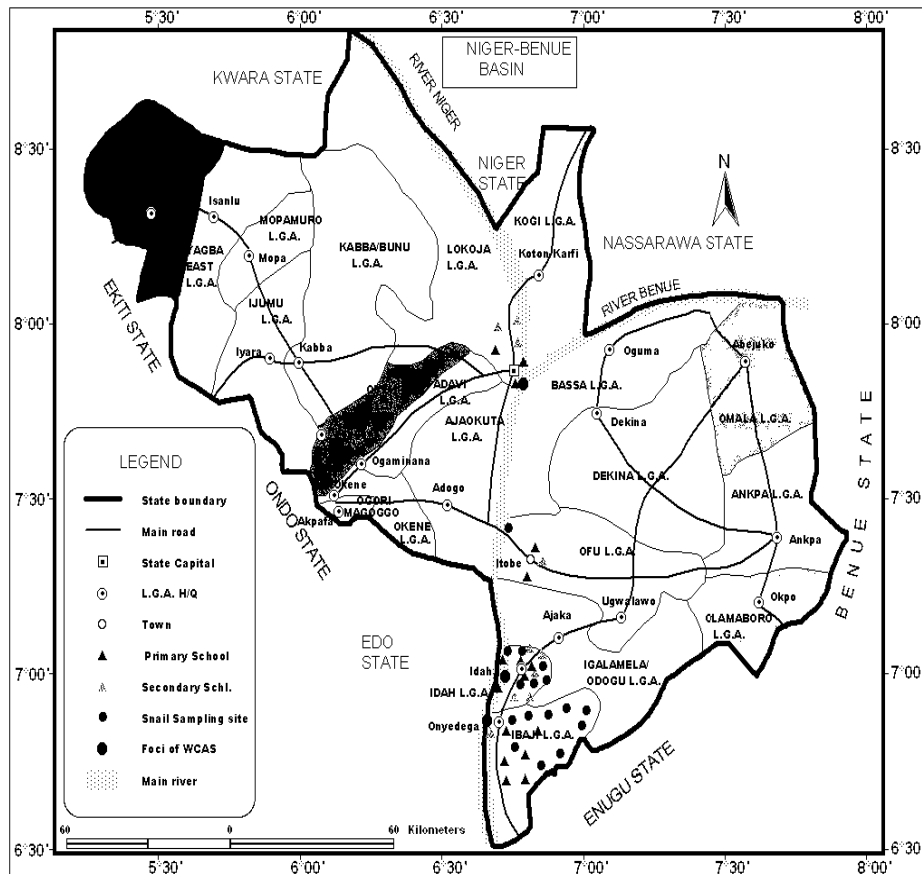


Fig. 1: Map of Kogi State showing the surveyed schools, snail sampling sites and foci of Water-Contact Activities (WCAs)

Table 1: A Profile of the population and institutions as well as the distance of the four local government headquarters (within the study sites) from the state capital (Lokoja)

Country/State/LGA	Population		Total	Distance of L.G. Hqs. from state capital (Lokoja) (km)	No. of primary schools	No. of post primary schools
	Male	Female				
Nigeria	44,529,608	44,462,612	88,992,220	-	-	-
Kogi state	1,098,084	1,049,672	2,147,756	-	-	-
Idah	105,916	108,849	214,765	175	39	8
Ibaji*	-	-	-	204	78	10
Igalamela/Odolu*	-	-	-	164	110	9
Ofu	55,059	57,638	112,697	151	162	13
Lokoja	-	-	77,516	-	83	10

*Ibaji and Igalamela/Odolu were formerly Districts in the Old Idah L. GA, National Bureau of Statistics (NBS, Fed. Office of Stat., Lokoja), Provisional Census results (1991), Ministry of Works and Housing (MOW), Lokoja, 2006, Ministry of Education (MOE), Lokoja, 2006

commissioners for Health and Education, chairmen/secretaries to the State Primary Education Board (SPEB) and head teachers were consulted and their cooperation solicited. The collection of samples was carried out on each occasion between 1100 and 1400 h. The presence of gross haematuria in urine samples was observed and recorded. Any urine sample without visible blood was tested with reagent strip (Med-test, combi 9[®] Düren) which was dipped into each urine to detect blood/infection by a change of colour (from yellow to green) corresponding with that on the standard chart on combi 9[®] Label.

From each urine container, 10 mL of thoroughly mixed urine was collected in a graduated centrifuge tube and subjected to centrifugation at 1500 rpm for 5 min. The supernatant was decanted and the number of eggs present in (100 µL) aliquot of the thoroughly mixed sediment was pipetted on to microscope slide and the eggs were systematically sought for and counted. The number of eggs in 10 mL of each urine sample centrifuged was calculated from the mean result of three counts by proportionality. Any urine samples that could not be examined within the same day were preserved with boric acid powder (0.1 g/10 mL urine) for subsequent examinations. The results so obtained were analyzed statistically for significant differences in the disease prevalence and intensity by sex, age and schools/areas. Chi square (χ^2) statistic was used to compare differences in prevalent rates of infections while Wilcoxon (1945) paired sample Test (T) was employed for testing differences in intensity (GMI) of infection among sexes, ages and schools/areas. Sensitivity of the reagent strip employed as a screening technique in detecting invisible blood in urine samples was determined in accordance with the method adopted by Uko *et al.* (1993). Briefly, this entails using the hypothetical formula:

$$\text{Sensitivity, } S = a/(a+b) \times 100$$

Where:

a = Total number of subjects parasitologically positive and at the same time positive with the strip reagent

b = Total number of subjects negative with strip reagent but parasitologically positive (infected)

RESULTS AND DISCUSSION

Table 2 shows the overall prevalence, Geometric Mean Intensity (GMI) and macrohaematuria of *S. haematobium* infection in the four local government Areas surveyed in Kogi State. The ages of the study population ranged from 5-20 years and mean±SD age was 14.2±4.9 years. The results showed that Ibaji LGA had the highest prevalence of infection (40.1%; CI: 0.345-0.457), intensity of infection (161.6 eggs/10 mL urine) and prevalence of macrohaematuria (11.6%) followed by Idah LGA with prevalence of 13.3% (CI: 0.052-0.214), intensity of 85.2 eggs/10 mL urine and haematuria of 0.2%.

Lokoja LGA had 7.7% (CI: 0.041-0.113) prevalence rate of infection, intensity of 138.4 eggs/10 mL urine and macrohaematuria of 1.9% whereas the least prevalence of 5.2% (CI: 0.008-0.096), intensity of 49.7 eggs/10 mL urine and 0.0% macrohaematuria were recorded in Itobe (Ofu LGA).

Table 3 shows that low-moderate and high Geometric Mean Intensities (GMI) occurred in the study cohort. The overall intensity of infection due *S. haematobium* in both sexes recorded for the four LGAs was 118.2 eggs/10 mL urine. About 23.3% of the infected children had low intensity of infection (1-49 eggs/10 mL urine) while 63.1% had moderate intensity (50-499 eggs/10 mL urine). About 13.6% of infected children excreted ≥500 eggs/10 mL urine and 6.8% excreted ≥1000 eggs/10 mL urine. About 76.7% of the infected subjects excreted ≥50 eggs/10 mL urine and 58.3% were males and 18.4% females (Table 3).

Figure 2 shows the pooled data of prevalence and geometric mean intensity of *S. haematobium* infection by age in 16 primary and 10 postprimary schools, respectively. The overall results showed that primary schools had a higher prevalence rate of infection (21.5%; CI: 0.184-0.246) than the postprimary schools (14.5%; CI:

Table 2: Overall prevalence (%), Geometric Mean Intensity (GMI) and macrohaematuria due to *S. haematobium* infection in four Local Government Areas (LGAs) of Kogi State

LGA	No. of examined	No. +ve	Prevalence (%)	CI 95%	GMI	Macrohaematuria (%)
Ibaji	294	118	40.1	0.345-0.457	161.6	11.6
Idah	504	67	13.3	0.052-0.214	85.2	0.2
Lokoja	209	16	7.7	0.041-0.113	138.4	1.9
Ofu (Itobe)	97	5	5.2	0.008-0.096	49.7	0.0
Total	1,104	206	18.7	0.164-0.210	118.2	4.8

Table 3: Intensities (GMI) of *Schistosoma haematobium* infection by sex in the 26 primary and post-primary schools surveyed in Kogi State, Nigeria

Sex	No. infected (+ve)	Low intensity 1-49 eggs/10 mL urine	Moderate intensity 50-499 eggs/10 mL urine	High intensity 500/999 eggs/10 mL urine	1000 eggs/10 mL urine and above	Percentage with eggs/10 mL urine and above	Overall geometric mean intensity (GMI)/10 mL urine
Male	160	38	93	13	14	58.3	138.2
Female	46	10	37	1	0	18.4	93.7
Total	206	48	130	14	14	76.7	118.2

Percentage of infected children with ≥ 500 eggs/10 mL urine = 13.6%. Prevalence (%) $\sigma = 19.4$: + = ϕ 16.5, ($p < 0.001$) $\chi^2_{cal} = 79.403$; $df = 8$, GMI/10 mL urine $\sigma = 138.2$; $\phi = 93.7$ ($p > 0.05$) $T_{cal} = 8$; $df = 9$

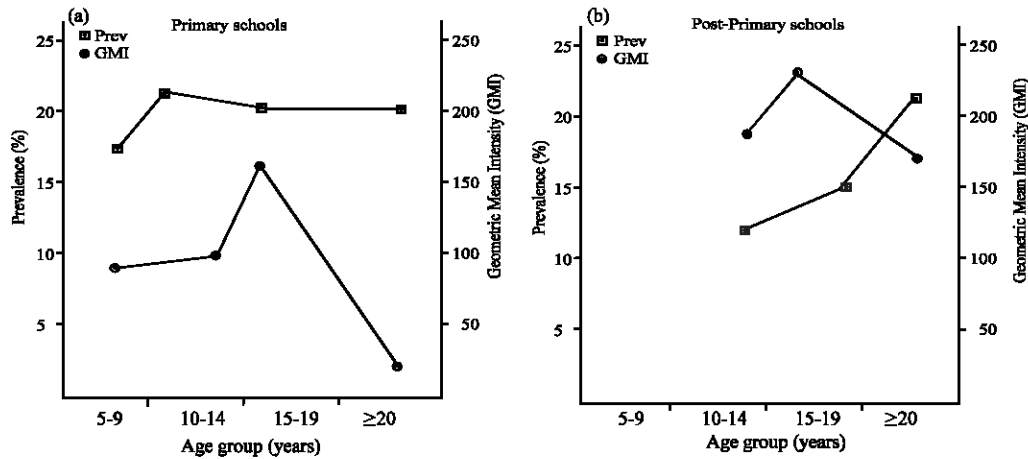


Fig. 2(a, b): Pooled data of prevalence (■) of *S. haematobium* infection and GMI (●) by age in the 16 primary schools and 10 post-primary schools in the four LGAs surveyed: X = indicates age-group in which no samples were recorded

0.144-0.175) ($p < 0.05$). The intensity of infection was however, higher in the latter (202.0 eggs/10 mL urine) than the former (102.1 eggs/10 mL urine) ($p < 0.05$). In the primary schools, the lowest prevalence and intensity of *S. haematobium* infection, 18.0% and 20.0 eggs/10 mL urine were recorded in the 5-9 and ≥ 20 year age groups, respectively. Whereas the highest prevalence (22.7%) and intensity (157.0 eggs/10 mL urine) occurred in 10-14 and 15-19 year age groups, respectively.

In the post-primary schools on the other hand, the lowest prevalence and intensity of infection, 11.0% and 167.2 eggs/10 mL urine were recorded in the 10-14 and ≥ 20 years age groups, respectively. The prevalence and intensity of infection (20.8% and 228.3 eggs/10 mL urine) however, attained the peak in the ≥ 20 and 15-19 year age groups, respectively among the post-primary school children (Fig. 2a, b).

Macrohaematuria recorded in the four LGAs ranges from 0.0-23.1% while Geometric Mean Intensity (GMI) ranges from 20-323 eggs/10 mL urine. The highest and the lowest macrohaematuria and GMI were recorded in Ibaji and Ofu (Ofu) LGAs, respectively. Generally, the study had shown that macrohaematuria and/or geometric mean intensity due to *S. haematobium* infection did not only vary with age and sex but the pattern of this variation differed between communities as shown by the curves (Fig. 3a-g). Also, the regular pattern of increase observed in prevalence and GMI curves in male subjects in Ibaji LGA has confirmed the fact that schistosomiasis haematobium is endemic in that LGA where it has been gathered through oral interview that the disease had been known to the natives as syphilis or gonorrhoea of he-goat but that they did not know how it is contracted. Some people were of the view that haematuria in teenagers (even males) is a sign of maturity.

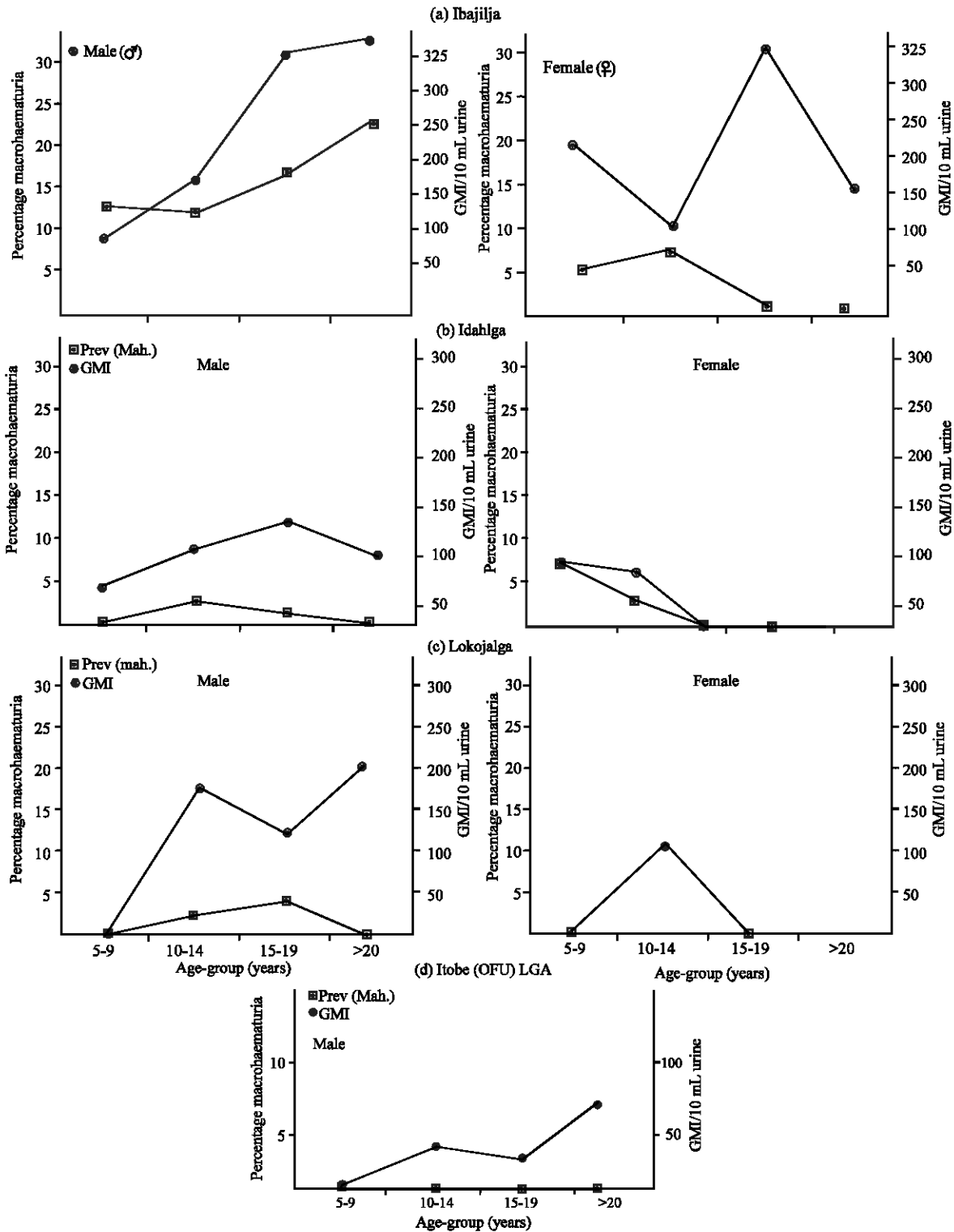


Fig. 3 (a-g): Percentage macrohaematuria (■) and GMI (●) of *S. haematobium* infection in Ibaji (a); Idah (B); Lokoja (c) and Itope (Ofu) (d) LGAs. X- No data for ♀

Urinary schistosomiasis has been established in this study to be endemic especially in the rural areas within

the Niger-Benue basin of Kogi State. The disease is equally becoming important in the urban areas of the

State. The overall prevalence of infection of 18.7% obtained in the present study is relatively high when compared to overall prevalence of infection recorded by various workers in Nigeria (Pugh and Gilles, 1978; Udonsi, 1990; Uko *et al.*, 1993; Amali, 1993; Egwuyenga *et al.*, 1994; Okoli and Odaibo, 1999). The prevalence of *Schistosoma haematobium* infection (40.1%) recorded for Ibaji in the present study was almost the same with the prevalence rate (40.8%) recorded for the LGA in the previous study by Ejima and Odaibo (2007).

The higher prevalence of the disease in Ibaji than the rest of the LGAs studied could be attributed to a number of favourable factors which include availability of man made water-bodies due to the activities of the defunct Lower-Benue-River-Basin Development Project (LBRBDP) in addition to the large number of temporary and permanent natural fresh water-bodies and consequently the greater abundance of snail host (*Bulinus* sp.) in the LGA. Several workers had reported similar and even higher prevalence rates of infection for riverine, rural setting of this kind with similar environmental factors (Cline *et al.*, 1989; Agi and Okafor, 2005). This community, being predominantly farmers and fishermen may be exposed to a high risk of schistosomiasis (Lucas and Gilles, 1973; Opoku, 1974; WHO, 1990; Ogbe, 1995).

With the exception of Idah LGA where the highest prevalence of *S. haematobium* infection was recorded for primary school children in the other LGAs, viz Ibaji, Lokoja and Itoke (Ofu), post-primary school children had higher prevalence of infection than those in primary schools. The fact that the overall result showed higher prevalence of infection among primary school children suggests higher participation of younger children in primary schools in water-contact activities and consequently higher exposure to schistosome infection than their older counterparts in the post-primary schools.

The highest prevalence rates of *S. haematobium* infection recorded in the 10-14 years age group for primary and post-primary schools respectively in Ibaji LGA agrees with the findings of several other workers that had recorded the highest prevalence of *S. haematobium* infection elsewhere in 10-14 years (Pugh and Gilles, 1978; Uko *et al.*, 1993; Egwuyenga *et al.*, 1994). This may be due to greater participation of the children in this age group in water-contact activities and hence, more exposed to schistosome infection than their adult counterparts.

The higher overall prevalence and intensity of *S. haematobium* infection in the pooled data of the four LGAs studied recorded for males (19.4%; 138.2 eggs/10 mL urine) than females (16.5%; 93.7 eggs/10 mL urine) in this study is in conformity with the general pattern of schistosome infection observed in endemic

areas (Agi and Okafor, 2005). Similar pattern of higher prevalence of infection in males than females have been observed in the individual LGAs studied except in Idah LGA where higher prevalence rate of infection was recorded for females (17.4%) than males (12.1%).

Intensity of infection has been recognized as the most important factor influencing the severity of human schistosomiasis (Kardorff *et al.*, 1996). Most of the subjects examined for *S. haematobium* infection in the four LGAs studied that harboured extremely high intensity of infection also demonstrated high macrohaematuria.

The observation that the more heavily infected school children with *S. haematobium* in both primary and post-primary schools occurred in the 15-19 year age group was in contrast to that of other workers (Lucas and Gilles, 1973; Ogbe, 1995) who observed that primary school children (<15 years) were more heavily infected than their older counterparts in post-primary schools. This was probably due to the fact that both the young and old children in both primary and post-primary schools had more or less equal exposure to infection, a situation imposed on them by being predominantly farmers and fishermen. In this study, about 76.7% of the infected subjects excreted >50 eggs/10 mL urine and 58.3% were males and 18.4% were females.

The high prevalence of macrohaematuria recorded for some of the LGAs studied was significant as it suggests heavy infection. Fajewonyomi and Afolabi (1994) considered haematuria of 23.3% as significant. However, Betterton *et al.* (1988) observed that 20% of the highly infected with *S. haematobium* showed no blood in their urine while 5% of the apparently uninfected subjects had haematuria, mostly adult (>20 years). Betterton *et al.* (1988) in another study, recorded prevalence of haematuria of 5.4% in the peak prevalence age group and 3.9% for those uninfected with *S. haematobium*. This explains the irregular patterns of macrohaematuria and GMI curves observed in the four LGAs studied (Fig. 3).

The overall Geometric Mean Intensity (GMI) of 118.2 eggs/10 mL urine recorded in the present research is relatively high when compared to that of WHO (1993) which considered ≥ 49 eggs/10 mL urine as heavy infection. Again, that the overall results showed higher intensity of infection (138.2 eggs/10 mL urine) in males than females (93.7 eggs/10 mL urine) is quite in agreement with the findings of other workers in Nigeria (Okoli and Odaibo, 1999) and Egypt (Al-Sherbiny *et al.*, 1999).

The prevalence and intensity of *Schistosoma haematobium* infection are high especially in the rural areas and the disease is becoming important in urban areas to be considered a disease of public health problem and be given priority by the Government of Kogi State.

CONCLUSION

The present research has provided baseline information in terms of disparity in prevalence and intensity of human schistosomiasis among the four LGAs studied which will be useful for planning control measures against the disease.

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