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INCIDENCE OF MIXED INFECTIONS OF SCHISTOSOMA AND SALMONELLA IN THE FEDERAL CAPITAL TERRITORY, ABUJA

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ABSTRACT

In areas where both Salmonella and Schistosoma are endemic, co-infections may be common and a synergistic interaction may complicate the course of infection and make diagnosis and therapy difficult. We examined the prevalence of mixed Schistosoma and Salmonella infections in the Gwagwa and Juwa communities of the Federal capital territory, Abuja, following the microscopic and cultural examination of freshly collected urine and stool specimens from individuals of all ages resident in these areas. Out of 410 individuals, 24 (5.85%) had concurrent schistosome and salmonella infections. Co –infections with *Schistosoma mansoni* and *Salmonella species* were more prevalent (18 out of 24 cases) compared with 6 out 24 cases for *S. hematobium* and *Salmonella species*. Egg densities ranged from light (1- 100 eggs/gm or ml feaces or Urine) to heavy (>above 400 eggs/gm or ml of faeces or urine). Individuals with co-infections had lighter schistosome egg densities (1-100 eggs/ml). The overall schistosomiasis prevalence for the two communities was 26.50% (109) and prevalence by area was 14.37% and 12.19% in Gwagwa and Juwa areas respectively. Prevalence of *S.mansoni* infections was 17.8% while *S. hematobium* accounted for 8.78%. There was no significant difference in the infection rate between males and females ($p > 0.05$). Children of the 11-15 year's age group accounted for 44 (10.72%) of all cases. In addition, *Salmonella species* were isolated in 12.43% and 16.83% of asymptomatic urine and stool samples respectively, confirming that Salmonella and schistosome infections are endemic in both communities. Other helminthes identified include: hookworm (3.17%), ascaris (3.75%), and *Trichuris trichuria* (1.7%). Schistosome infections may be complicated by bacterial and viral infections, and this requires considerations especially in febrile conditions in persons who are immunocompromised.

INTRODUCTION

Mixed infections of schistosome and bacterial species have been demonstrated both experimentally and clinically (Munize- Junqueira *et al.*, 1992., Young *et al.*,1993, Njunda and Oyerinde, 1996, Tanyigna *et al.*, 1998). The effect of these mixed infections on renal complications in patients infected with *S. mansoni* and concurrent salmonellosis have been observed in Egypt (Farid *et al.*, 1982) and on the development of certain disease conditions like the nephritic syndrome and glomerulonephritis have also been documented (Barsoun *et al.*, 1987, Strausbaugh *et al.*,1988). In a case report of urinary tract infection caused by *Salmonella paratyphi* A in a patient concurrently infected with *Schistosoma mansoni*, Hennquin *et al.*, (1991) observed that the relationship

between the bacteria and the parasite was symbiotic with the schistosomes acting as reservoirs of bacteria. This can result in bacterial discharges, followed by a long carrying period and a persisting infection that results in a protracted course for the salmonella infection that may be difficult to diagnose and therapeutically remedy (Melhem and Loverde, 1984). Nutritional factors and not a deficiency in the host's immune response also are believed to explain the relationship between these two organisms (Mikhail *et al.,* 1981; 1982). Both *Schistosoma mansoni* and *S. hematobium* have been reported to be concurrently infected with *Salmonella species.*

The fact that schistosome infections can modify the development of various diseases with grave consequences for the patients highlights the importance of identifying and classifying such infections in our environment in which salmonella and schistosomes are endemic. In the present study, we examined the prevalence of mixed schistosome and salmonella infections in the Gwagwa and Juwa communities of the Federal Capital Territory, Abuja that share similar environmental and population characteristics. We also determined the prevalence of schistosome infections and the carrier rate of *Salmonella species* in asymptomatic urine and Stool Specimens in the same area.

MATERIALS AND METHODS

Study Area

Gwagwa and Juwa are neighboring peri-urban settlements in the Federal Capital territory of Nigeria, Abuja. The residents of these communities are mostly low-income earners, mostly artisans and civil servants. A stream (River Usuman) runs adjacent to these two settlements and is the source of water for their recreational and domestic use. The area is also characterized by poor sanitary facilities.

Study population and specimen collection

A total of 410 individuals from the two communities were examined. Both adult males and females were randomly grouped according to their age range (0-above 21years). Also, children from both primary and secondary schools were randomly sampled and similarly grouped according to their ages. Terminal urine and stool specimens were collected in wide mouth screw-capped plastic specimen bottles and transported to the Pharmaceutical Microbiology Laboratory of the National Institute of Pharmaceutical Research and Development (NIPRD) Idu, Abuja for examination.

Stool and Urine microscopy

Basic sedimentation techniques and the Formol-ether concentration technique were employed for the examination of urine and faecal specimens (Cruickshank *et al.*, 1975).

Determination of schistosome egg counts in stool and urine samples

In order to determine the intensity of infection, the quantitative egg count was carried out by examining 10ml urine and 10g of stool specimens. Egg counts per gram of stool samples prepared using the Formol -ether technique was taken. Similarly egg counts per ml of urine sample were determined by sedimentation of 10ml of sample. The average of 5- 10 replicates of egg counts per field viewed were taken and were divided by the total volume examined, and this served as the number of eggs per ml.

Stool and Urine culture for Salmonella species

Both urine deposits and emulsified stool specimens were inoculated in selenite -F-broth and incubated overnight and then further sub-cultured onto Bismuth Sulfite Agar (BSA) at 37 ^{0}C for 24hrs.Suspected *Salmonella species* colonies were identified and confirmed using standard biochemical tests (W.H.O., 1991).

RESULTS

Prevalence and distribution of Schistosome infections in the Gwagwa and Juwa communities

Examination of four hundred and ten (410) individuals from both communities revealed that a total of 109 (26.50%) persons were infected with either *S. mansoni* or *S. hematobium* (Table 1). Fifty-nine (14.37%) individuals in the Gwagwa community and 50 (12.19%) in Juwa community respectively were infected with *Schistosoma species*. There was no statistical difference in the infection rate between the two communities ($p>0.05$). Prevalence of infection according to the schistosome species for both communities indicated that *S.hematobium* was found in 36(8.78%) of individuals while *S.mansoni* occurred in 78 (17.80%) of individuals examined (Table 1).

Similarly, infection was equally distributed between the sexes, with 60(14.62%) males and 49 (11.94%) females being infected in the two communities. Infection rates ranged between (5.36 - 10.72%) with children of the 11 - 15 years age group having the highest rate of infection 44 (10.72%) and the 16-20 age group had 6.09%, while the 6-10 years group had 5.36%, but only one child in the 0 - 5 year group was infected (Table.2).

Intensity of infection as assessed by the quantitative egg counts revealed that light infections were common in both communities irrespective of schistosome species. Out of the 109 persons infected with schistosomes, 78 (71.5%) had light infection (1-100 eggs, ml or g of specimen). Fifty-two (47.7%) of this had *S.mansoni* while 26 (23.8%) had *S. hematobium*. Twenty three (21.1%) persons had moderate (101-400 eggs/ml or g of specimen) and 8(7.3%) persons were classified as being heavily infected with more than 400 eggs/ml or g of specimen (Table 3). Other helminthes observed in the stool specimens were: Hookworm 13 (3.17%), Ascaris 15(3.75%), and *Trichuris trichuria* 7 (1.7%).

The incidence of mixed infections of Schistosome and Salmonella species in the Gwagwa and Juwa communities

Our study shows that overall; co-infections between schistosome species and *Salmonella species* occurred in 24 cases in both the Juwa and Gwagwa communities ($n = 410$). The rate of *S. mansoni* and Salmonella co- infections and *S.haematobium* and *Salmonella species* co- infections were 4.39% and 1.46% respectively. There was significant association between *S. mansoni* and Salmonella infection ($p< 0.05$). *Salmonella species* was isolated in 12.43% of asymptomatic urinary samples and in 16.83% faecal samples in the two communities (Table 4).

Table 1. Prevalence and distribution of Schistosome species Infections in the Gwagwa and Juwa communities of the Federal Capital Territory, Abuja

Location	Number Sampled	Number Positive (%) for Schistosome		
		Schistosoma haematobium	*Schistosoma mansoni*	Total Positive(%)
Gwagwa	232	20(4.86)	39(9.51)	59 (14.37)
Juwa	178	16 (3.90)	34 (8.29)	50 (12.19)
Total	410	36 (8.76)	73 (17.80)	109 (26.56)

$X^2 = 0.04$; df = 1; p> 0.05

Table 2. Distribution of Schistosome Infections by Sex and Age Group in the Juwa and Gwagwa Districts of the FCT, Abuja.

Age Range (Yrs)	Number Sampled	Sex		Total Positive (%)
		Males (%)	Females (%)	
0 - 5	54	0	1	1 (0.24)
6 - 10	100	11	11	22 (5.36)
11 - 15	100	25	19	44(10.72)
16 - 20	80	14	11	25(6.09)
≥21	76	10	7	17(4.14)
Total	410	60(14.62)	49(11.94)	109(26.58)

$X^2 = 0.66$; df = 4; $p < 0.05$, N = 410

Table 3. Intensity of Schistosome infection among infected individuals in the Juwa and Gwagwa communities of the Federal Capital Territory, Abuja

Infection density/ Egg Counts /gm or ml	Number of persons infected (%)		
	Schistosoma haematobium	*Schistosoma mansoni*	Total (%)
1 - 100	52 (47.7)	26 (23.8)	78 (71.5)
101 - 400	16 (14.7)	7 (6.4)	23 (21.1)
401 - above	5 (4.6)	3 (2.7)	8 (7.3)
Total	73 (67.1)	36 (32.9)	109(100)

Table 4. Prevalence of co-infection between *Schistosoma* spp and *Salmonella* spp in Gwagwa and Juwa

	Salmonella species			*S. hematobium*	*Salmonella species*		
S. mansoni	No. +ve(%)	No. -ve(%)	Total		No +ve %	No -ve %	Total
No.positive	18(4.39)	55(13.4)	73	No. positive	6 (1.46)	30(7.31)	36
No.negative	51(12.44)	286(69.75)	337	No. negative	45(10.97)	329(80.24)	374
Total	69(16.83)	341(83.15)	410		51(12.43)	359(87.55)	410

$X^2 = 0.29$; df = 1 p< 0.05

DISCUSSION

We demonstrated the existence of mixed Schistosome and *Salmonella species* infections in two peri-urban settlements (Gwagwa and Juwa) in the Federal capital territory of Nigeria (FCT). The prevalence of 5.95% co-infection in the two communities also showed that *S.mansoni* infection was significantly associated with Salmonella carrier rates in the asymptomatic stool and urine samples examined.

Tanyigna *et al.*, (1998) had reported the occurrence of concurrent Salmonella and *S.mansoni* infections in 6.4% of 94 patients at the Jos University Teaching Hospital, Jos and suggested that this association could be responsible for the increased cases of chronic septicemic salmonellosis. Idoko *et al.*, (1988) also reported a 12% prevalence of concurrent *S.mansoni* and Salmonella infections in Zaria, Nigeria. Although the incidence of Schistosome and *Salmonella species* co-infection in these communities was low, there is need to establish the clinical relevance of these co-infections. The high urinary and faecal carrier rates of *Salmonella species* of 12.43% and 16.82% respectively suggest it is endemic in the two communities. A look at samples with co-infections in relation to the density of schistosome eggs showed mostly light schistosome infections, as evidenced by their egg densities (1-100 eggs/ml). It is possible that the bacterial infection affects the parasites fecuncudity. Karanja *et al.*, (1997) had demonstrated that schistosomiasis patients with HIV-1 infections and reduced $CD4^+$ T- cell levels excreted fewer eggs than HIV-1 negative persons despite having comparable circulating antigen levels, and that the efficiency of egg excretion had a significant and positive correlation. Of the eight persons with heavy *S. hematobium* infections, only one was co-infected with salmonella.

This report highlights an important phenomenon that may be neglected in the treatment of febrile cases in which either salmonellosis or schistosomiasis are considered. Synergistic bacteria-parasite interactions have been demonstrated especially in salmonella infection that has resulted in a protracted course, which proved difficult to diagnose and therapeutically remedy. Salmonellosis in schistosome-infected patients has been attributed to an association between *Salmonella species* with the schistosome worms themselves and further that the schistosome worms provided a multiplication focus for these bacteria in the portal mesenteric system, with a persisting bacteremia following (Tauzon *et al.*, 1985., Young *et al.*, 1993).

The 26% prevalence of schistosome infection in the 2 communities confirms the endemicity of schistosomiasis in this semi-arid region in Nigeria. *S.mansoni* and *S. hematobium* infections are highly prevalent in both northern and southern regions of Nigeria. Currently, schistosomiasis control employs mass chemotherapy with praziquantel. However control measures have continued to be unsuccessful as the development of resistance to chemotherapy and molluscicides are a challenge.

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