# Urinary Schistosomiasis Among School Age Children In Ebonyi State, Nigeria

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**Citation**

C Uneke, P Oyibo, C Ugwuoru, A Nwanokwai, R Iloegbunam. *Urinary Schistosomiasis Among School Age Children In Ebonyi State, Nigeria*. The Internet Journal of Laboratory Medicine. 2006 Volume 2 Number 1.

**Abstract**

Infection is one of the major public health problems facing developing countries, with school age children at greatest risk. A survey of S. haematobium infection was conducted among school children in Ohaukwu and Onicha in Ebonyi State, Nigeria using standard techniques. Of the combined total of 876 pupils examined, 235(26.8%, 95% CI., 23.9-29.7%) were infected with S. haematobium. A total of 129 (27.01%, 95% CI., 23.0-31.0%) males and 106 (26.6%, 95% CI., 22.3-30.9%) females were infected. The prevalence of the infection was significantly higher in Ohaukwu than Onicha (47.9%,95% CI., 42.9-52.9% versus 11.0%, 95% CI., 8.3-13.7%) ($\chi^2$ =148.6, df =1, P < 0.05). Individuals aged 5-10years old were more likely to be infected and the intensity of the infection was higher among the males. To control urinary schistosomiasis, methodologies and managerial tools should be integrated to improve preventive strategies, with emphases on health education, information and communication.

## INTRODUCTION

Urinary schistosomiasis caused by Schistosoma haematobium is reportedly endemic in 53 counties in the Middle East and most of the African continent [1]. It is still one of the major public health problems facing humanity, with severe social and economic consequences [2]. Nigeria is one of the countries known to be highly endemic for urinary schistosomiasis with estimated 101.28 million persons at risk and 25.83 million people infected [1]. Accordingly the estimates for morbidity and mortality in affected populations are high with school age children usually presenting with the highest prevalence and intensity of S. haematobium infection [3,4]. Although infection with schistosomes does not always result in clinical disease, and many infections are asymptomatic, persons with these infections in resource-constrained tropical areas of the world often present for care with severe illness and often only after complications have developed [5]. In urinary schistosomiasis the risk of haematuria, dysuria, nutritional deficiencies, lesion of the bladder, kidney failure, an elevated risk of bladder cancer and-in children- growth retardation, are well established [6]. The work capacity of rural inhabitants is severely reduced because of the weakness and lethargy caused by the disease and the school performance and growth patterns of infected children are also retarded [2]. Urinary schistosomiasis therefore ranks high among parasitic diseases in terms of socioeconomic and public health importance in tropical and subtropical areas. One measure of that importance within the development strategies of endemic countries is reflected in executive level planning and inclusion of schistosomiasis control activities in national budgets.

In Nigeria, the national policy on schistosomiasis control adopted praziquantel as the main drug of use in the control strategy aimed at reducing morbidity. However, it was not until recently that an assessment was made on different channels for praziquantel delivery in mass treatment effort [7]. Unfortunately not much has been achieved in the control of urinary schistosomiasis in the country largely because the disease is mainly a rural occupational disease that affects people engaged in agriculture or fishing and other people residing in rural agricultural and periurban areas. There is a high level of the risk of becoming infected as a result of low literacy level, poverty, sub-standard hygiene, and inadequate public infrastructure. Another important factor that has adversely affected control efforts is lack of scientific information on the disease in many rural communities among the high risk groups particularly school age children.

The dearth of specific baseline epidemiological data on S. haematobium infection in many rural communities of South-eastern Nigeria has adversely affected adequate patient evaluation and management, control programs and even identification of drug resistance [8,9]. This study was therefore designed to describe the patterns of S.

haematobium infection at baseline with the view to provide scientific information that would be required to monitor socio-economic impact, treatment programs and assess re-infection after treatment in rural communities, in order to develop most effective and sustainable strategies that would have relevance for future control efforts in resource constrained endemic settings.

## MATERIALS AND METHODS

### STUDY AREA

This study was conducted from August 2005 through July 2006 in Ebonyi State, South-Eastern Nigeria. Two of the major Local Government Areas in the State including Ohaukwu LGA (in the northern region) and Onicha LGA (in the southern region) were selected for the study. The choice of the zone was based on reports from local hospitals, clinics and health centres of cases of urinary schistosomiasis in the rural communities particularly among school children. The climate of both areas is tropical and the vegetation characteristic is predominantly the rain forest with an average annual rainfall of about 1300mm and average atmospheric temperature of 30 $^{\circ}$ C. There are two distinct seasons, the wet and the dry seasons, the former takes place between April and October, while the latter occurs from November to March.

The areas are traversed by streams and rivers which constitute the major source of water supply to all the communities in the areas. Water contact activities like bathing, swimming, and washing are generally the norm.. Agriculture, especially swamp-rice cultivation and fishing are the main stay of the economy of the inhabitants. Educational status of most of the inhabitants is generally very low particularly at Ohaukwu LGA and systematic helminthic deworming exercise has never been applied in both areas.

### STUDY POPULATION

The largest primary schools in Ohaukwu LGA and Onicha LGA were selected for this survey and a combined total of 876 pupils were enrolled in the study. A total of 376 pupils were sampled in Ohaukwu and the schools surveyed included; Community Primary School (CPS) Amofia Ngbo, Comprehensive School (CS) Amofia Ngbo, Community Primary School (CPS) Igube, and Central School (CS) Umuezeka Ngbo. In Onicha, a total of 500 pupils were sampled and the schools surveyed were; Community Primary School (CPS) Agbabor-Isu , Central Primary School (CPS) Igboeze-Onicha, Community Primary School (CPS) Anioma, and Union Primary School (UPS) Amanator.

Primary school pupil were considered for this study because: (i) schools are accessible without much difficulties, (ii) the peak of prevalence of schistosomiasis is to be found in this group [$_{10}$] and (iii) experience shows that there is general good compliance from children and parents [$_{11}$]. The sex of each pupil was recorded while age was obtained from each participant by interview.

### ETHICAL CONSIDERATION

The protocol for this study was approved by the Infectious Diseases Research Division (IDRD), Department of Medical Microbiology/Parasitology, Faculty of Clinical Medicine, Ebonyi State University Abakaliki, Nigeria. The approval was on the agreement that patient anonymity must be maintained, good laboratory practice/quality control ensured, and that every finding would be treated with utmost confidentiality and for the purpose of this research only. All work was performed according to the international guidelines for human experimentation in biomedical research [$_{12}$]. Approval for the study was obtained from the Chairman, and the Secretary Local Government Education Authority (LGEA), of both Ohaukwu LGA and Onicha LGA, Ebonyi State, Nigeria. Approval was obtained from the Parents Teachers Association (P.T.A.) of each school studied and informed consent was obtained from each of the participating pupils. Pupils who declined participation were excluded from the study. Infected pupils were referred to the Primary Health Care Centre PHCC in the areas for immediate treatment.

### SAMPLING TECHNIQUE

About 20ml of clean-catch, midstream urine samples were collected in 50ml capacity autoclaved wide mouthed, leak, proof universal containers by subjects themselves, who were previously carefully instructed with illustration aids. Samples were obtained between 10:00hrs and 14:00hrs [$_{13}$]. Samples with visible haematunia were noted. The specimens were appropriately labeled with identification numbers and placed in a cold box with ice packs, immediately after collection. They were processed 1-2hrs of collection. In situations where delay in transportation of specimens to laboratory was inevitable, ordinary household bleach was added to the urine samples (ratio; 1ml bleach: 50ml urine) to preserve any schistosome ova present [$_{13,14}$].

### LABORATORY ANALYSIS

The urine sedimentation technique described previously

[13,14] was used to detect the presence of S. haematobium ova in the urine samples and to determine the intensity of the infection in each case. Intensity was reported as the number of ova/10ml of urine and was categorized as light (≤ 50 ova/10ml of urine) and heavy (≥50 ova/10ml of urine). A few drops of saponin solution were added to samples with visible haematunia to enhance clarity in microscopy [14].

## STATISTICAL ANALYSIS

Differences in proportion were evaluated using the Chi-square test. Statistical significance was achieved it $P < 0.05$.

## RESULTS

Of the combined total of 876 pupils (478 males and 398 females) examined in the State, 235(26.8%, 95% CI., 23.9-29.7%) were infected with S. haematobium. A combined total of 129 (27.01%, 95% CI., 23.0-31.0%) males and 106 (26.6%, 95% CI., 22.3-30.9%) females had the infection. The prevalence of S. haematobium infection was significantly higher in Ohaukwu than Onicha (47.9%,95% CI., 42.9-52.9% versus 11.0%, 95% CI., 8.3-13.7%) ($\chi^2$ =148.6, df =1, $P < 0.05$). In Ohaukwu the females were more infected than the males (51.9% vs 44.9%) but the difference was not statistically significant

($\chi^2$ =1.29, df =1, $P > 0.05$). The males were more infected than the females in Onicha (12.5% vs 9.3%), the difference was also not statistically significant ($\chi^2$ =1.80, df =1, P> 0.05) (Table 1).

**Figure 1**

Table 1: Prevalence of infection in Ohaukwu LGA and Onicha LGA, Ebonyi State, Nigeria

| Parameter | Male | | Female | | Overall Total | | |
|---|---|---|---|---|---|---|---|
| | No. examined | No. (%) infected | No. examined | No. (%) infected | No. examined | No. (%) infected | 95% Confidence interval |
| Ohaukwu LGA | | | | | | | |
| School | | | | | | | |
| CPS Amofia Ngbo | 32 | 20(62.5) | 13 | 7(53.8) | 45 | 27(60.0) | 45.7-74.3 |
| CS Amofia Ngbo | 50 | 10(20.0) | 20 | 7(35.0) | 70 | 17(24.3) | 14.3-34.3 |
| CPS Ndiagu Igube | 22 | 14(64.0) | 21 | 12(57.1) | 43 | 26(60.5) | 45.9-75.1 |
| CS Umuezeka Ngbo | 110 | 52(47.3) | 108 | 58(53.7) | 218 | 110(50.5) | 43.9-57.1 |
| Total | 214 | 96(44.9) | 162 | 84(51.9) | 376 | 180(47.9) | 42.9-52.9 |
| Age | | | | | | | |
| 5-10 | 87 | 45(52.0) | 73 | 38(52.1) | 160 | 83(52.1) | 44.4-59.8 |
| 11-15 | 103 | 46(51.1) | 82 | 45(47.3) | 185 | 91(49.2) | 42.0-56.4 |
| ≥16 | 24 | 5(21.3) | 7 | 1(14.3) | 31 | 6(19.3) | 5.4-33.2 |
| Total | 214 | 96(44.9) | 162 | 84(51.9) | 376 | 180(47.9) | 42.9-52.9 |
| Onicha LGA | | | | | | | |
| School | | | | | | | |
| CPS Agbabor-Isu | 68 | 21(39.9) | 57 | 9(15.8) | 125 | 30(24.0) | 16.5-31.5 |
| CPS Igboeze-Onicha | 72 | 7(9.7) | 53 | 3(5.7) | 125 | 10(8.0) | 3.2-12.8 |
| CPS Anioma | 62 | 2(3.2) | 63 | 7(11.1) | 125 | 10 (8.0) | 3.2-12.8 |
| UPS Amanator | 62 | 2(3.2) | 63 | 3(4.8) | 125 | 5(4.0) | 0.6-7.4 |
| Total | 264 | 33(12.5) | 236 | 22(9.3) | 500 | 55(11.0) | 8.3-13.7 |
| Age | | | | | | | |
| 5-10 | 160 | 20(12.5) | 135 | 10(7.41) | 295 | 30(10.2) | 6.75-13.7 |
| 11-15 | 102 | 13(12.75) | 99 | 12(12.1) | 201 | 25(12.4) | 7.84-17.0 |
| ≥16 | 2 | 0(0) | 2 | 0(0) | 4 | 0(0) | - |
| Total | 264 | 33(12.5) | 236 | 22(9.3) | 500 | 55(11.0) | 8.3-13.7 |

In Ohaukwu, the highest infection prevalence was recorded at CPS Ndiagu Igube (60.5%, 95% CI., 45.9-75.1%), while the lowest prevalence was observed in CS Amofia Ngbo (24.3%, 95% CI., 14.3-34.3%) (Table 1). Statistical analysis showed a significant difference in the trend ($\chi^2$ =21.59, df =3, $P < 0.05$). The prevalence of S. haematobium infection decreased with increase in the age of pupils in Ohaukwu with the highest prevalence occurring among individuals aged 5-10 years old (52.1, 95% CI., 44.4-59.8%) (Table 1), the difference in the trend was statistically significant ($\chi^2$ =11.10, df =1, $P < 0.05$). The prevalence of heavy infection (≥50 ova/10ml of urine) was higher among the males (40.6%,95% CI., 30.8-50.4%) than the females (36.9%,95% CI., 16.3-57.5%), in Ohaukwu (Table 2).

**Figure 2**

Table 2: Intensity of infection in Ohaukwu LGA and Onicha LGA, Ebonyi State, Nigeria.

| Parameter | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | No. (%) with light infection | No. (%) with heavy infection | Total infected | No. (%) with light infection | No. (%) with heavy infection | Total infected |
| Ohaukwu LGA | | | | | | |
| School | | | | | | |
| CPS Amofia Ngbo | 12(60.0) | 8(40.0) | 20 | 5(71.4) | 2(28.6) | 7 |
| CS Amofia Ngbo | 7(70.0) | 3(30.0) | 10 | 4(57.1) | 3(42.9) | 7 |
| CPS Ndiagu Igube | 9(64.3) | 5(35.7) | 14 | 7(58.3) | 5(41.7) | 12 |
| CS Umuezeka Ngbo | 29(55.8) | 23(44.2) | 52 | 37(63.8) | 21(36.2) | 58 |
| Total | 57(59.4) | 39(40.6) | 96 | 53(63.1) | 31(36.9) | 84 |
| Age | | | | | | |
| 5-10 | 22(51.2) | 21(48.8) | 43 | 24(60.0) | 16(40.0) | 40 |
| 11-15 | 33(68.8) | 15(31.2) | 48 | 29(67.4) | 14(32.6) | 43 |
| 16-20 | 2(40.0) | 3(60.0) | 5 | 0(0.0) | 1(100.0) | 1 |
| Total | 57(59.4) | 39(40.6) | 96 | 53(63.1) | 31(36.9) | 84 |
| Onicha LGA | | | | | | |
| School | | | | | | |
| CPS Agbabor-Isu | 21(100.0) | 0(0.0) | 21 | 8(88.9) | 1(11.1) | 9 |
| CPS Igboeze-Onicha | 3(42.9) | 4(57.1) | 7 | 1(33.3) | 2(67.7) | 3 |
| CPS Anioma | 2(67.7) | 1(33.3) | 3 | 6(85.7) | 1(14.3) | 7 |
| UPS Amanator | 1(50.0) | 1(50.0) | 2 | 3(100.0) | 0(0.0) | 3 |
| Total | 27(49.1) | 6(10.9) | 33 | 18(32.7) | 4(7.3) | 22 |
| Age | | | | | | |
| 5-10 | 18(90.0) | 2(10.0) | 20 | 6(60.0) | 4 (40.0) | 10 |
| 11-15 | 9(69.2) | 4 (30.8) | 13 | 10(100.0) | 0(0.0) | 10 |
| 16-20 | 0(0.0) | 0(0.0) | 0 | 2(100.0) | 0(0.0) | 2 |
| Total | 27(49.1) | 6(10.9) | 33 | 18(32.7) | 4(7.3) | 22 |

In Onicha, the highest infection prevalence was recorded at CPS Agbabor-Isu (24.0%,95% CI., 16.5-31.5%), while the lowest prevalence was observed in UPS Amanator (4.0%,95% CI.,0.6-7.4%) (Table 1), the difference in the trend was statistically significant ($\chi^2$ =30.1, df =1, P< 0.05). Individuals of age group 11-15 years old recorded the highest prevalence of infection (12.4%, 95% CI., 7.84-17.0%), followed by those aged 5-10 years old (10.2%, 95% CI., 6.75-13.7%) but the difference was not statistically significant ($\chi^2$ =1.12, df =3, P> 0.05) (Table 2). The prevalence of heavy infection was higher among the males (10.9%, 95% CI., 10.4-32.2%) than the females (7.3%,95% CI.,3.9-18.2%) in Onicha (Table 2).

## DISCUSSION

The results of this survey which indicated S. haematobium infection prevalence rates of 47.9% in Ohaukwu and 11.0% in Onicha, suggest that Ebonyi State, South-eastern Nigeria falls within the WHO classification as endemic [15]. The present study supports a number of previous reports which have consistently shown that S. haematobium infection endemicity in Nigeria is on the increase, particularly in the rural areas with school aged children at greatest risk [16,17]. The poverty, ignorance, poor living conditions, inadequate sanitation and water supplies as well as deplorable personal and environmental hygiene characteristic of many rural communities in Nigeria as in other developing tropical countries are identified as important factors contributing to increasing transmission of schistosomiasis [9]. The major factors that may have been responsible for the endemicity of urinary schistosomiasis in the study areas particularly at Ohaukwu are low literacy level, lack of basic amenities, the inadequate and indiscriminate disposal of human sewage and high water contact activity with snail infested pond, rivers and streams. The snail intermediate hosts particularly Bulinus globossus and B. truncates which are very efficient intermediate hosts of S. haematobium are the most abundant and wide spread species in south-eastern Nigeria [18,19]. This observation supports the recommendation by the WHO Expert Committee [20] on the reduction of schistosomiasis prevalence by the use of operational components such as adequate water supply, sanitation and environmental management.

Our results showed that the males were generally more infected and with higher intensity than the females in both LGAs studied. This is presumably due to higher water contact activities by male pupils particularly in the swamp-rice farming and fishing, where fathers engage every male in their household in the profession. In addition, other regular water contact activities such as swimming and bathing in cercariae infested streams and rivers are male dominated; besides, females in the area are usually restricted from swimming and bathing in the rivers on religious and socio-cultural grounds. This is similar to the observations made in Tanzania [21], Cote d'Ivoire [22] and in south-western Nigeria [3].

In this study, it was observed that the percentage of pupils with heavy infection was considerably lower than those with light infection. An earlier report indicated that the distribution of schistosomiasis in endemic communities fits a negative binomial curve, with most infected persons harboring low worm burdens and only a small proportion having heavy infections [23]. This may explain the trend we have observed. However, the aggregation of worm burden in a small proportion of infected individuals may have multiple explanations including genetic susceptibility [24]. The implications of these epidemiologic findings are relevant to our understanding of the dynamics of the infection and its control in the communities studied. However additional studies that are immunologically and ecologically based, as well as information on the extent of interaction between schstosomes and other pathogenic agents , are required for

development of specific, effective and sustainable S. haematobium control and management strategies for the zone.

It is pertinent to state that in many parts of Nigeria including the south-eastern region, the epidemiology of urinary schistosomiasis is only partially known. In these areas, in spite of efficient control tools being available, no clear control strategy is in place, and the drug praziquantel is only minimally or not available to most endemic communities. The situation is similar in most countries in the sub-Saharan Africa where schistosomiasis is endemic. As a public health measure therefore, it is recommended that urinary schistosomiasis control build upon and strengthen the capacities of existing health services and national policies, with emphasis given to the integration of control and decentralisation of decision-making and delivery [9]. Furthermore national policy makers and health authorities should recognize the focal public health importance of the disease and give the necessary support to peripheral health services to deal with it. Primary health care services should also be strengthened so that they are capable of dealing with control and maintaining their effort. Community-based treatment using praziquantel should first be targeted to school-age children. This high risk group can be reached through the primary school system, in collaboration with the educational sector. Even in areas where school enrolment rates are low, outreach activities can be designed to ensure good coverage [11]. In order to enhance the effect of regular chemotherapy, long-lasting improvement in hygiene and sanitation should be promoted. This includes the provision of safe water in sufficient amounts to cover all domestic needs, as well as sanitation and appropriate health education.

In conclusion, reports from the World Health Organization state that the control of schistosomiasis has to be an integrated effort which includes methodologies and managerial tools to improve preventive strategies, and emphasizes health education, information and communication [20,25]. The importance of information/education for children and the role of school and teachers in disease prevention is easily demonstrated by diverse examples of successful strategies that reflect the progressive drop in prevalence and incidence of certain health problems, verified through longitudinal analyzes [26]. Hence instructing children to correct personal habits which are conducive to infection and practice good personal hygiene can be an effective and safe substitute for repeated deworming, reducing the opportunity for the emergence of drug-resistance, which should prolong the time antihelminthic drugs such as praziquantel may be used for treatment of urinary schistosomiasis

## ACKNOWLEDGEMENT

Authors are grateful to the Parents-Teachers Association of all the primary schools used in this study for logistical support.

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