# Assessment of polyparasitism with intestinal parasite infections and urinary schistosomiasis among school children in a semi-urban area of south eastern Nigeria

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**Citation**

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**Abstract**

Polyparasitism with intestinal parasites and schistosomiasis constitutes a major pubic health challenge in Nigeria especially among school age children. Using standard parasitological techniques, intestinal parasitic infections and urinary schistosomiasis were assessed among school age children in Edda a semi-urban area of south-eastern Nigeria. Of the 300 children screened, 32(10.7%) had intestinal parasitic infections while 41(13.6%) of the children were infected with S. haematobium. Up to seven intestinal parasites were identified. E. histolytica was more commonly observed than other parasites. Children of age group 11-12years old were more infected with intestinal parasites than other age categories, statistically, there was a significant difference in the trend ($\chi^2$= 16.48, df=2, P<0.05). Males had slightly higher prevalence (14.7%) of S. haematobium infection than the females (12.5%) and age-specific prevalence showed that those aged 10-11 years old had the highest prevalence (14.6%). School-based treatment campaigns and health education can improve children health.

## INTRODUCTION

Polyparasitism with intestinal parasites and schistosomiasis is now globally recognized be the norm for many residents of parasite endemic regions and particularly among children of school age [1234]. Intestinal parasitic infections caused by protozoans and helminths are globally endemic and have been described as constituting the greatest single worldwide cause of illness and disease [56], in fact about one third of the world, more than two billion people, are infected with intestinal parasites [6]. Ascaris lumbricoides, Trichuris trichiura and hookworms, collectively referred to as soil-transmitted helminths (STHs), are the most common intestinal parasites [7]. It is estimated that globally A. lumbricoides infects 1.221 billion people, T. trichiura 795 million, and hookworms 740 million [8]. Giardia lamblia, causing giardiasis, is the most prevalent protozoan parasite worldwide with about 200 million people being currently infected [59]. Urinary schistosomiasis caused by Schistosoma haematobium constitutes a major public health problem in many tropical and sub-tropical countries and is reportedly endemic in 53 counties in the Middle East and most of the African continent [1011]. Two hundred million people worldwide are estimated to be infected with S. haematobium of which 70% live in sub-Saharan Africa [3].

Intestinal parasitic infections and urinary schistosomiasis have been described as diseases of poverty and underdevelopment because they have been linked to lack of sanitation, lack of access to safe water and improper hygiene [12]. These parasitic diseases deprive the poorest of the poor of health, contributing to economic instability and social marginalization; and the poor people of under developed nations experience a cycle where under nutrition and repeated infections lead to excess morbidity that can continue from generation to generation [13]. School age children in developing countries are the most severely affected by polyparasitism with intestinal parasites and schistosomiasis and continue to bear the greatest health burden due to the infections [414]. According to a World Bank report, morbidity due to helminth infections accounts for an estimated 20% of the disability-adjusted life years lost due to infectious diseases in children less than 14 years old [15].

It is pertinent to state that despite the high global incidence, STH infections rarely cause death. Instead, the burden of disease is related less to mortality than to the chronic and insidious effects on the hosts' health and nutritional status [1617]. Similarly, infection with S. haematobium does not always result in clinical disease, and many infections are asymptomatic, S. haematobium infection however could cause haematuria, dysuria, nutritional deficiencies, lesion of the bladder, kidney failure, and an elevated risk of bladder cancer [18]. Nevertheless in addition to the morbidity associated with acute intestinal parasitic infections and urinary schistosomiasis, the burden of the chronic infections may affect physical fitness [19], cognitive performance [20], nutritional status and growth [21], and school attendance [22] of school age children.

In Nigeria intestinal parasitic infections and urinary schistosomiasis continue to constitute a major pubic health and developmental challenge especially among school age children. A number of earlier assessments of these parasitic infections among children in the south-eastern Nigeria were conducted in the rural areas [232425]. This study was therefore designed to better assess the distribution and prevalence of intestinal parasitic infections and urinary schistosomiasis in a semi-urban area prior to a school-based de-worming campaign. The major objectives were to provide understanding of the epidemiology and related morbidity of the infections with the view to providing basis for development of new tools for the control of soil-transmitted helminths, to recognize the impact of helminth infections on the health of infected groups and to create a rational basis for their control.

## MATERIALS AND METHODS

## STUDY AREA

The study was conducted in a locality called Edda, which is one of the semi-urban areas of Afikpo South Local Government Area (LGA) in Ebonyi State south-eastern Nigeria. Afikpo South is in the southern senatorial zone of Ebonyi State, with a population size of 256,422 on an annual growth rate of 2.5%. Edda territory is made up of dry valley, poor ground water resources, impervious rocks and numerous dry channels which contain water during the rains and dry up in the dry season. The climate of Edda is controlled by three air masses: the warm wet tropical moisture air mass or south westerly winds, and the cool dry upper air mass or equatorial easterly winds blowing east to west. The south-westerly winds bring the rain during the months of April to October, while the north-east trade winds attract low relative humidity from December to February. The economic activities of Edda inhabitants revolve round farming, trading, and civil service. The average temperature of the area is 30C in the undulating plains and 27C in the plateau region. The mean annual rainfall is 2050mm. The vegetation of Edda is characterized by three principal zones, namely, the forest, savannah and swampy zones, they are located roughly between latitudes 5 45' and 6 50' north and longitude 7 55' east of the Greenwich meridian [26]. Systematic helminthic deworming exercise has never been applied in the area.

## STUDY POPULATION

The study was conducted from May 2007 to February 2008 and the study population was made up of school children who were five years to thirteen years old. Three primary schools were selected for the study and these were Oriental Primary School I (OPS I), Oriental Primary School II (OPS II) and Ejikewu Primary School (EPS). The choice of these schools was based on the reason that schools were located such that they could serve as a cross random sampling of the locality. A total of 300 pupils participated in the study. At OPS I, 105 pupils were selected; at OPS II a total of 95 pupils were also selected, while 100 pupils were sampled at EPS.

Primary school pupil were considered for this study because: (i) schools are accessible without much difficulties, (ii) the peak of prevalence of intestinal parasitic infection and schistosomiasis is to be found in this group [27] and (iii) experience shows that there is general good compliance from children and parents [28].

## ETHICAL CONSIDERATION

The protocol for this study was approved by the 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 [17]. Approval for the study was obtained from the Authorities of the LGA and from the Parents Teachers Association (PTA) of each school used for studied and informed consent was obtained from each of the participating pupils. The participating pupils were given exercise books, pencils, pens, eraser and pencil sharpeners as incentives. Infected pupils were referred to the Primary

Health Care Centre PHCC in the area for immediate treatment.

## SAMPLING TECHNIQUE/ LABORATORY ANALYSIS

The pupils were educated on the causes of intestinal helminthic infections and schistosomiasis among school aged children and they were convinced that every child ought to be free from such infections, thus the necessity of participating in the research work was appreciated by them. Thereafter, wide mouthed corked sterile bottles were given to the pupils for the collection of their stool samples at home and structured questionnaires were distributed among the participating pupils for the collection of demographic information such as age, sex, source of water and parental occupation. The pupils were taught how to collect stool sample and with the aid of their teachers, the questionnaires were correctly filled.

The following day as the pupils submitted their stool samples, bout 20ml of clean-catch, midstream urine samples were obtained form each child in 50ml capacity autoclaved wide mouthed, leak, proof universal containers. The children were instructed on how to collect the urine specimen. The urine samples were obtained between 10:00hrs and 14:00hrs [29]. Samples with visible haematuria were noted. The both of urine and stool samples from each child were appropriately labeled and were carried in a cold box filled with Ice Packs and transported to the laboratory of the Primary Health Care Centre in the area for analysis. They were processed 1-2hrs of collection. Stool analysis was performed using the Kato-Katz technique [2930]. The urine sedimentation technique described previously [2930] was used to detect the presence of S. haematobium ova in the urine samples.

## STATISTICAL ANALYSIS

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

## RESULTS

Of the 300 children screened, a total of 32(10.7%) had intestinal parasitic infections. Children from Oriental Primary School I recorded the highest prevalence of intestinal infections (23.2%) compared to the other schools screened and the difference was statistically significant ($\chi^2$= 23.51, df=2, P<0.05) (Table 1). A total of 41(13.6%) of the children were infected with S. haematobium. Among the primary schools, Ejikewu Primary School had the highest prevalence of (22.0%), while the least prevalence was recorded at Oriental Primary School I (7.4%). Statistical analysis showed that there was a significant difference in the association of schistosomiasis infection among the three schools ($\chi^2$= 9.52, df=2, P<0.05) (Table 1).

### Figure 1

Table 1: Prevalence of intestinal parasites and urinary schistosomiasis in relation to sex among school children in Edda, south-eastern Nigeria

| Schools studied | Males No. examined | Males No.(%) infected | Females No. examined | Females No.(%) infected | Total No. examined | Total No. (%) infected |
|---|---|---|---|---|---|---|
| **Intestinal parasites** | | | | | | |
| OPS I | 50 | 7(14.0) | 45 | 15(33.3) | 95 | 22(23.2) |
| OPS II | 51 | 4(7.8) | 54 | 3(5.6) | 105 | 7(6.7) |
| EPS | 55 | 1(1.8) | 45 | 2(4.4) | 100 | 3(3.0) |
| Total | 156 | 12(7.7) | 144 | 20(13.9) | 300 | 32(10.7) |
| **Urinary schistosomiasis** | | | | | | |
| OPS I | 50 | 2(4.0) | 45 | 5(11.1) | 95 | 7(7.4) |
| OPS II | 51 | 5(9.8) | 54 | 7(12.9) | 105 | 12(11.4) |
| EPS | 55 | 16(29.1) | 45 | 6(13.3) | 100 | 22(12.0) |
| Total | 156 | 23(14.7) | 144 | 18(12.5) | 300 | 41(13.6) |

Key: OPS I= Oriental Primary School I; OPS II= Oriental Primary School II; EPS= Ejikewu Primary School

Up to seven intestinal parasites were identified (Table 2). E. histolytica was more commonly observed than other parasites. The females were more infected than the males (13.9% vs. 7.7%) but the difference was not statistically significant ($\chi^2$= 2.95, df=1, P>0.05). Children of the age 11-12years old were more infected than other age categories, statistically, there was a significant difference in the trend ($\chi^2$= 16.48, df=2, P<0.05) (Table 2).

### Figure 2

Table 2: Prevalence of various types of intestinal parasites in relation to sex and age among school children in Edda, south-eastern Nigeria

| Parameter assessed | No. exam. | No. (%) infected | *E. hist* | *T. trich* | *G. lamb* | Hookw | *T. spp* | *A. lumb* | *S. sterc* |
|---|---|---|---|---|---|---|---|---|---|
| **Sex** | | | | | | | | | |
| Male | 156 | 12(7.7) | 5(3.2)* | 2(1.3) | 0(0.0) | 2(1.3) | 2(1.3) | 1(0.6) | 0(0.0) |
| Female | 144 | 20(13.9) | 6(4.2) | 0(0.0) | 7(4.9) | 0(0.0) | 1(0.7) | 2(1.4) | 4(2.9) |
| Total | 300 | 32(10.7) | 11(3.7) | 2(0.7) | 7(2.3) | 2(0.7) | 3(1.0) | 3(1.0) | 4(1.3) |
| **Age** | | | | | | | | | |
| ≤ 9 | 67 | 5(7.5) | 1(1.5) | 0(0.0) | 0(0.0) | 0(0.0) | 2(3.0) | 2(3.0) | 0(0.0) |
| 10-11 | 180 | 13(7.2) | 4(2.2) | 2(1.1) | 2(1.1) | 2(1.1) | 0(0.0) | 1(0.6) | 2(1.1) |
| 12-13 | 53 | 14(26.4) | 6(11.3) | 0(0.0) | 5(9.4) | 0(0.0) | 1(1.9) | 0(0.0) | 2(3.8) |
| Total | 300 | 32(10.7) | 11(3.7) | 2(0.7) | 7(2.3) | 2(0.7) | 3(1.0) | 3(1.0) | 4(1.3) |

Key: *E. hist= Entamoeba histolytica*; *T. trich= Trichuris trichiura*; *G. lamb= Giardia lamblia*; Hookw= Hookworm; *T. spp= Taenia* species; *A. lumb=Ascaris lumbricoides*; *S. sterc=Strongyloides stercoralis*; ()*= figure in parenthesis represent percentage

The association between S. haematobium and the children's age and sex was evaluated (Table 3). Males had slightly higher prevalence (14.7%) than the females (12.5%). The age-specific prevalence showed that those aged 10-11 years old had the highest prevalence (14.6%). Statistical analysis showed no significant difference in the trend between S. haematobium infection and sex and age ($\chi^2$= 1.34, df=1, P>0.05 and $\chi^2$= 0.32, df=1, P>0.05 respectively) (Table 3).

### Figure 3

Table 3: Prevalence of infection in relation to age among school children in Edda, south-eastern Nigeria

| Age (years) | Males | | Females | | Total | |
|---|---|---|---|---|---|---|
| | No. examined | No. infected | No. examined | No. infected | No. examined | No. infected |
| 6-7 | 3 | 0(0.0) | 2 | 0(0.0) | 5 | 0(0.0) |
| 8-9 | 26 | 2(7.7) | 31 | 6(19.4) | 57 | 8(14.0) |
| 10-11 | 102 | 19(18.6) | 81 | 8(9.9) | 183 | 27(14.6) |
| 12-13 | 25 | 2(8.0) | 30 | 4(13.3) | 55 | 6(10.9) |
| Total | 156 | 23(14.7) | 144 | 18(12.5) | 300 | 41(13.6) |

## DISCUSSION

Polyparasitism with intestinal parasites and urinary schistosomiasis among school age children continues to be a major public health challenge in developing tropical countries. Although intestinal parasites (particularly the soil transmitted helminths) and schistosome infections are neglected diseases that occur predominantly in rural areas, the deplorable social and environmental conditions as well as inadequate basic amenities in the urban poor communities and the so-called semi-urban areas of developing countries including Nigeria are ideal for the persistence of these parasites [141214]. Despite the fact that the prevalence rates of infections with intestinal parasites and S. haematobium observed in this study were considerably lower than prevalence rates observed in similar studies conducted in the rural areas of the same region in south-eastern Nigeria [232425], the rates of the infections are however of public health significance. The occurrence of intestinal parasites and S. haematobium among school-age children can cause chronic infections which can negatively affect all aspects of children's health, nutrition, cognitive development, learning, and educational access and achievement [31].

In this study the following intestinal parasites were observed Entamoeba histolytica; Trichuris trichiura; Giardia lamblia, Hookworm, Taenia species, Ascaris lumbricoides, and Strongyloides stercoralis. However the protozoan parasites Entamoeba histolytica and Giardia lamblia occurred more frequently than the helminth parasites. Common helminth parasites like Trichuris trichiura and Ascaris lumbricoides were seen only among two and three children respectively. Some studies have reported that in urban and semi-urban areas Entamoeba histolytica and Giardia lamblia are more common intestinal infections than intestinal helminths among children [1332]. The transmission of Ascaris/Trichuris infections are known to generally occur more in rural areas than in urban or semi-urban areas however in urban slums, the transmission is probably related to poor sanitary conditions or contaminated water supplies and perhaps Trichuris and other soil-transmitted helminths cannot successfully complete their life cycle in the absence of a more soil rich rural environment and may well be less adapted to conditions in urban or semi-urban areas for successful transmission [1333].

Children of the oldest age group (12-13years) were significantly more infected with the intestinal parasites particularly Entamoeba histolytica and Giardia lamblia than other age categories. This may be due to higher level of exposure by this age group to the epidemiological factors that enhance susceptibility to intestinal protozoal infections. On the contrary, the helminth infections noted in this study were observed more frequently among the younger age group. In our previous study the prevalence of soil transmitted helminth infection was highest among the youngest age category [25]. This could be because of high level of soil contact activity and low personal hygiene in this age group. This finding is supported by a previous report from India [34]. However the age-dependent patterns of infection prevalence are generally similar among the major helminth species, exhibiting a rise in childhood to a relatively stable asymptote in adulthood [35]. The females were more infected with the intestinal parasites than the males in this study although the difference was not statistically significant. A similar observation was made in a number of studies [36,37] but contrary in others [38,39]. It is therefore not apparently clear if the prevalence of intestinal parasitic infection among children is gender dependent, more systematic research works are required to elucidate this.

Findings from this study showed that male children were more infected with S. haematobium than the females and the age group 10-11years had the highest prevalence of infection. Although the differences were not statistically significant, a number of other studies indicated that male children are much more prone to S. haematobium infection than the [23,25]. The reason for the higher prevalence among the male children is presumably due to higher water contact activities by male pupils particularly in swimming and bathing in cercariae-infested rivers and this is common among children aged 10-12 years [25].

In conclusion it is pertinent to state that simple interventions, such as school based deworming programme and health education, have the potential to improve children's health and educational achievement, especially for those worst affected by intestinal parasites and urinary schistosomiasis. The World Health Organization states that the control of schistosomiasis and intestinal parasitic infections has to be an integrated effort which includes methodologies and managerial tools to improve preventive strategies, and emphasizes health education, information and communication [12,31]. There is therefore need for a more pragmatic approach to parasite control among school age children in order to enhance their overall wellbeing. This is necessary both in the rural and semi-urban areas. .

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