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Giardiasis and its Associated Risk Factors Among School Children in Selected Rural Communities in South Eastern Nigeria

Oluchi Ogbuu[1], Carmelita Chima Ohaeri[1], Ebube Charles Amaechi[1,2*], Blessing Uzoamaka Ejike[1,3]

[1]Department of Zoology and Environmental Biology, Michael Okpara University of Agriculture, Umudike, Umuahia, Abia State, Nigeria
[2]Department of Zoology, University of Ilorin, Ilorin, Nigeria
[3]Department of Biology and Microbiology, Abia State Polytechnic, Aba, Abia State, Nigeria

*Corresponding Author: ebubeamechi@yahoo.com

ABSTRACT

The study was conducted to determine the prevalence of giardiasis among school children in Afikpo North Local Government Area, Ebonyi State, Nigeria. The study was carried out from June to October, 2015. Direct smear, iodine wet mounts, and the formol-ether concentration technique were used to analyze the stool samples. Out of 600 stool samples from pupils aged 5-16 years from six primary schools examined, 30 (5.0%) were infected. The prevalence rate was higher among males (5.7%) than among females (4.8%), although the difference was not statistically significant ($\chi^2 = 0.91$, df = 1, $p > 0.05$). Pupils in the 8- to 10-year age group had the highest prevalence (5.8%, $n = 260$), while those in the age group of 11-13 years had the lowest prevalence (3.9%, $n = 230$). Similarly, pupils in primary 2 had the highest prevalence (7.1%, $n = 170$) while those in primary 6 had the lowest (2.5%, $n = 80$). Infection was higher among children whose parents were traders (11.7%, $n = 120$) and farmers (10.0%, $n = 100$, than among those whose parents were civil servants (1.6%, $n = 380$). There was a significant statistical difference in the prevalence of giardiasis with respect to occupation of parents of these children ($\chi^2 = 25.85$, df = 2, $p < 0.05$). On the sources of drinking water, children who drank rain and stream water recorded high prevalence rates of (6.3% $n = 270$) and (5.7% ($n = 230$), respectively. There was statistically significant difference in the prevalence of giardiasis with respect to the sources of water ($\chi^2 = 6.42$, df = 2, $p < 0.05$). These findings indicate that giardiasis was prevalent among school children in Afikpo. It is recommended that adequate health education and sanitary measures be carried out in order to decrease the rate of *Giardia* infection in school children.

Keywords: *Giardia lamblia*, Prevalence, school children, Ebonyi, Nigeria

INTRODUCTION

Giardia lamblia (Syn. *G.intestinalis*, *G.duodenalis*) is a major intestinal protozoa that commonly causes diarrheal disease throughout the world. About 200 million people globally are estimated to be infected with *G. lamblia* (Murray et al.,2002) with children of about 2–14 years living in poor communities particularly in sub-Saharan Africa most affected. It has been found in several studies that the incidence of diarrhea associated with *G. lamblia* is higher in developing countries such as those in Africa, Asia, and South and Central America, where environmental factors are precarious and access to basic amenities is lacking. The prevalence rate of *G. lamblia* infection in developed nations is 2% to 5%, but in developing nations, it is 20% to 30% (Thielma & Guerrant, 1998).The major known modes of transmission include water-borne and food-borne, person-to-person, and animal-to-person transmission (Baklursso & Karanis, 2011; Anuar et al., 2012). Apart from causing morbidity and mortality,infections with *G.lamblia* have been positively associated with poverty,poor environmental sanitation, lack of clean and safe drinking water supply,and contamination of the environment by human excreta and animal waste, poor personal hygiene, lack of toilet facilities, contact with animals, and prevailing climatic and environmental conditions amongst others (Stephenson et al.,2000). In school children, long-term growth retardation has been associated with giardiasis in most parts of the world (Adam,2001).

The occurrence of giardiasis have been reported in parts of Nigeria with varying prevalences ranging from 18.5% to 40.4% (Obiukwu et al., 2008; Biu et al., 2009; Nyamngee et al., 2009).The present work's goal is to ascertain the prevalence of giardiasis and possible associated risk factors among school children and possible ways of controlling the spread of the infection in rural communities around southeastern Nigeria.

Study Area

The study was conducted between June and October 2015 in selected rural communities in Afikpo North Local Government Area of Ebonyi State, Nigeria. Afikpo has an average annual rainfall of 198mm with a tropical climate having mean daily maximum air temperatures ranging from 22°C to 30°C and mean daily minimum air temperatures ranging from 17°C to 29°C. The highest temperatures occur between February and April, and the lowest temperatures occur during the Harmattan period. The wet season starts from April to October, and the dry season starts from November to March. The area lies between 6°401 E and 6°202 E and 6°404 N and 7°006 N. Afikpo has a large population that is heterogeneous with people of different groups and occupational backgrounds. These include students, civil servants, traders, artisans, and a greater proportion of farmers. The people there get their drinking water from borehole, harvested rain water during the rainy season, and streams. Different toilet facilities such as water closet systems and pit latrines are present,although open-air toilets are not common. Government health clinics and dispensaries are fairly distributed in the area. Afikpo is a hilly area with plains suitable for agricultural production. Economic trees present are mango, orange, and pear. The riverine communities engage largely in the fishing industries. The Ndibe River is present, and swimming in this river predisposes children to the infective stages of *G. lamblia*.

Study Population

The study population was composedof pupils from three randomly selected communities, namely, the Ohaisu community, Nkpoghoro community, and Ugwuegu community. Two

schools were randomly selected from each community, and the schools were the Ngodo/Amachi Community Primary School, Ukpa/Amachara Primary School, Amauro/Mgbom Community Primary School, Nkpoghoro Community Primary School, Enohia Nkalu Primary School, and Ohabuike Primary School. The total population in the six schools studied was 1000 pupils (550 males and 450 females). An average of 18 pupils from each class (Basic 1–6) formed the sampled population in the six schools. A total number of 600 pupils (350 males and 250 females) responded to the questionnaire and also brought their stool samples for analysis. The study was carried out from June to October 2015.

ETHICAL CONSIDERATION

The researchers sought and received ethical approval from the Health Department of the Afikpo North Local Government before embarking on the study. Before commencement of the study, the principal investigator and her research team conducted meetings with local leaders and community members in all the communities where the school children were located, during which the objectives of the study including the procedures to be followed were properly explained in the local Igbo language for proper understanding. The participants were also told that they could voluntarily withdraw from the study at any time without any consequences. All participants gave informed oral and written consent before being included in the study. Parents and guardians of children younger than 16 years gave consent on behalf of their wards after the details of the study were explained.

ADMINISTRATION OF QUESTIONNAIRES

The questionnaires were given to the selected group of pupils for study through their teachers. The information sought for included sex, age, place of residence, parent's occupation, source of drinking water at home and in school, and the type of toilet facilities and refuse disposal method available in their home.

COLLECTION OF STOOL SAMPLE

The selected pupils were each given a sterilized, capped, and well-labeled specimen container with which the stool samples were collected. Pupils were instructed to place their stool samples into the sterile universal bottle, which was collected in their homes the following morning with the help of their parents/guardians and brought to school the next day. Upon receiving the stool sample from each pupil, the researcher obtained the following information: age, sex, occupation of parents, type of toilet system, and sources of water. The stool samples were taken to the Rehoboth Medical Laboratory, Afikpo, Ebonyi State, where the samples were processed and examined microscopically.

LABORATORY INVESTIGATION

In the laboratory, each stool sample was macroscopically examined with unaided eye, using an applicator stick. Appearance of the fecal sample was noted reporting the following: color of the specimen, consistency, and presence of blood, mucus, and/or pus. For every stool sample, direct smear, iodine wet mounts, and the formol-ether concentration technique were used to prepare slides for microscopic examination of the stool sample according to Cheesbrough (2005) and Arora and Arora (2009). The stool samples were microscopically examined for trophozoites and cysts of *Giardia* under 40 × magnification. Prevalence of the parasite was defined as the total number of individuals infected using all the three methods of laboratory investigation divided by the number of persons examined.

STATISTICAL ANALYSIS

The data obtained from the samples were analyzed using χ^2 test in Microsoft Excel 2007 at $p < 0.05$. For descriptive analysis, the prevalence of infection and other categorical variables were expressed in tables and percentages.

RESULTS

The highest prevalence rates of giardiasis were observed in children in the age group of 8–10 years (5.8%,n = 260),males (5.7%,n = 350), those enrolled in Enohia Nkalu Primary School (10.5%,n = 105), and those in primary 2 (7.1 %,n = 170), while lowest rates were observed in the age group of 11–13 years (3.9%, n = 230), females (4.0%, n = 250), those enrolled in Amauro/Mgbom Community Primary School (2.0%, n = 100), and those in primary 6 (2.5%, n = 80). However, none of the differences in these groups were statistically significant ($p > 0.05$).

Occupationally, the difference in infection rates was statistically significant ($\chi^2 = 25.85$, df = 2, $p < 0.05$) and highest among children of traders (11.7%, n = 120), followed by children whose parents were farmers (10.0%, n = 100), and lowest among children of civil servants (1.6%, n = 380). Likewise, the difference in infection rates with respect to the source of drinking water was also statistically significant, with those who consumed rain water having the highest prevalence (6.3%, n = 270), followed by those who consumed stream water (5.7%, n = 230).Children who consumed borehole water were not infected (n = 100).

The difference in infection rates according to toilet facilities was not statistically significant($\chi^2 = 3.42$, df = 2, $p > 0.05$), but those who used water closets recorded the highest prevalence (6.4%, n = 296), followed by those whousedpit latrines (3.6%, n = 302). Children who defecate in nearby bushes were all negative for infection (n = 2). All prevalence rates are summarized in Tables 1–7.

Associated Risk Factors for Giardiasis Among School Children in Afikpo North

This study analyzed the association between certain factors and the prevalence of Giardiasis. Those that were deemed risk factors and their corresponding odds ratios are presented in Table 8.

Table 1. Prevalence of Giardiasis by Age Group Among School Children in Afikpo North

Age Group (Years)	Number Examined	Number Infected	% Infection
5–7	90	5	5.6
8–10	260	15	5.8
11–13	230	9	3.9
14–16	20	1	5.0
Total	600	30	5.0

*Not significant ($\chi^2 = 6.45$, df = 3, $p > 0.05$).

Table 2.Prevalence of Giardiasis by SexAmong Table 2. Prevalence of Giardiasis by Sex Among School Children in Afikpo North

Sex	Number Examined	Number Infected	% Infection
Males	350	20	5.7
Females	250	10	4.0
Total	600	30	5.0

Not significant ($\chi^2 = 0.91$, df = 1, $p > 0.05$).

Table 3. Prevalence of Giardiasis by School Among School Children in Afikpo North

Schools	Number Examined	Number Infected	% Infection
Ngodo/Amachi Community Primary School	100	6	6.0
Ukpa/Amaechara Primary School	100	4	4.0
Amauro/Mgbom Community Primary School	100	2	2.0
Nkpoghoro Community Primary School	105	3	2.9
OhabuikePrimary School	90	4	4.4
Enohia Nkalu Primary School	105	11	10.5
Total	600	30	5.0

Not significant ($\chi^2 = 9.37$, df = 5, $p > 0.05$).

Table 4. Prevalence of Giardiasis by Class Among School Children in Afikpo North

Class	Number Examined	Number Infected	% Infection
Primary 1	120	4	3.3
Primary 2	170	12	7.1
Primary 3	100	6	6.0
Primary 4	60	3	5.0
Primary 5	70	3	4.3
Primary 6	80	2	2.5
Total	600	30	5.0

Not significant ($\chi^2 = 3.56$, df = 5, $p > 0.05$).

Table 5. Prevalence of Giardiasis by Occupation of Parents Among School Children in Afikpo North

Occupation	Number Examined	Number Infected	% Infection
Farmers	100	10	10.0
Civil servants	380	6	1.6
Traders	120	14	11.7
Total	600	30	5.0

Significant ($\chi^2 = 25.85$, df = 2, $p < 0.05$).

Table 6. Prevalence of Giardiasis by Source of Drinking Water Among School children in Afikpo North

Sources of Water	Number Examined	Number Infected	% Infection
Stream	230	13	5.7
Rain water	270	17	6.3
Borehole	100	0	0.0
Total	600	30	5.0

Significant ($\chi^2 = 6.42$, df = 2, $p < 0.05$).

Table 7. Prevalence of Giardiasis by Toilet Facility of Drinking Water Among School Children in Afikpo North

Toilet Facility	Number Examined	Number Infected	% Infection
Pit latrine	302	11	3.6
Water closet	296	19	6.4
Nearby bush	2	0	0.0
Total	600	30	5.0

Not significant ($\chi^2 = 3.42$, df = 2, $p > 0.05$).

Table 8. Risk Factors Associated With Giardiasis Among School Children in Afikpo North

Risk factors	Yes	No	OR (95% Cl)	χ^2	p-Value
Not washing hands before eating	300 (50.0%)	100 (16.7%)	0.435 (0.196–0.779)	9.306	0.002
Lack of toilet in the house	250 (41.7%)	150 (25.0%)	0.480 (0.279–0.922)	7.312	0.006
Not washing hands after playing with animals	350 (58.3%)	100 (16.7%)	0.445 (0.176–0.579)	10.305	0.001
Not boiling water before consumption	400 (66.7%)	130 (21.7%)	0.217 (0.118–0.270)	7.413	0.003
Not wearing shoes when outside	150 (25.0%)	350 (58.0%)	0.249 (0.147–0.454)	22.134	0.000
Indiscriminate garbage disposal	195 (32.5%)	295 (49.2%)	0.345 (0.184–0.690)	13.401	0.000
Not washing vegetables/fruits before consumption	400 (66.7%)	130 (21.7%)	0.467 (0.190–0.650)	7.025	0.050
Indiscriminate defecation	375 (62.5%)	125 (20.8%)	0.367 (0.180–0.750)	8.055	0.050
Low educational level	350 (58.3%)	150 (25.0%)	0.576 (0.176–0.690)	6.155	0.000
Use of preventive drugs	100 (16.7%)	400 (66.7%)	0.934 (0.132–0.491)	4.133	0.002

DISCUSSION

Epidemiological studies on prevalence of an infection in different localities seek to identify high-risk communities with the aim of formulating appropriate intervention measures. In line with this view, the present study was undertaken to assess the prevalence of giardiasis among school children in selected primary schools in Afikpo, Ebonyi State, Eastern Nigeria. The overall prevalence of giardiasis among school children in Afikpo denoted low endemicity (5.0%). Overall prevalence recorded in this study was lower compared to previous studies done in other parts of the country. Oguoma et al. (2008) reported the prevalence of *G. lamblia* in the studied health facilities and resident homes to be 25.5% in Imo State, while Abdullahi and Abdulazeez (2000) reported a prevalence rate of 11.6% in Zaria. In Zambia, Siwila et al. (2010) recorded a value of 28.0% in children attending pr-schools or day-care centers in Kafued District, Zambia. Only the report of Ifeora (2002) recorded a prevalence value of 4.8% in Awka Capital Territory of Anambra State, which is similar to the prevalence in the current study.

In contrast, the overall prevalence in this study was higher than the 1.9% prevalence reported by Claudia et al. (2012) among children attending healthcare centers in Portugal. Several reports from other parts of Nigeria have shown higher infection rates of giardiasis among the various communities. Njudan and Viban (2006) reported a value

of 31.25%, 28.5%, and 25.0% for unformed, semi-formed, and formed stools, respectively. Okolo (2009) recorded a value of 2.8% among Unity primary school pupils in Oraifite, Ekwusigo Local Government Area, Anambra State. Ukpai and Ugwu (2003) reported a prevalence of 1.7% in Umudike, Ikwuano Local Government of Abia State, and Houmsou et al.(2011) reported prevalence value of 1.3% in Makurdi, Benue State. Variations in prevalence of giardiasis from different communities could be related to several factors including people's level of education, standard of personal/environmental hygiene, timing and seasonal differences of conducting the survey, ecological factors such as temperature, relative humidity, rainfall in the study areas, and different diagnostic techniques employed by various workers (Okolo, 2009; Adefioye et al., 2011).The low prevalence of *Giardia* infection observed in this study could be due to the fact that the pupils had improved personal and environmental hygiene and water supply.

In this study, the 8- to 10-year age group recorded the highest prevalence (5.8%). The high value observed in this age group might be due to the fact that they spend more time in water washing, fishing, playing or swimming. They are also in contact more often with the soil and are fond of eating indiscriminately with unwashed hands. The prevalence rate decreased among the older school children possibly due to change in attitude, habits, and awareness regarding personal hygiene. Luka et al. (2000), Adefioye et al. (2011), and Amaechi et al. (2013) observed a similar trend in the Kaduna, Osun, and Abistates, respectively. In this study, male children were infected more than the females. This was in agreement with the results of Luka et al. (2000), Ukpai and Ugwu (2003), Sam-Wobo et al. (2004), and Ohaeri and Odukaesieme (2010). This may be because male children engage in activities such as swimming and playing football in the soil, which exposes them to infection. Only the results of Onugha (2008,reported higher infection rates in females (85.19%) than in males (43.87%).The low prevalence recorded in Amauro/Mgbom Community Primary School reflects the semi-developed nature of the place. Pupils from this school have improved personal/environmental hygiene. The high prevalence of giardiasis among pupils in Enohia Nkalu Primary School may have been a result of the fecal pollution at home, lack of household cleanliness and personal hygiene, large family size, unhygienic premises of the school,sand its rural location. Primary 2 had the highest prevalence (7.1%) while those in in primary 6 had the lowest (2. 5 %). This was in contrast with the findings of Onugha (2008), who recorded the highest prevalence by class in primary 4 (6.28%) and the lowest in primary 1 (0.6%).The current study showed that pupils whose parents were traders (11.7%) harbured more parasites than those whose parents were farmers and civil servants. This was in contrast with the results of Okolo (2009), who recorded the highest prevalence of intestinal parasites (66.7%) among pupils whose parents were farmers. It is important to note that in the schools included in the current study, children fetched their own drinking water and also worked in the school farms for their teachers. Children whose parents were civil servants had the lowest prevalence (1.6%). This seems unsurprising, as these parents were literate and probably knew about good personal hygiene and had adequate health education. It was observed that pupils who drank rain and stream water showed high prevalence rates of 6.3% and 5.7%, respectively. These water sources are usually not covered and are prone to contamination by wastes including human and animal feces containing parasite cysts or ova spread by vectors such as flies (Ukpa & Ugwu, 2003), greatly enhancing the chances of ingesting the infective stages of the parasite. Possible sources of contamination

of the rain drinking water that caused the highest prevalence rate are the deplorable state of the environment and unwashed contaminated hands of children after playing with the soil. The process of fetching water may also contaminate the water containers, the mouth or handle of the tap, and the water itself. This confirms the fact that intestinal parasitic disease transmission depends on poor environmental conditions including indiscriminate deposition of feces and poor personal hygiene. Most of the respondents were treated with metronidazole (flagyl) for giardiasis because of its popularity compare to other drugs.

Significant association was found between giardiasis and knowledge of participants of personal hygiene practice such as washing of hands before eating OR = 9.30, $p = 0.002$). Study participants who had poor knowledge of personal hygiene were more likely to acquire the infection compared to those who had good knowledge of personal hygiene practice. This report was in agreement with previous studies in other areas (Anuar et al.,2012; Amaechi et al.,2013). School children have been found in most cases to have a carefree attitude towards hand washing and other personal hygiene practices. They usually play in contaminated outdoor environments, within and around disposal sites, all of which can constitute to severe health problems.

Generally, the prevalence of giardiasis and certain risk factors such as parents' occupation, availability of latrines at home, sources of drinking water, eating habits, and having regular contact with animals without washing of hands have been found to be significantly associated with giardiasis in this study. Therefore, to eradicate this infection, proper health education in schools is advocated. Children of school age learn faster and are most likely to adopt healthy behavior and practice,and transfer such to their parents and wards at home.

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