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Prevalence of Intestinal Protist Infections among School Children Attending Selected Primary Schools in Maiyama, Kebbi State, Nigeria

M. M. Galamaji[1*], D. D. Attah[1] and J. I. Amaka[1]

[1]Department of Biological Science, Kebbi State University of Science and Technology, P.M.B. 1144, Aliero, Kebbi State, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Author MMG designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors DDA and JIA managed the analysis of the study. Author DDA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

This study was carried out to determine the prevalence of intestinal protist infection in five selected primary schools in Maiyama Local Government Area of Kebbi State, Nigeria. Stool samples from 200 pupils were collected and examined using formol-ether concentration technique for protist cysts, out of which 49 (24.5%) were infected with different species of intestinal parasitic protists. *Entamoeba histolytica* was the most common intestinal parasitic protist encountered in the study area. With respect to gender, the prevalence of the infection was higher in males (29.0%) than their female counterpart (20.0%). The prevalence of the infection changed with age of the pupils (X^2= 5.298, *P* = .02). The result of this study also shows significant association between the prevalence of the infection and other risk factors such as source of drinking water (X^2= 6.59, *P* = .04), toilet facilities (X^2= 25.388 and *P* <.0001) and regular hands washing (X^2=11.409, *P*= .0007). It was concluded that poverty, ignorance, and poor personal and environmental hygiene were factors found to be associated with the high prevalence rates recorded in this study area. Health education, personal and environmental hygiene, regular mass treatment program and improvement in the standard of living of the people are recommended.

**Corresponding author: E-mail: mmgalamaji2000@gmail.com;*

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1. INTRODUCTION

Protists are one-celled organisms found worldwide in most habitats. Most species are free living, but most higher animals are infected with one or more species of the parasites. Protist infections range from asymptomatic to life threatening, depending on the species and strain of the parasite and the resistance of the host [1]. The intestinal protist parasites of medical importance include *Entamoeba histolytica, Entamoeba coli, Giardia lamblia, Cryptosporidium* species*, Cystoisospora belli, Balantidium coli and Cyclospora* species.

The main transmission route for intestinal protist is fecal–oral. Infections with intestinal parasitic protists occur through the ingestion of the infective stages of the parasites often in contaminated hand, water and food [2]. Their transmission has been associated with contaminated drinking water and food, low socioeconomic status and overcrowding conditions [3].

Infection with pathogenic intestinal protists results in considerable gastrointestinal morbidity, malnutrition and mortality worldwide [4], particularly among young children in developing countries [5]. It has been estimated that *E. histolytica*, the causative agent of amoebiasis, kills between 40,000 and 100,000 people each year [4]; hence, is one of the deadliest parasitic infections worldwide [6]. In the People's Republic of China alone, *Giardia lamblia* (= *G. intestinalis*) affects an estimated 28.5 million people every year [4]. The prevalence of *Giardia lamblia* (= *G. intestinalis*) has been estimated at 2–3% in the industrialised world [4] and 20–30% in developing countries [7]. *Cryptosporidium* spp. is another major causal agent of diarrhoea, primarily affecting immune-compromised individuals such as those infected with HIV [8]. In this study area, information on the prevalence of intestinal protist infections is scarce and little data are available. It is against this background that this study was carried out to provide current information on the prevalence of intestinal protist infection among primary school children in the study area.

2. MATERIALS AND METHODS

2.1 Study Area

Maiyama local government area is located at latitude 13º north and longitude 5º east. The area has a total land mass of 1,028 km^2 and a population of 175,686 based on 2006 population and housing census figure [9]. The inhabitants are predominantly Hausa people by tribe. The major occupation of the people is farming and trading.

2.2 Study Population

The study population comprised 200 primary school pupils from 5 primary schools randomly selected in Maiyama LGAs for this study and 40 pupils were selected from each of the primary schools. The schools were selected using cluster sampling and stratified random sampling was used in selecting the pupils for the study.

2.3 Administration of Questionnaire

A structured questionnaire was administered to obtain information on demographic data and risk factors of acquiring intestinal protozoan infection. Ethical approval for the study was obtained from the Ethics and Research committee of Kebbi State University, Aliero. Permission to conduct the study in the schools was sought from the Local Government Education secretary, primary school head teachers and the parents through written consent.

2.4 Sample Collection

Faecal samples were collected from 200 pupils (100 males and 100 females) from the five primary schools area. Each pupil was given a sample collection bottle bearing serial number that was assigned to his/her name in the record book. The pupils were instructed to bring their early morning stool sample. The faecal samples collected was preserved in 10% formalin (NCCLS, 1997) and transported to Laboratory for analysis.

2.5 Laboratory Analysis

About 1 gm of stool was emulsified with 7ml of 4% formol-saline solution and filter through the gauze into a centrifuge tube. About 3ml of diethyl-ether was added to the solution and shake well and centrifuge with gradual acceleration for 2-3 minutes at 2000 rpm. Plug of debris was dislodge with applicator stick and supernatant decanted. A drop Lugol's iodine was added to the sediment at the bottom of the tube and a drop of the sediment was placed on slide

and covered with cover slip [10]. The slide was observed for cyst of intestinal parasites under X 10 and X 40 objective lens.

2.6 Data Analysis

The data collected was analysed using Graph Pad Instat software (V 3.05). Prevalence was calculated and express in percentages. Chi square test was used to compare prevalence by age and gender and to confirm possible association between infection and other risk factors. *P*-value of ≤ 0.05 is considered significant at 95% CI.

3. RESULTS AND DISCUSSION

A total of 200 primary school pupils (100 males and 100 females) submitted their stool samples for laboratory investigation, out of which 49 representing 24.5% were positive. The intestinal protists are widely distributed and infection usually vary according to immunity, region and age [11]. An increase in the incidence of these infections is evident in communities with poor sanitation [11]. The findings of this study reveal higher prevalence of the infection compare to others studies. In Kaduna state Nigeria, [12] reported a prevalence of 1.9% among patients aged 2 months to 70-years-old, and [13] reported a prevalence rate of 4.8% among malnourished children aged 0– 5 years. This high prevalence of intestinal protist infections in schools in Maiyama may be due to poor environmental hygiene, favorable climatic condition like high temperature and moisture of the area which supports the survival of the parasites, socio-economic condition of the study population, and limited access to clean water and use of dumping site for defecation.

The intestinal parasitic protists observed were *E. hystolitica*, *E. coli, Giardia lamblia* and *Cryptosporidium* species. *E. hystolitica* was the predominant intestinal protist parasite species found in the area (58.2%), (Fig. 1).

3.1 Distribution of Intestinal Protist with Respect to Age and Gender of the Pupils

Table 1 shows the pattern of infection in relation to age of the pupils in the area. The distribution of the infection was age-dependent with significantly higher prevalence among 4 – 9 years (32.0%) than the 10 – 14 years (17.0%). *P* = .04 obtained in this study shows that there is a statistically significant association between the prevalence of the infection and age. Stratifying our results into age groups, we observed that the prevalence of the infection generally decreases with increasing age. This may be due to their level of exposure to the risk factors. Thus, as age increases exposure to intestinal parasitic infection decreases possibly due to improved personal hygiene. As the children grow there is better awareness in hand washing and other personal hygiene measures this may reduce the risk of the children from getting infected. Similar observations were made by several authors [14] and [15].

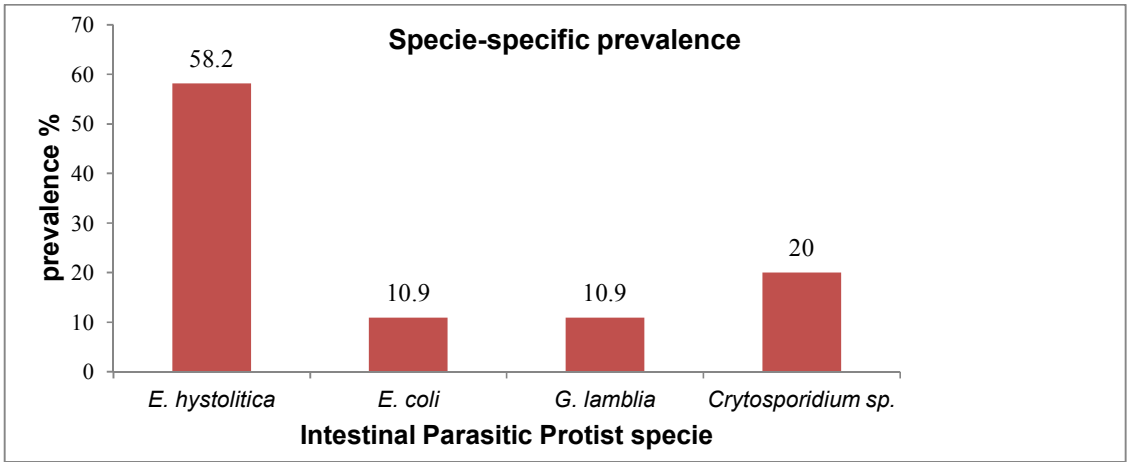

Fig. 1. Specie-specific prevalence of intestinal Protist among primary schools pupils

Gender wise prevalence is shown in Table 2. Prevalence in relation to gender was higher among males (29.0%) than their female counterpart (20.0%) but the effect was not significant (*P* = .19). Similar observation was made by Williams et al. [16] in Kumasi, Ghana. Most scholars have attributed this skewness to socio-cultural and behavioural differences between males and females children. Males obtained higher prevalence of intestinal parasitic infection because they get more freedom than females whose leisure hours are strictly controlled and restricted hence are less exposed to parasitic infections [17]. In addition, the highly aggressive and explorative behaviour of the boys consequently make them more prone to infection and re- infection than girls.

3.2 Prevalence of Intestinal Protist Infection in Relation to Behavioural and Socio-Environmental Factors

Table 3 depicts the Prevalence of intestinal protist infection in relation to behavioural and socio-environmental factors. Washing hands with soap and water after using latrine was significantly associated with the infection (X^2 = 11.409 and *P* = 0.0007). Highest prevalence of intestinal protist was recorded among subjects who do not wash their hand regularly after using latrine (36.8%) than those who regularly wash their hands with soap or ash after using the latrine (15.0%). In this study, washing hands with soap or ash after using toilet was significantly protective. Pupils who washed hands regularly after using toilet were less likely to be infected than those who only washed occasionally or do not wash at all. *P*-value (.0007) shows intimate association between washing hands after toilet and the transmission of intestinal protist. It has been reported that the hands readily become contaminated after defaecation even with the use of tissue paper [18]. Hands can act as conduits to transfer parasites from surfaces in or outside the home, currency, food and animals (pets or wild). Hand washing is an economical method of primary prevention.

Variation of prevalence with respect to source of water supply was observed in this study and this effect was statistically significant (X^2 = 6.591 and *P* = .04). Prevalence based on water source showed that the prevalence was higher in the pupils who used wells (38.2%) as their source of drinking water and least in those that used either borehole (16.2%) or pipe-borne (16.0%) water as source of drinking water (Table 3). The high prevalence among the pupils who indicate that wells are the sources of their drinking water may be because shallow wells may be prone to contaminations. Also some wells in the towns are dug closed to pit latrine, and poor sanitation around the well enhances transmission of intestinal parasites.

Prevalence of intestinal protist infections according to type of toilet used showed that individuals that use pit latrine and open field defaecation had a higher prevalence than those that use water closet. Those that responded they use pit latrine had (21.8%) positive cases, and 57.6% prevalence among those who used open field defaecation (Table 3). Whereas those that use water system had least prevalence of 12.1%. Presence of good toilet facility was protective compared to open field defecation in nearby bushes. Comparable patterns have also been observed by earlier study like [3]. The result of this research showed strong association between the prevalence of the infection and toilet type (*P* < .0001). This could be due to poor sanitation which might encourage flies and cockroaches to spread cysts and eggs of intestinal parasites [19].

Table 1. Distribution of intestinal Protist in relation to age of the pupils

Ages (years)	Number examined	Number positive	Percentage	Chi-square	*P*-value
4 – 9	100	32	32.0	5.298	0.02
10 - 13	100	17	17.0		
Total	200	49	24.5		

Table 2. Prevalence of intestinal Protist infection stratified by gender of the pupils

Gender	Number examined	Number positive	Percentage	Chi-square	P-value
Male	100	29	29.0	1.730	0.19
Female	100	20	20.0		
Total	200	49	24.5		

Table 3. Prevalence of the infection in relation to behavioural and environmental factors

Factors	Number examined	Number positive (%)	Chi-square	*P*-value
Regular hand washing				
No	87	32(36.8)	11.409	0.0007
Yes	113	17(15.0)		
TOTAL	200	49(24.5)		
Source of drinking water				
Well	76	29(38.2)	6.591	0.04
Bore hole	99	16(16.2)		
Pipe borne water	25	4(16.0)		
TOTAL	200	49(24.5)		
Toilet type				
Open field	33	19(57.6)	25.388	<0.0001
Pit latrine	101	22(21.8)		
Water closet	66	8(12.1)		
Total	200	49(24.5)		

4. CONCLUSION

It was concluded that the prevalence of intestinal protist among school-aged children in Maiyama local government area is high. This high prevalence may be attributed to poor environmental management, poor personal hygiene and lack of public health education. Public health education and improved sanitary conditions in our environment are key success to the prevention of spread of intestinal protist infections. Sustainable intervention measures which should include health education, improvement in the standard of living of the people, regular mass treatment program, improved personal and environmental hygiene are recommended.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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