Asian Journal of Immunology

2(1): 56-63, 2019; Article no.AJI.52961

Epidemiological Study of Intestinal Parasites in School Children in Vandeikya LGA, Benue State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Authors TSA, CKK and CTT designed the study and carried out the field research. Author EUA wrote the protocol and supervised the research. Author VUO performed the statistical analysis. Author JIC wrote the first draft of the manuscript and managed the literature searches. All authors read and approved the final manuscript.

Article Information

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Complete Peer review History: http://www.sdiarticle4.com/review-history/52961

Original Research Article

Received 01 October 2019
Accepted 04 December 2019
Published 12 December 2019

ABSTRACT

A study was conducted to determine the epidemiology of intestinal parasites in school children in Vandeikya LGA, Benue State, Nigeria. Two hundred and ninety three (293) stool samples from school children were examined in selected schools across the Local Government Area. 22 of 293 children were infected with parasites which include: *Ascaris lumbricoides*, *Entamoeba histolytica*, Hookworm, *Strongyloides stercularis* and *Taenia spp*. Hookworm had the highest prevalence rate of 9(3.1%), *Entamoeba histolytica* 7(2.3%), *Taenia* spp had 3(1.0%), *Strongyloide stercolaris* had 2(0.7%) while *Ascaris lumbricoides* recorded the least prevalence rate of 1(0.3%). For mixed infections, *Entamoeba histolytica* and *Ascaris lumbricoides* recorded the highest prevalence of 5(1.7%); *Entamoeba histolytica*, Hookworm and *Strongyloides stercolaris* recorded prevalence of 2(0.7%); and *Entamoeba histolytica*, *Ascaris lumbricoides* and Hookworm recorded prevalence of 2(0.7%); there was however, no significant difference (P>0.05) in prevalence of mixed infections.

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For prevalence based on age, there was significant difference (P<0.05) between the age groups, x^2 calculated (10.117), x^2 tabulated (4.891), df = 2. There was no significant difference (P>0.05) in the infection rate based on sex, x^2 calculated (3.245), x^2 tabulated (5.991), df = 2. Intestinal parasites are prevalent in Vandeikya LGA, Benue State. Risk factors like open defecation, use of stream and well water should be minimized in order to prevent infection.

Keywords: Prevalence; intestinal parasites; mixed infection.

1. BACKGROUND

Intestinal parasites are helminthes (worms) and protozoa that reside in the intestines of their hosts; disease burden is higher in children and women [1]. At least 880 million children are in need of treatment for intestinal worms [1]. According to World Health Organization estimates, 500 million people in the world are infected with *Entamoeba histolytica*; this protozoon causes symptomatic illness in about 50 million people and is responsible for 100,000 mortalities [2]. Intestinal parasites may cause morbidities like: weakness, inflammation of the intestines, abdominal pains, nausea and dysentery in those infected [3]. In addition, infection in children may result in reduced ability to learn, reduced food absorption leading to malnutrition, anaemia, stunted growth, and may lead to death [4]. Intestinal parasites are endemic in the tropics where favorable climatic, environmental and sociocultural factors permit transmission [5]. The infection rate for these parasites has primarily been attributed to poverty, unhygienic environmental conditions and over-dispersion of parasites [4]. Significantly higher prevalence of intestinal parasites was reported in children from homes where livestock are reared and in children of farmers [6]. According to a study conducted in Ethiopia, hygiene factors like the inconsistent use of shoes is strongly associated with prevalence of hookworm infection, and long untidy finger nails and drinking of well water are important risk factor for *E. histolytica* [7]. Drinking of rainwater is a possible risk factor for intestinal parasites [8]. In contrast, however, no association was found between household drinking water source and prevalence of intestinal parasites in school aged children in Burkina Faso [9]. Proper understanding of prevalence, distribution and associated risk factors for intestinal parasites could help in development of strategy aimed at transmission interruption and control of the diseases they cause. This study was therefore aimed at: 1) investigating the prevalence and distribution of intestinal parasites in school aged children in Vandeikya LGA and (2) determining the association between prevalence of parasite species in children and three (3) risk factors: drinking water source, occupation of parents and type of toilet used.

2. MATERIALS AND METHODS

2.1 Study Area

The research was carried out in select public and privates schools across Vandeikya Local Government Area of Benue State.

2.2 Samples Collection

School children that participated in the study were aged 3 – 15 years. School children were given 20 ml universal bottles the previous day and asked to return it the next morning with their early morning stool sample in it. Questionnaires were used to obtain data on age, sex, drinking water source, type of toilet system used at home and occupation of parents. After collecting the stool samples from the children at school, the specimen were then taken to the science laboratory at General Hospital Gboko where they were analyzed.

2.3 Method of Identification of Intestinal Parasites

The method that was used to identify the presence of intestinal parasites was direct microscopy of wet preparation, and stool concentration. Stool sample was emulsified in saturated salt solution in the test tube, the supernatant was poured out and the concentrate was centrifuge for 5 minutes. A drop or two of saline solution was placed on the microscopic slide with a cover slip and viewed under a microscope with ×10 and ×40 objective lens. Positive stool samples were identified by: Presence of characteristic eggs for *Taenia* species, Hookworm and *Ascaris* species. For *strongyloides* species, the presence of larvae was used for identification, while presence of characteristic trophozoites in stool was used of diagnose *E. histolytica*.

2.4 Statistical Analysis

Chi-square test was used to determine the homogeneity of the disease in the different schools.

3. RESULTS

Table 1 shows age related prevalences of a range of intestinal parasites present in stool samples of research subjects: The total prevalences of the intestinal parasites were as follows: *Ascaris lumbricoides* 1 (0.34%), *Entamoeba histolytica* 7 (2.39%), Hookworms 9 (3.07%), *Strongyloides stercularis* 2 (0.68%), *Taenia* spp. 3 (1.02%). Among children aged 0-4 years, Hookworm was the most prevalent intestinal parasite with prevalence of 2 (2.99%), and no intestinal parasite was observed among children aged 15-19 years. There was no significant difference (P>0.05) in prevalence between the different age groups.

Table 2 shows sex related prevalences of intestinal parasites in stool samples of research subjects. In males, prevalences of *Ascaris lumbricoides* was 1 (0.6%), *Entamoeba histolytica* 4 (2.55%), Hookworms 4 (2.55%), *Strongyloides stercularis* 1 (0.64%) and *Taenia* spp 0 (0.0%). Prevalences in females were as follows: *Ascaris lumbricoides* 0 (0.0%), *Entamoeba histolytica* 3(2.21%), Hookworms 5 (3.68%), *Strongyloides stercularis* 1 (0.74%), *Taenia* spp. 3 (2.21%). Females had higher total prevalences of intestinal parasites 12(14%) than males 10(8.3%).

Table 3 shows the prevalence of mixed intestinal parasite infections in school children with respect to age. *Entamoeba histolytica*, *Ascaris lumbricoides* and Hookworm had prevalence of 2 (0.68%); *Entamoeba histolytica* and *Ascaris lumbricoides* had the highest prevalence rate of 5(1.71%); and *Entamoeba histolytica*, Hook worm and *Strongyloides stercolaris* had prevalence of 2(0.68%).

Table 4 shows the prevalence of mixed intestinal parasites in school children with respect to sex. Prevalence of mixed infections was higher among males 4(2.55%) than among females 5(3.68%), giving a 9(3.07%) total prevalence of mixed infections.

Fig. 1 represents the prevalence of intestinal parasites in relation to the type of toilet used by the subjects. Those that used nearby bush were more infected accounting for 45% of total infections with intestinal parasites, while those that used "Pit" and water system toilets accounted for 40% and 15% total infection respectively.

Fig. 2 shows the relationship between source of drinking water and the prevalence of intestinal parasites. School children who obtain drinking water from streams were most infected accounting for 60% of total infections; children who obtain drinking water from wells had the second highest infection rates accounting for (30%) of total infection; while children who obtain drinking water from borehole were the least infected accounting for (10%) of the total infection.

Table 1. Age related prevalence of intestinal parasites

Age	No examined	*A. lumbricoides*	*E. histolytica*	Hookworms	*S. stercoralis*	*Taenia* spp
0-4	67	0(0.00)	1(1.49)	2(2.99)	1(1.49)	0(0.00)
5-9	146	1(0.68)	3(2.05)	4(2.74)	1(0.68)	3(2.05)
10-14	77	0(0.00)	3(3.90)	3(3.90)	0(0.00)	0(0.00)
15-19	3	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Total	293	1(0.34)	7(2.39)	9(3.07)	2(0.68)	3(1.02)

x^2 Cal = 10.117, df = 12, P>0.05

Table 2. Sex related prevalence of intestinal parasites

Sex	No examined	*A. lumbricoides* (%)	*E. histolytica*	Hookworm (%)	*S. stercoralis* (%)	Taenia spp (%)	Total (%)
Male	157	1(0.64)	4(2.55)	4(2.55)	1(0.64)	0(0.00)	10(6.37)
Female	136	0(0.00)	3(2.21)	5(3.68)	1(0.74)	3(2.21)	12(8.82)
Total	293	1(0.34)	7(2.39)	9(3.07)	2(0.68)	3(1.02)	22(7.51)

x^2 Cal = 3.245, df = 4, P>0.05

Table 3. Prevalence of mixed infections with intestinal parasites in different age groups

Age	No examined	No infected (prevalence)			Total
		***E. histolytica A. lumbricoides* Hookworm (%)**	***E. histolytica A. lumbricoides* (%)**	***E. histolytica* Hookworm *S. stercoralis* (%)**	
0-4	67	0(0.00)	1(1.49)	1(1.49)	2(2.99)
5-9	146	1(0.68)	2(1.4)	1(0.68)	4(2.74)
10-14	80	1(1.25)	2(2.50)	0(0.00)	3(3.75)
Total	293	2(0.68)	5(1.71)	2(0.68)	9(3.07)

x^2 Cal = 2,948, df = 4, P>0.05

Table 4. Prevalence of mixed infections with intestinal parasites in different sexes

Sex	No examined	No infected (prevalence)			Total (%)
		***E. histolytica A. lumbricoides* Hookworm (%)**	***E. histolytica A. lumbricoides* (%)**	***E. histolytica* Hookworm *S. stercoralis* (%)**	
Male	157	1(0.64)	2(1.27)	1(0.64)	4(2.55)
Female	136	1(0.74)	3(2.21)	1(0.74)	5(3.68)
Total	293	2(0.68)	5(1.71)	2(0.68)	9(3.07)

x^2 Cal = 0.052, df = 2, P>0.05

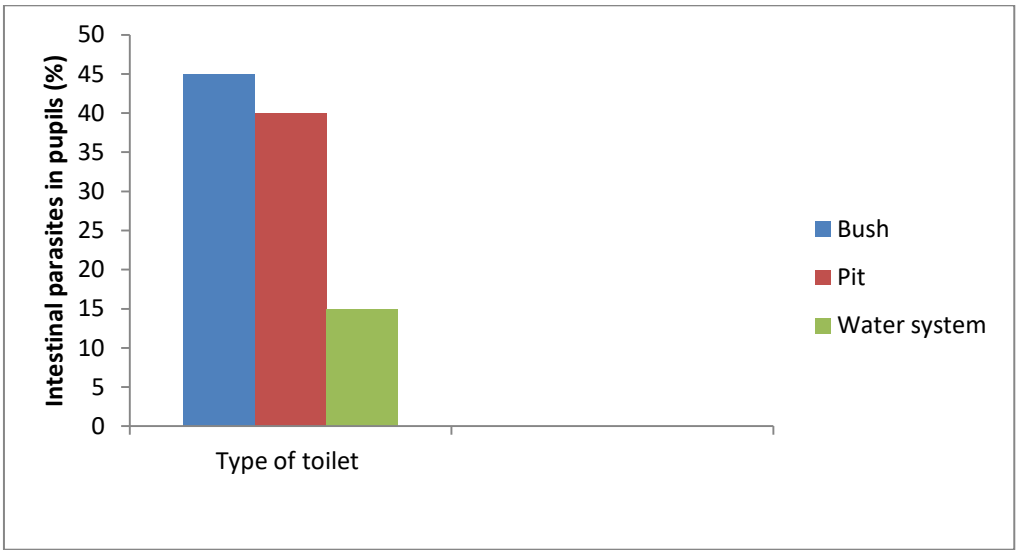

Fig. 1. Relationship between toilet facility and parasitic infection in pupils

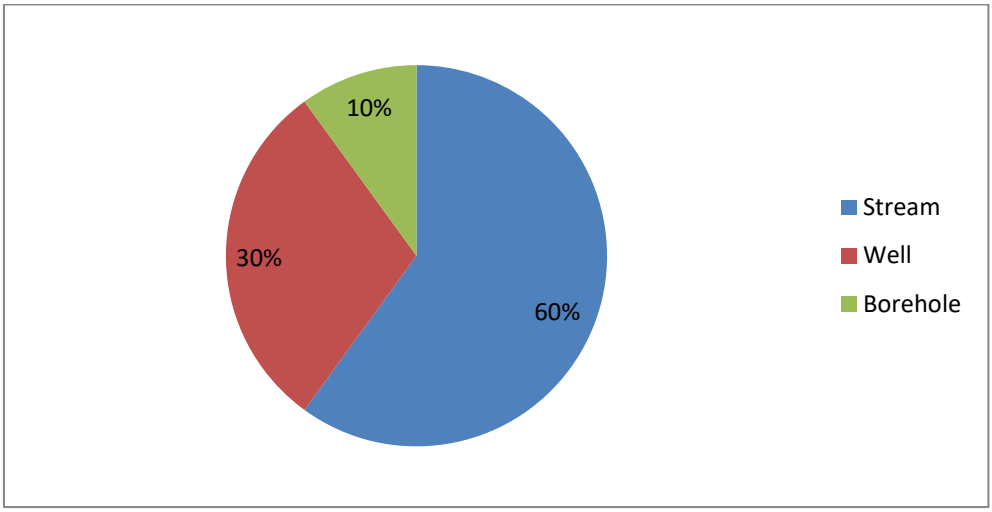

Fig. 2. Relationship between source of drinking water of the pupils and parasitic infection

Fig. 3 shows the relationship between parental occupation of school children and infection with intestinal parasites. Children whose parents were farmers accounted for (50%) of those infected, children whose parents were Traders accounted for (30%) of those infected, while children whose parents were Civil-servants accounted for 20% of those infected.

4. DISCUSSION

The study revealed the presence of *A. lumbricoides*, *E. histolytica*, *Hookworms*, *S. stercoralis*, and *Taenia* spp infections in school aged children. Hookworms and *E. histolytica* had the highest prevalences. The temperature in the tropics is known to favour the prevalence of a range of intestinal parasites and could be the reason for their presence in the study area. Seasonal variations in abiotic factors like temperature, humidity and rainfall may affect intensity of intestinal parasites [10], particularly soil transmitted helminthes [11]. Hookworms and *E. histolytica* had significantly higher prevalences than the other parasites. Although the trophozoite stage of *E. histolytica* which is used to diagnose the parasite is fragile and cannot survive outside the host for longer than 24 hours, the infective stage of the parasite which is the cyst stage can withstand desiccation. Inspite of harsh temperature, cysts may linger in the environment for months, and could be the reason for high *E. histolytica* prevalence. In addition, the cysts of *E. histolytica* can be transmitted through water and food.

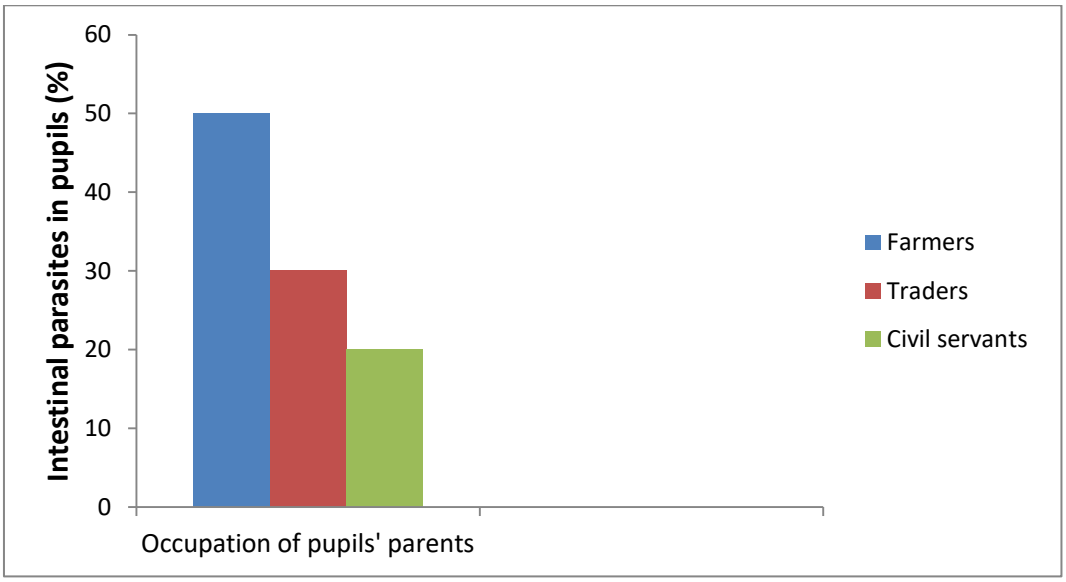

Fig. 3. Relationship between parental occupation of the pupil and parasitic infection

Hookworms are transmitted primarily by walking barefoot on soil containing parasite larvae, and by ingestion of larvae in the case of *Ancylostoma duodenale*. Multiple modes of infection could have contributed to high prevalence of hookworms in this study. In agreement with our findings, *Entamoeba histolytica* also had the highest prevalence among intestinal parasites infecting food vendors in Wolaita Sodo, Ethiopia, while tapeworms and hookworms had equal prevalences [12]. The author opined that untrimmed fingernails of researcher subjects could be contributing to high prevalence of intestinal parasites in the study. In contrast however, *E. histolytica* had second highest prevalence and *A. lumbricoides* had the highest prevalences among tuberculosis suspected patients in Gondar, Northwest Ethiopia, however, among protozoan infections, *E. histolytica* had the highest prevalence [13]. The researchers opined that unsafe water sources, economic status and environmental sanitation could be contributing to high prevalence of parasitic diseases in the study area.

Intestinal parasite prevalences were highest in children aged 5-9 years, as the children grew older (15-19 years), zero (0%) prevalences were recorded for all intestinal parasites. Children aged 5-9 may be more prone to playing with soil than other age groups and are likely to move around bare-foot thus exposing themselves to parasite infections. In addition this age group may have lower immunity than their older counterparts which may be an additional factor responsible for observed higher prevalences with intestinal parasites. Aging has an effect of immunity, and this could be a reason for variations in prevalences among different age groups with similar levels of exposure to infection [14]. In a research carried out in Ethiopia, prevalences of intestinal parasite as high 15.5%, in children under 5 years were reported; the author noted that poor hand washing habits of this age group could be responsible for the high prevalence [15]. Higher prevalence of intestinal parasites in older age groups than in younger age groups may be attributed to possible increased exposure to contaminated soil in older age groups [16].

Mixed infection (polyparasitism) was recorded among pupils examined; infection with as many as three different intestinal parasites was recorded in children. Mixed infections could be as a result of the fact that factors such as high temperature, poor sanitation and the use of unsafe water favour a range of intestinal parasites, and as such, children are exposed to infection with more than one parasite. There were three (3) groups of mixed infections, and *E. histolytica* was present in all three (3) groups of mixed infections. This could be as a result of the ability of *E. histolytica* cysts to survive harsh environmental conditions leading to a buildup of the cysts in the environment.

4.1 Toilet System

Children who defecate in the bush had highest prevalence with intestinal parasite. This could be because after defecating in the open, children

tend to wipe their anuses with leaves of plants or paper and may not wash their hand afterwards. Children who use pit toilet had the second highest prevalence of intestinal parasites, this could be because children tend to defecate on the mouth of the pit toilet which is sometimes unroofed and in bad conditions. Untidy pit toilets could attract houseflies causing spread of intestinal parasite eggs and cysts. Higher prevalence of intestinal parasite in people who practice open defecation was also reported in Benue State, Nigeria [17].

4.2 Source of Drinking Water

Infection rate relating to the source of drinking water showed that pupils that obtain their drinking water from the streams recorded the highest number of parasitic infection; this could be as a result of run off of parasite infected soil into streams during rainfall and run off water from gutters, drainages and sewages.

The ova of intestinal parasites are easily transported by water and other means thus contaminating the source of drinking water. High prevalence was reported among people using stream and well as primary source of water in Ebonyi, Abakaliki, Nigeria [18].

4.3 Parental Occupation/Socioeconomic Factors

Children are active and playful, the children of farmers in particular because of the nature of the occupation of their parents , stay for long hours on the farms with their parents, thereby making them highly prone to contact with soil contaminated with intestinal parasites.

5. CONCLUSION

Intestinal parasites are prevalent in Vandeikya LGA, Benue State. Risk factors like open defecation, use of stream and well water should be minimized in order to prevent infection.

CONSENT AND ETHICAL APPROVAL

Ethical clearance was obtained from research ethics board. Informed consent was obtained from parents and school authorities, and informed accent was obtained from research subjects.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/52961