A STUDY OF THE PREVALENCE OF GEOHELMINTHS IN SELECTED PRIVATE AND PUBLIC PRIMARY SCHOOLS IN ILARO

[*1]OLUDAYO ODUWOBI & [2]AZEEZ ADENIJI

[1, 2]Science Laboratory Technology Department,
The Federal Polytechnic, Ilaro,
Ogun State
[*]E-mail: dwheazy2012@gmail.com; 08057954550

Abstract

The incidence of geohelminthic infections, particularly among poor human populations living in low and middle-income countries, continues to be a major public health concerns. It is widely recognized that school children carry the heaviest burden of morbidity due to intestinal helminthiasis. The eggs of four different types of helminths belonging to two phyla were isolated after the microscopic examination. They include Trichuris trichiura, hookworms (Necator americanus, Acylostoma duodenale), Taenia spp. and Ascaris lumbricoides. School Model II recorded the highest numbers with 18 Trichuris trichiura's ova, 11 eggs of hookworms, 21 ova of Taenia spp. and 59 eggs of Ascaris lumbricoides. School Model III recorded the least numbers with 2 Trichuris trichiura's ova and 5 eggs of Ascaris lumbricoides. The study shows that the pupils attending those two public primary schools (School Models I and II) are likely to be more susceptible to infections from geohelminths, as evidenced by the high prevalence of helminthic eggs detected in the soil samples collected from their schools' playgrounds, than their counterparts attending those private schools. Personal hygiene and public health education should be tutored to pupils attending both public and private primary schools, with more emphasis on those attending public schools.
Keywords: *Incidence, Morbidity, Intestinal helminthiasis, Personal hygiene, Health education*

Introduction

Geohelminths (soil-transmitted helminths (STHs) are group of intestinal parasites causing human infections through contact with parasite eggs or larvae that thrive in warm and moist soil and belong to the class nematoda, which includes roundworms (*Ascaris lumbricoides*), whipworms (*Trichuris trichuira*) and two hookworms (*Ancylostoma duodenale* and *Necator americanus*) (CDC, 2013). Geohelminths infections can also be contacted by ingesting the infective stages of these parasites through contaminated and not properly washed or cooked foods (fruits, vegetables etc.), dirty hands with soil particles and penetration of exposed human skin in contact with contaminated soil (Omotola and Ofoezie, 2019). The global distribution of these intestinal parasites and the diseases they cause have been documented by many authors and the global prevalence depends not so much on the regional ecological conditions but on the standard of the social and economic development (Cheesbrough, 1992; WHO, 1998).

Globally, about 1.5 billion people (24% of the world's population) are infected with geohelminths; highest prevalence occurs in sub-Saharan Africa, the Americas, China and East Asia (WHO, 2020). Geohelminths occur in all age groups but higher prevalence occur in children (preschool-age and school-age), especially those in rural areas of sub-Saharan Africa and these children are usually found playing with soil and other objects in the environment with no or minimum supervision (Bethony, Brooker, Albinico, Geiger and Loukas, 2006; Ojurongbe, Oyesiji, Ojo, Odewale and Adefioye, 2014).

A previous yet-to-be-published study (a student's project work) focused only on some selected public primary schools in Ilaro; a prominent town in Ogun State, Nigeria, on the subject matter but there is little or no information for private primary schools. The private primary schools in Ilaro, a semi-urban area, could also be plagued with the same propensity and fate as their public primary schools' counterparts. Geohelminths are natural soil inhabitants with a beneficial ecological niche, however, some are found to be pathogenic. Children are particularly at a greater risk of helminthic infections due to their playing habits, especially with soil and poor sanitation. These predispose children especially those in rural areas to helminthic infections.

The aim of the study is to investigate the prevalence of geohelminths in some private and public primary schools in Ilaro, Ogun State, Nigeria.

Materials and methods

Sample Collection

The laboratory analysis was carried out in the Microbiology Laboratory of The Federal Polytechnic, Ilaro, Ogun State, Nigeria. The soil samples used were the sub-surface soil collected at different points from the pupils' playgrounds of decisively selected public primary schools (designated as School Model I and School Model II) and private primary schools (designated as School Model III and School Model IV) all within Ilaro town, after first formally informing the schools' respective head teachers of the purpose of the investigation and obtaining the permission to do so. The schools were purposely chosen for their perceived contingency for a high incidence of geohelminths, without being stereotypical. The soil samples were collected into separate well-labeled clean polythene bags using a hand trowel. Appropriate precautionary measures were adopted during the course of the investigation such as the use of a pair of hand gloves.

Isolation and Characterization of the Geohelminths

The soil samples were collected from the four schools at a ground depth of about 3cm using a hand trowel according to Nguyen *et al*. (2020). The samples were taken to the Microbiology Laboratory for the microscopic analysis for the detection of the ova of helminthes. At the laboratory, the samples (about 30g each) were preserved in separate well-labeled plastic containers containing 10% formalin. They were then examined using the formol-ether concentration sedimentation technique as described by W.H.O. (1991) Cheesbrough (2010) to increase the yield of helminths' eggs.

The helminthic parasites were isolated using the sieving and centrifugal floatation method. The soil sample was sieved using a fine sieve. 2g of each sieved sample was introduced into test tubes containing 3ml of 30% sodium hypochlorite solution. The solutions were vigorously shaken and 5ml of concentrated saccharin solution was added to each and centrifuged at 1500rpm for 15mins. After the centrifugation, more saccharin solution was added to raise the meniscus and float the parasites. Cover slips were carefully placed on top of each filled test tube. The cover slips were removed after 15mins and their wet surfaces were placed on the surfaces of microscope slides for microscopy (Nock *et al*., 2003).

Identification of the Geohelminths

The obtained solutions were subjected to the direct saline smear method to detect and identify helminths' eggs under x100 magnification. The eggs were observed for their sizes and shapes by using bench aids (Sepulveda and Kinsella, 2013). The slides were viewed under a microscope for the presence of helminthic parasites using x40 objective lens of a compound microscope.

Parasitic Load of the Geohelminths

The Kato-Katz quantitative technique, a commonly employed technique for human-helminth surveys, was used to accurately determine the number of eggs present in each sample (Gillespie, 2001), as recommended by the World Health Organization.

Results

Table 1: Characterization and Identification of the Helminthic Eggs

S/N	Egg Description	Probable identity	Class
1	Barrel shaped, unembryonated, bipolar plugs, smooth shell	*Trichuris trichiura*	Nematoda; Enoplea
2	Oval shaped, embryonated, six segmented embryos, thin shell, clear space between the cell and its shell	Hookworms: *Necator americanus*, *Acylostoma duodenale*	Nematoda; Chromadorea
3	Oval shaped, six refractive hooks, radially striated	*Taenia* spp. e.g. *Taenia solium*, *Taenia saginata*	Platyhelminthes; Cestoda
4	Round shaped, thick shell, external mammillated layer	*Ascaris lumbricoides*	Nematoda; Chromadorea

Table 1 shows the probable identities of the characterized eggs of the geohelminthes found in the soil samples. The eggs of four different types of helminthes belonging to two phyla were isolated after the microscopic evaluation basically for their shapes and anatomy.

As also revealed in table 1, *Trichuris trichiura* belonging to the phylum nematoda and class enoplea has ova that are barrel shaped, un-embryonated, with bipolar plugs and smooth shells. The hookworms belonging to the phylum nematoda and class chromadorea have oval shaped and embryonated eggs with six segmented embryos, thin shells and clear spaces between their cells and their shells. *Taenia* spp. belonging to the phylum platyhelminthes and class cestoda have oval shaped eggs with six refractive hooks and are radially striated while *Ascaris lumbricoides*, also belonging to the phylum nematoda and class chromadorea, has ova that are round shaped with thick shells and external mammillated layers.

Table 2: The Prevalence of the Helminthic Eggs

Helminth/Code	SM I	SM III	SM II	SM IV
Trichuris trichiura	12	2	18	7
Hookworms	8	-	11	1
***Taenia* spp.**	15	-	21	4
Ascaris lumbricoides	29	5	59	9
Total	64	7	109	21

Keys: SM I = School Model I

SM III = School Model III

SM II = School Model II

SM IV = School Model IV

Table 2 shows the prevalence of the helminthic eggs where the number ranged from 1 to 59 ova. School Model II recorded the highest numbers with 18 *Trichuris trichiura*'s ova, 11 eggs of hookworms, 21 ova of *Taenia* spp. and 59 eggs of *Ascaris lumbricoides*. This is followed by those of School Model I with 12 *Trichuris trichiura*'s ova, 8 eggs of hookworms, 15 ova of *Taenia* spp. and 29 eggs of *Ascaris lumbricoides*. School Model III recorded the least numbers with 2 *Trichuris trichiura*'s ova and 5 eggs of *Ascaris lumbricoides*. Surprisingly, there was no ovum of hookworms and *Taenia* spp. School Model IV recorded the second-to-the-last least numbers with 7 *Trichuris trichiura*'s ova, 1 egg of hookworm, 4 ova of *Taenia* spp. and 9 eggs of *Ascaris lumbricoides*. In terms of the prevalence of the helminthic eggs in the soil samples, it was observed that the two public schools that were examined had higher numbers of the helminthic eggs in their soil samples compared to that of the private schools.
Helminthic parasites were not found in the soil samples collected from both the private and public schools, perhaps, due to the fact that the playground might not have been a suitable place for *Ascaris*' eggs, *Taenia* and *Trichuris* but dunghills, being the most appropriate except for *Ancylostama* species.

Unfortunately, due to the unavailability of a photographic microscope/image-capturing microscope but a simple compound microscope, images to validate the results presented in table 1 could not be provided.

Discussion

The study shows that the all the four schools examined for the presence of soil-transmitted worms were infested with the four kinds of parasitic worm species except School Model III, which had no egg of hookworms and *Taenia* spp. in the soil sample collected from it. The high prevalence of helminthic eggs in the selected public schools, as compared to those of the private primary schools, could be attributed to the socio-cultural behaviors of the pupils of the schools which may predispose them to infections. The socio-cultural behaviours are behaviours combining social and cultural elements or values e.g. indiscriminate open defecation particularly in rural areas. Pupils could seed the soil with eggs of worms from their faeces through indiscriminate defecation in nearby bushes. Helminthic eggs in soil could facilitate their dissemination both far and wide within the school area. The high prevalence rate in School Model II as compared to School Model I may be attributed to that fact that the former has no water supply system which inevitably makes its students experience poor toilet sanitation, perhaps, it could also explain the rot odour of its soil sample. The fact that the school playground is always active for sport and other recreational activities both during and after school hours could also facilitate the high prevalence of soil-transmitted helminthes. School Model I, on the hand, has a water supply system for its school's toilets but water is only supplied in the water tank and not on a daily basis, hence, students who cannot withstand the pressure defecate indiscriminately by doing so in the bush.

The low prevalence of helminthic eggs from the playgrounds of the private primary schools could be attributed to good toilet conditions and toilet sanitation observed in the schools. The pupils also seldom play on their playground, hence, low chances of seeding helminthic eggs in the soil by the dirty and playful ones amongst them.

The result of this investigation is in agreement with Wogu *et al*. (2020) who reported statistically significant high prevalence and distribution of geohelminths among their study participants, with *Ascaris lumbricoides* also having the highest prevalence. Soil continues to be one of the most comfortable habitats for soil-transmitted helminths to thrive in, posing increased possibilities for young ones to be infected with them, who see soil or ground as the most probable place or surface to enjoy and relax themselves. This may be attributed to their playful habits, love for sports and other recreational activities poor socio-cultural behavior and poor toilet and environmental sanitation practices. Although, the rate of public health issues caused by soil-transmitted parasites has reduced over the years, yet there are still reported cases of infections of intestinal parasites globally.

Conclusion

The study shows that the pupils attending those two public primary schools are likely to be more susceptible to infections from geohelminths, as evidenced by the high prevalence of helminthic eggs detected in the soil samples collected from their schools' playgrounds, than their counterparts attending those private schools. School Model II, a public school, recorded the highest prevalence of geohelminths.

Recommendations

- Personal hygiene and public health education should be tutored to pupils attending both public and private primary schools, with more emphasis on those attending public schools.
- Children should be educated on the risk of playing with soil with bare hands both by school teachers and parents, in the school and at home respectively.
- Regular clean water and standard toilet facilities should be provided and well maintained in all public and private primary and secondary schools.

References

Bethony, J., Brooker, S., Albinico, M., Geiger, S. M. & Loukas, A. (2006). Soil transmitted helminth infections: Ascariasis, trichuriasis and hookworm. *Lancet*. **2006**; 367:1521–1532.

Centre for Disease Control and Prevention (2013). Available at http://www.cdc.gov/parasites/sth/. Accessed on January 10, 2013.

Cheesebrough, M. (1992). *Medical laboratory manual for tropical countries*. 2edUni.press Cambridge. Pg 200-357.

Cheesbrough, M. (2010). *District laboratory practice in tropical countries*. Cambridge: Cambridge University Press, Part 1, 2nd edition; 191–198.

Gillespie, S. H. (2001). *Intestinal Nematodes; In Principles and Practice of Clinical Parasitology.* Volume 21. Edited by: Gillespie, S. H., Pearson, R. D. John Willy & Sons, Ltd, New York: 562-583.

Omotola, O. A. & Ofoezie, I. E. (2019). Prevalence and intensity of soil transmitted helminthes among school children in Ifetedo, Osun State, Nigeria. *Journal of Bacteriology & Parasitology*; 10:352.

Ojurongbe, O., Oyesiji, K. F., Ojo, J. A., Odewale, G. & Adefioye, O. A. (2014). Soil transmitted helminth infections among primary school children in Ile – Ife, Southwest, Nigeria: A cross – sectional study. *International Research Journal of Medicine & Medical Science*. **2**:6–10.

Nguyen, T.B., Bach, T. K., Vo, B. H. Guy, T. Juan, J. C. & Alexis, R. (2020). Characteriation of Gastrointestinal Helminths and their Impact in Commercial Small-Scale Chicken Flocks in the Mekong Delta of Vietnam. Trop. Anim. Health Prod. 52(**1**) 53 – 62 doi:10.1007/s11250-019-01982-3

Nock, I. H. & Dauda, T. (2000). Prevalence and public health significance of parasite oocysts and ova on the sole of shoes: a case study in Zaria, Nigeria. *The Nigerian Journal of Parasitology*, **21**:137-142.

Nock, H. I., Duniya, D. & Galadima, M. (2003). Geo-helminth eggs in the soil and stool of pupils of some primary schools in Samaru, Zaria, Nigeria. *Nig. J. Parasitol*.**24**:115–22.

Sepulveda, M. S. and Kinsella, J. M. (2013). Helminth Collection and Identification from Wildlife. *J. Vis Exp*. (**82**): 5100 doi: 10.3791151000

WHO (1981). Intestinal protozoan and helminthic infections: report of a WHO Scientific Group. *WHO Tech Rep Ser*. 666.

WHO (1998). A global strategy for the control of soil-transmitted nematodes in high risk groups. *TAG Meeting*. 9th to 11th March, 1998.

WHO(2020). Soil-transmitted helminth infection. Retrieved 02 March, 2020. Available:http://www.who.int/newsroom/fact-sheets/detail/soil-transmittedhelminth-infections.

WHO (1991). *Basic laboratory methods in medical parasitology.* WHO. Geneva. Pg. 67-70.

Wogu, M. N., Onosakponome, E. O. & Harry, U. A. (2020). Prevalence of Geohelminthes among Primary School Children in Edoh Community, Esit Eket Local Government Area, Akwa Ibom State, Nigeria. *Asian Journal of Medicine and Health.* 18(**9**): 123-127.