



Distribution Pattern of Soil-transmitted Helminths and Common Practices Enhancing Transmission in Owena, Southwestern Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author OBA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors OA and TAO managed the analyses of the study. Author OA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Geohelminth infection are a major public health problem worldwide particularly in Africa. This study was carried out to investigate the distribution pattern of soil-transmitted helminths and common practices enhancing transmission in Owena, Southwestern Nigeria. Two hundred (200) soil samples were obtained from five different locations in Owena community and examined for the presence and absence of geohelminths eggs and larvae using Modified Cobbs decanting and sieving method. Different activities and practices that could enhance parasite transmission in the environment were investigated through a well-designed questionnaire. The result revealed that out of the 200 soil samples, 61% were contaminated with at least one parasite. The parasites encountered include *Ascaris lumbricoides*, *Trichiuris trichiura*, hookworms and *Strongyloides stercoralis*. Hookworm have the highest contamination prevalence of 55.8%. Furthermore, the result showed that 167 (38.5%) of the respondents does not have appropriate means of waste disposal and as such 29 (14.5%) dispose their waste in the river and 165 (82.5%) dispose their waste materials in any available site such as bushes and backyards. In the same vein only

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115 (57.5%) have toilet facilities while 82 (42.5%) does not have toilet facilities. With regard to the type of toilet used, 30 (15%) uses water closet toilet, 84 (42%) make use of pit toilet while 86 (43%) get rid of their faeces through any available mean including bushes and backyards. This result is an evidence that geohelminth is still prevalent and pose a significant health challenge to the residents of Owena community. Thus appropriate management strategy such as health education should be encouraged.

Keywords: Geohelminths; owena; soil contamination; *Ascaris lumbricoides*; hookworms.

1. INTRODUCTION

Geohelminth parasites are also known as soil-transmitted helminths and have remained a major public health problem in poor and developing countries of the world particularly in Africa [1,2]. It causes high morbidity and disability worldwide [3]. They cause significant morbidity such as malnutrition, growth retardation, anaemia, vitamin A deficiency and impaired intellectual performance in humans [4]. Geohelminths distribution does not only depend on regional environmental conditions but also on local standard or socio-economic development of the people [4]. It is reported that an estimated 1.5 million people are infected with at least one species of geohelminth worldwide [5,6]. In Nigeria, geohelminth infection is common due to suitable environmental conditions and mode of life [7,8].

In many countries worldwide, four major species of soil helminths are highly important compared to others. This is because of their widespread prevalence and distribution that result in millions of human infections. These include the large round worms (*A. lumbricoides*), whipworm (*T. trichuria*), *Strongyloides stercoralis* and hookworms which are *Necator americanus* and *Ancylostoma duodenale*. Two of these parasites namely *A. lumbricoides* and *T. trichuria* enter into the body through faecal oral route while hookworms and strongyloides enter through penetration of the skin. Studies on geohelminths are highly essential in order to enhance infection control. However, updated epidemiological data upon which control method could be based are insufficient. In view of this, this study is to investigate the distribution of Geohelminth parasites in Owena community, Ondo East Local Government area of Ondo State, Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in Ojuelegba, Igbo-epo, Ipinlerere, St. Matthew primary school and

Oke-Odo areas of Owena, Ondo East Local Government Area, Ondo State, Nigeria. It is located at 7° 11' 47.965" N of the equator and 5° 1' 6.964" E. Farmers in these locations live sparsely, cultivate their vegetables and fruits around their houses and are owners of cocoa farms and oil palm plantations. A good number of the population are also fishermen and local palm oil producers. The rainfall pattern is between 1150 mm - 2000 mm annually with a relative humidity of 78%. The annual rainfall has its peak in July; a short break occurs during the month of September, the rain comes again, which finally declines between the months of October and November each year. The average temperature of the area is 26°C during the rainy season and 32°C in the months of dry seasons (November - April). The main occupation of people of the areas is farming at subsistence level and trading. Sanitation facilities are either non-existent or grossly inadequate in the study areas. Thus, defecation on open farmlands is a popular practice. These conditions furnish predisposing factors to many parasitic and other diseases.

2.2 Sample Collections and Analysis

2.2.1 Collection of soils samples from contaminated foci

A pin quadrat was thrown at random on the vegetable gardens and shovel was used to collect 2 cm deep topsoils at 10 sampling sites in one field each month, in the amount of about 200 g each from each quadrant area. The sample collected were kept in black polythene bags and taken to laboratory. A total of 200 samples were collected in different locations. The average temperature of the soils when tested was 26°C for all the areas. The collection was done in the morning hours from 6.00 am-11.00 am, when the larvae and eggs of geohelminths are still active and fresh. These soils are mostly loamy soil, rich in organic manure or nutrients. It is predominantly a rural setting with mainly banana and plantain trees, cocoa plantation, grassy areas and houses. The humidity is always favourable with the soil full of moisture.

2.3 Questionnaire Administration

A structured questionnaire was used to obtain data on the relationship and activities of individuals with the soil. The questionnaire bothered about individual's bio-data and also asking questions on their activities on the soil such as how do you get rid of household waste, how do you get rid of the faeces (excreta), do you have plantation or garden around your house and what type of plantation. The questionnaire was administered to each individual who volunteered.

2.4 Detection of Helminthic Eggs in the Soil

The parasite eggs and larvae were detected using modified Cobb's decanting and sieving method. This method requires five buckets (white plastic buckets preferably) and three series of sieves of 1000 µm, 215 µm and 65 µm. The contaminated soil samples (100 g) of topsoils were suspended with 1-litre of water in white plastic bucket and when heavy particles have settled, the nematode suspension is poured off (decanted). Stir the remaining sediment again with water and decant the supernatant in the same plastic bowl. Repeat a third time. The sediment in the beaker can be discarded. A proper stirred mixture of suspension (supernatant) was first filtered with 1000 µm aperture into the second bucket, leaving behind heavy soil particles on the top of 1000 µm sieve. Shake the sieve, which is submerged in the suspension, to help nematodes to pass through. The debris remaining on the 1000 µm sieve can be discarded. The filtrate was then turned into another bucket through the 215 µm sieve, to obtain the residue. The residue was stained with eosin (8.0 ml) solution and filtrate of the second sieve was then turned into another bucket with the third sieve of 65µm. The filtrate of the last sieve was left overnight, so that the water could settle down, excess water was decanted out and

centrifuged. The preparations were examined or viewed under microscope for the parasites using x10 and x40 objectives. The pictures of eggs observed are shown in Fig. 1 and Fig. 2.

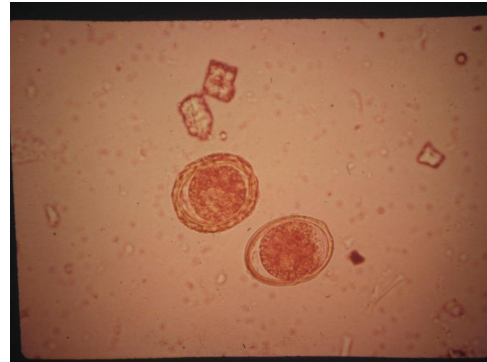


Fig. 1. Egg of *Ascaris lumbricoides* (x400) observed from samples in Owena



Fig. 2. Egg of hookworm (x400) observed from samples in Owena

3. RESULTS

Laboratory analysis was carried out on the 200 soil samples collected from different locations in Owena community and it was observed that 122(61%) of the whole samples were contaminated (Table 1).

Table 1. Geohelminths contamination of soil in different location

Location	Number of soil samples examined	Number of contaminated soil samples	% Contamination
Vegetable garden	40	36	90%
Banana plantation	40	32	80%
Cocoa Plantation	40	14	30%
Backyard	40	22	55%
Cocoyam plantation	40	18	45%
Total	200	122	61%

Fig. 3 showed that four soil helminthic parasites were encountered. These include *A. lumbricoides*, *T. trichiura*, Hookworm and *S. stercoralis*. Hookworm have the highest prevalence in the soil samples. Of all the 122(61%) contaminated samples, 139(55.8%) hookworm eggs was found compared to *A. lumbricoides* in which 76(30.5%) eggs were found, 27(10.8%) *S. stercoralis* larvae were found and also 7(2.8%) eggs of *T. trichiura* were observed to be present in the soil samples from different locations.

Analysis of questionnaires showed that 167(38.5%) of the respondents does not have dumping site while 33(16.5%) have a method of

waste disposal in which 6(3%) dispose their waste through the waste management authority, 29(14.5%) dispose their waste in the river and 165(82.5%) dispose their waste materials in any available site such as bushes and backyards (Table 2).

Furthermore, availability of toilet in the community could enhance the distribution of geohelminths in the community. The questionnaire revealed that 115 (57.5%) have toilet while 82(42.5%) does not have toilet. Also, 30 (15%) uses water closet toilet, 84(42%) make use of the pit toilet while 86 (43%) get rid of their faeces on any available site or location (Table 2).

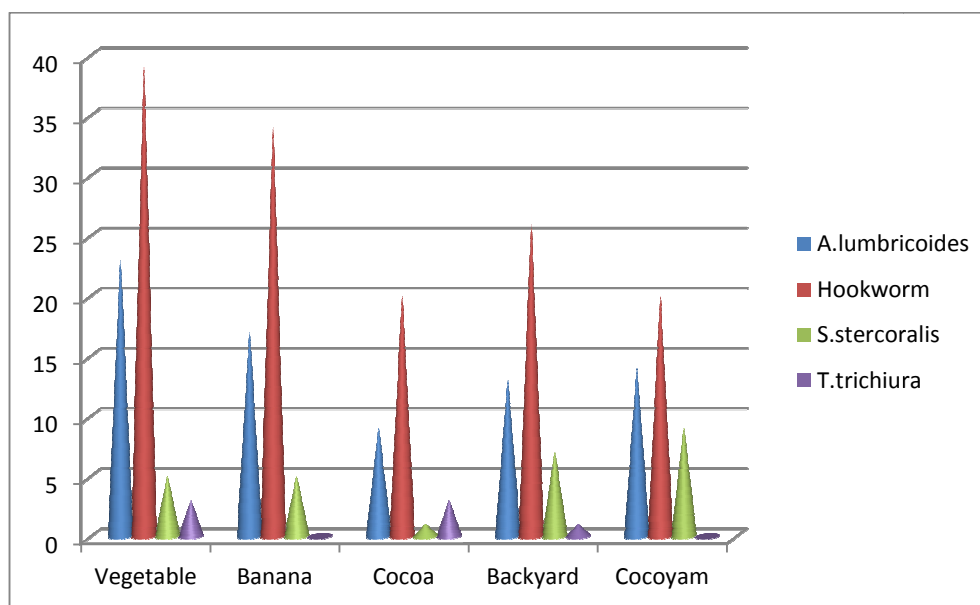


Fig. 3. A histogram showing the prevalence of geohelminthic parasites in different locations in Owena community area of Ondo State

Table 2. General method of waste disposal and ownership of toilet facilities among residents of Owena community

Parameters	Frequency (%)
Availability of dumpsite	Yes: 33 (16.5%) No: 167 (83.5%)
Method of waste disposal	Dumpsite: 165 (82.5%) River: 29 (14.5%) Waste management: 6(3%)
Availability of toilet	Yes: 115 (57.5%) No: 85 (42.5%)
Type of toilet available	Water closet: 30 (15%) Pit toilet: 84 (42%) Available site: 86 (43%)

4. DISCUSSION

This study reveals a high intensity of soil-transmitted helminths in Owena community area of Ondo State. This is quite similar to reports from other parts of the country [8]. The detection of helminthic eggs/ larvae has a significant public health implication to many who have close contact with such contaminated soil [9]. This is of great importance in health of many populations in third world countries where illiteracy, poverty and associated poor environmental sanitation practices have been implicated in the heavy burden of helminthiasis [10]. In this study, our findings revealed that only 16.5% have good waste disposal facilities and 83.5% lack waste disposal facilities among respondents in Owena community. Generally, like in other developing countries, Owena community could be faced with the dilemma of inadequate disposal of excreta-related human waste discharged into the environment. Thus, in this rural community, it has been a routine practice to defecate on open fields and farmlands thereby giving a stable soil contamination with parasite eggs and larvae throughout the year. Additionally, the soil moisture could also favour contamination of the study areas as it enhances parasites survival.

This study has shown the potential risk of contracting helminthic infection through ingestion of unwashed, raw/uncooked fruits and vegetables obtained from these farmlands [11].

It is obvious that hygienic status of individuals could influence the infection rate in area where toilet facilities are inadequate. In this area, the soil ecology was very suitable with a lot of organic matter that ensure the survival of geohelminth eggs and larvae. As long as ecological conditions are favourable in the contaminated foci, the larvae of hookworm and *S. stercoralis* remain quiescent in the moisture films of contaminated soils until contact with suitable host is made where it penetrate through the skin or remain viable on leaf surface of low growing vegetation which are common features in this study areas [12]. These environmental conditions which were observed during this study included inadequate sanitation, poor hygiene, untreated farmlands which was also noted by Adebote et al. [13] in their studies. The presence of economic trees such as plantains, bananas, raffia palms, paw-paw and local pears provide moisture and cover for defecating humans and developing larvae and eggs of geohelminths,

therefore, making such environments conducive for the transmission of geohelminths [14,15].

5. CONCLUSION

Conclusively, this study showed the various risk factors which can be responsible for the distribution of geohelminths in the soil. Cultivation of plants around households, inadequate toilet and household waste disposal facilities creates a favourable environment for better development of soil-transmitted helminths in the environment. Thus, there is need for appropriate management strategy such as deworming of children and encouraging health education on hygiene in order to reduce disease burden in this study area.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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