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# Soil Contamination as an Indicator of Geohelminthiasis in Primary Schools in Ibarapa East Local Government Area of Oyo State

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*Keywords: geohelminths, soil contamination, sanitation, antihelminthic, control.*

*GJMR-K Classification: NLMC Code: QT 162*

SOILCONTAMINATIONASANINDICATOROFGEOHELMINTHIASISINPRIMARYSCHOOLSINIBARAPAEASTLOCALGOVERNMENTAREAOFOYOSTATE

*Strictly as per the compliance and regulations of:*

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## I. Introduction

The spread of geohelminthiases is often associated with behavioral or cultural practices in endemic communities and are mostly found in impoverished rural areas in developing countries in the tropics (Hotez *et al.,* 2009). These diseases are part of the neglected tropical diseases and they continued to plague school aged pupils across the world. Ascariasis, Hookworm disease, Trichuriasis and, many others infect several million globally (Ogbe *et al.,* 2002). To curb this scourge, the Fifty-fourth World Health Assembly urged all WHO member states to ensure access to antihelminthic drugs where these diseases are endemic (WHO, 2003). Soil-transmitted parasites are the largest group of parasites that live in the soil during their development. Contamination of soil with parasite eggs, infective larvae, cysts and, oocysts is a direct risk factor and public health indicator of geohelminths (Saathoff *et al*., 2002). Risk factors and habits such as geophagia, nonuse of footwear, indiscriminate fecal and waste disposal, and improper sanitary and hygiene practices promote the spread of geohelminth infections (Saka *et al.,* 2014). These predisposing environmental factors are influenced by behavior with hygiene practices topping the list. Most public schools in rural communities in Nigeria do not adequately cater for toilet habits of the pupils, which promotes environmental contamination with parasite stages. In some instances, the toilets are either dysfunctional or non-existent, leaving the pupils to nearby bushes to defaecate when the need arises. Endemicity is a function of continuous contamination of the soil and frequent contact by new hosts (Mohaghegh *et al*., 2017). With this background, this study assessed soil contamination with geohelminth ova in primary schools in Ibarapa east local government area of Oyo state as an indicator of disease endemicity.

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## II. Materials and Methods

### a) Study Area

The study was conducted among school-aged pupils in Ibarapa East Local Government (Fig.1), Oyo State, southwestern Nigeria. Ibarapa East Local Government is located between longitudes 7°45' North and 7°25' North and latitudes 3°25' East and 3°40' East. The inhabitants are majorly farmers, while others are traders and civil servants. The area had a good number of houses without toilet facilities, making the occupants visit bushes, refuse dump and mountains to defecate. Few houses in the area had modern toilet facilities. Water was usually a problem, especially during dry season, thereby making wells and boreholes the major sources of water. Information obtained from the health department of the Local Government revealed that about 70% of the children had received antihelminthic drugs in their childhood. Most of the school children go to school barefooted.

### b) Ethical Considerations/Advocacy Visits

Advocacy visits were paid to the Local Government authority and the Heads of the schools where soil samples were collected before commencement. Since methodology did not involve any invasive method or human body samples, approval was given.

*c) Study Population and Sampling*

From the study area map, six locations were selected; the two main towns; Eruwa and Lanlate and one area each from the North, South, West, and East of the local government area namely Opo-Ogede, Agasa, Dagilegbo and Owode- Adegbola respectively. Three primary schools were selected randomly by balloting from each of the six locations. However, soil samples were collected from sixteen primary schools eventually because two Nomadic schools were not available.

*d) Sample Collection*

About 500g of soil samples at 4cm depth were collected with a hand trowel at three different spots each from the playground, classroom and toilet areas in each of the primary schools and stored in clean and well-labelled polythene bags. Samples were collected between 10:00hrs and 13:00hours. In all, a total of 144 soil samples were collected and transported to the laboratory for analysis within 48-72 hours (Nock *et al.,* 2003).

*e) Larvae Extraction*

Modified Baermann Culture Technique was used for the extraction of soil nematodes. About 20g of soil was placed at the center of a double layer disposable paper towel on the bench. A pouch was formed containing the soil sample by holding the four corners of the disposable paper towel together and wrapping it around the soil sample. Rubber band was used to close the disposable paper towel pouch, and suspended in the funnel filled with lukewarm water ensuring that the soil sample was covered. The apparatus was left to stand for about 72 hours, to allow larvae actively move out of the suspended soil samples and settled at the bottom of the funnel by gravity from where it was collected with a petri dish and was viewed under the microscope using the X10 and X 40 objective lenses to check for the presence of nematode larvae (Barker, 1985).

*f) Isolation and Concentration of Geohelminth Eggs*

The samples were analyzed using a modified Zinc Sulphate ($ZnSO_4$) floatation technique. 50 g of the soil sample was mixed thoroughly with distilled water. The suspension was strained through a sieve of 150 μm mesh size to remove coarse particles. The homogenized solution was placed into sedimentation cups, filled with water, and allowed to stand for 2 hours. After the supernatant was decanted and the sediment was re-suspended with 50 mL water, it was placed in centrifuge tubes and centrifuged at 1500 rpm for 5 min. Finally, the sediment was re-suspended in 15 mL sucrose solution (specific gravity 1.2) and poured into centrifuge tubes filled to the brim; the cover slip was superimposed and allowed to stand for a few minutes with a cover slip on the tube to collect any floating egg. The cover slip was then removed and examined under the microscope at X10 and X40 objectives (Giacometti *et al.,* 2000) and examined for the presence of parasite eggs. Slides were examined microscopically and identification was done using standard keys (CDC, 2013).

## III. Results

Of the 144 soil samples collected from various locations in the surroundings of the sixteen primary schools in the local government area, 131 (91%) were positive for ova or larvae of one or more parasites. Hookworm larvae were the most frequently encountered with an occurrence of 90.2%, *Strongyloides stercoralis* larvae (9.1%), Ascaris eggs (0.5%), Hookworm egg (0.1%) and *Trichuris trichiura* egg (0.1%). Six out of the sixteen schools had all the soil samples contaminated with different parasite stages (Table 1) thereby exposing the children to infection either on the playground, classroom or around the toilet areas. African Church Primary School, Opo-Ogede had the most contaminated soil samples with 265 (14.9%) hookworm larvae though soil samples from ADS Primary School 1, Ateo had the greatest diversity of parasite ova/larvae recovered with Hookworm larvae and egg, larvae of *Strongyloides stercoralis* and ovum of *Trichuris trichiura.* Soil samples from toilet areas were the most contaminated with parasites, n = 48 (47.2%). The least contaminated soil samples were from the playground area, n= 41 (31.3%), while the classroom area had 42 (32.1%) soil samples contaminated with parasite stages (Fig.2).

## IV. Discussion

Over a quarter of the world population stands at risk of geohelminthiasis (Jourdan et al., 2017). The estimate is not farfetched as a part of that population will derive from the African continent largely due to little or no political will towards control. The evident unavailability or dysfunctional toilet system increases the rate of environmental contamination with the ova of these parasites by the children who see no shame *per se* in defaecating in the open. The mainstay of control of geohelminthiasis and Schistosomiasis is chemotherapy (Edelduok et al., 2013; Ohiolei et al., 2017), health education and improved sanitation (WHO, 2019). The schools investigated displayed poor sanitation as soil samples from all the premises harbored one parasite stage or the other with hookworm larvae accounting for 90.2% of stages found, and seen in all soil samples across the sixteen schools.

The playground is not immuned to contamination despite being a high activity area. Even in other climes (Mohaghegh et al., 2017), such level of contamination has also been reported among school-aged pupils. The risk of contracting infection on the playground may be higher than any of the other two sampled sites. Most times, the children play here unsupervised and may engage in very physical plays which may, one way or the other, end up in geophagia. A very close practice to this is the habit of walking barefooted. Many of the children enjoyed playing on the grounds without shoes, a comfortable practice on a very contaminated surface, making it easy for hookworm infection and reinfection.

From the results, it is safe to predict that the prevalence of soil-transmitted helminthiasis in the schools will be high. Although 70% of the school pupils were acclaimed to have received antihelminthics, the degree of contamination suggests this may not have been effective. The recommended deworming regime by WHO is once a year, when baseline prevalence of soil-transmitted helminths is over 20%; and twice a year if infection in the community is over 50% (WHO, 2019). It was impossible to obtain consent for a population study as the local authorities were opposed to the collection of fecal samples despite processing ethical clearance. The cultural belief that collecting such samples from the pupils was a pointer to something diabolical was rampant among them, and these prevented getting actual data on prevalence.

The three sites from which soils were sampled in each of the schools predisposed the pupils to infection. Therefore infections could be easily contracted by contamination of hands or walking barefooted. Though the schools had toilets, with pit latrines featuring more than the water closet system, the practice of using it was not common among the pupils. Whether attitudinal or due to dysfunctional facilities, the level of soil contamination was high (91%) enough to provoke a bother about the level of transmission where there was no apparent attempt to improve on sanitation. At this present age, the use of pit latrines should at least be SanPlat in impoverished rural areas, and adequate provision and maintenance of the facilities ensured.

The call is on the concerned authorities to urgently improve on the sanitation in all primary schools to curb the rate of soil contamination and also abide by the recommended deworming regimes in endemic communities to achieve control.

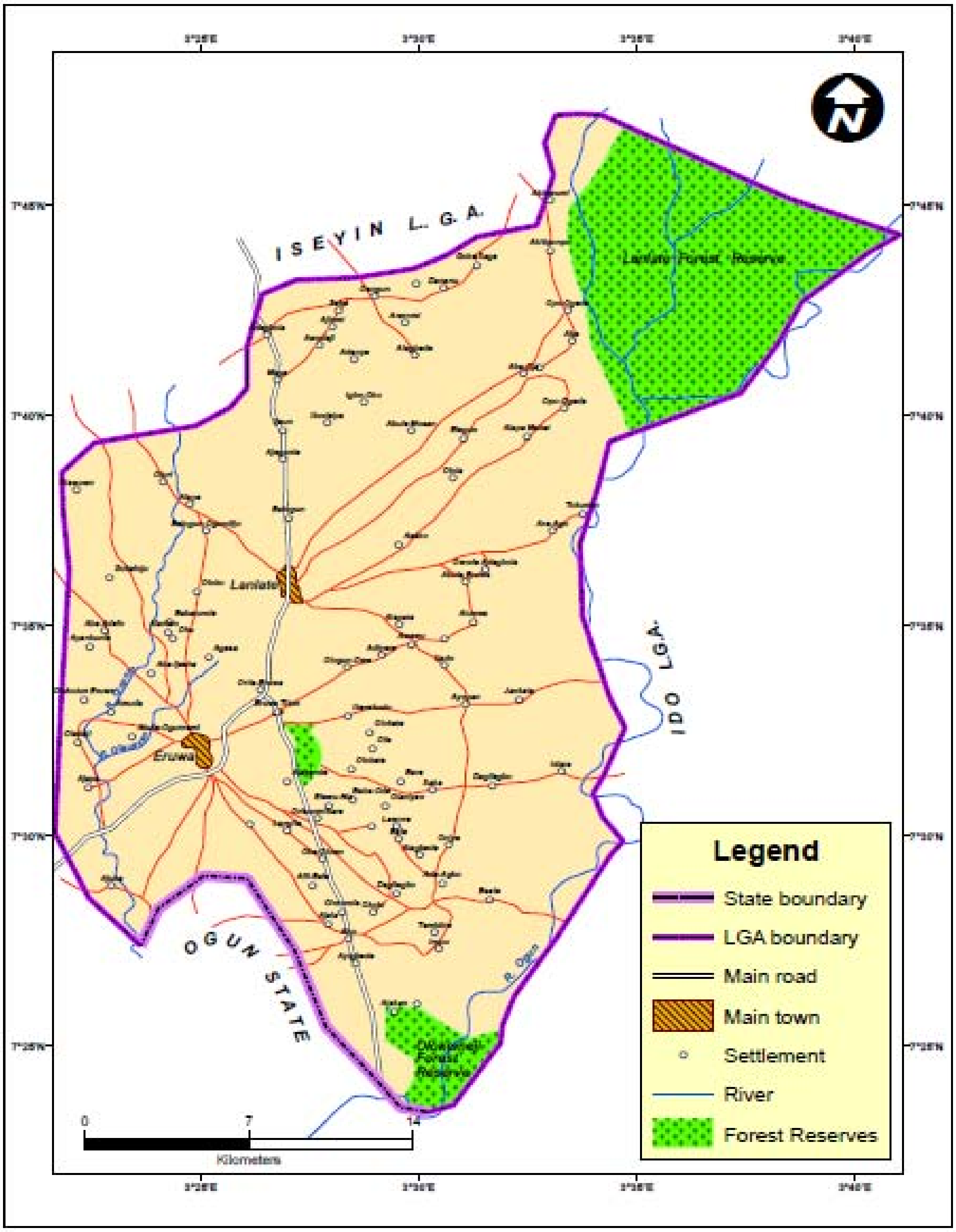


*Fig.1:* Ibarapa East Local Government, Oyo state

*Table 1:* Rate and Intensity of Soil Transmitted Parasite Stages in Soil Samples from the Sixteen Primary Schools Studied

| S/No. | SCHOOLS | No. of samples examined | No. of contaminated samples (%) | *Ascaris lumbricoides* (egg) | Hookworm (larvae) | Hookworm (egg) | *Strongyloides stecoralis* (larvae) | *Trichuris trichiura* (egg) | Total parasite count/ (%) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ISLAMIC PRIMARY SCHOOL, ABORERIN | 9 | 7 (77.8) | 0 | 70 | 0 | 29 | 0 | 99 (5.6) |
| 2 | LA PRIMARY SCHOOL 1, OKE OBA | 9 | 8 (88.9) | 0 | 105 | 0 | 19 | 0 | 124 (7.0) |
| 3 | BAPTIST PRIMARY SCHOOL, ISABA | 9 | 8 (88.9) | 0 | 95 | 0 | 17 | 0 | 112 (6.3) |
| 4 | ISLAMIC PRIMARY SCHOOL 1, AGASA | 9 | 8 (88.9) | 0 | 64 | 0 | 17 | 0 | 81 (4.5) |
| 5 | ISLAMIC PRIMARY SCHOOL 2, AGASA | 9 | 9(100) | 0 | 25 | 0 | 26 | 0 | 51 (2.9) |
| 6 | BAPTIST PRIMARY SCHOOL 1, LANLATE | 9 | 7(77.8) | 0 | 49 | 0 | 6 | 0 | 55 (3.1) |
| 7 | METHODIST PRIMARY SCHOOL, ATEO-LANLATE | 9 | 9(100) | 0 | 61 | 1 | 1 | 0 | 63 (3.5) |
| 8 | ADS PRIMARY SCHOOL 1, ATEO | 9 | 8 (88.9) | 0 | 107 | 1 | 13 | 1 | 122 (6.9) |
| 9 | NITECOM PRIMARY SCHOOL, MAYA ROAD | 9 | 8 (88.9) | 0 | 101 | 0 | 11 | 0 | 112 (6.3) |
| 10 | ISLAMIC MISSION SCHOOL, OGUNLEKE | 9 | 8 (88.9) | 0 | 96 | 0 | 7 | 0 | 103 (5.8) |
| 11 | BAPTIST PRIMARY SCHOOL, OKOLO | 9 | 9 (100) | 0 | 107 | 0 | 2 | 0 | 109 (6.1) |
| 12 | NEW COVENANT CHURCH KIDDIES ACADEMY, ABA-AYINDE | 9 | 9 (100) | 9 | 200 | 0 | 8 | 0 | 217 (12.2) |
| 13 | COMMUNITY PRIMARY SCHOOL, OWODE | 9 | 9 (100) | 0 | 75 | 0 | 0 | 0 | 75 (4.2) |
| 14 | NOMADIC SCHOOL, GAA-YUSUF | 9 | 7 (77.8) | 0 | 92 | 0 | 0 | 0 | 92 (5.2) |
| 15 | AFRICAN CHURCH PRIMARY SCHOOL, OPO-OGEDE | 9 | 8 (88.9) | 0 | 265 | 0 | 0 | 0 | 265(14.9) |
| 16 | NOMADIC SCHOOL, PANLATI | 9 | 9 (100) | 0 | 95 | 0 | 6 | 0 | 101 (5.7) |
| | TOTAL | 144 | 131 (91%) | 9 (0.5%) | 1607 (90.2%) | 2 (0.1%) | 162 (9.1%) | 1 31(0.1%) | 1781 |

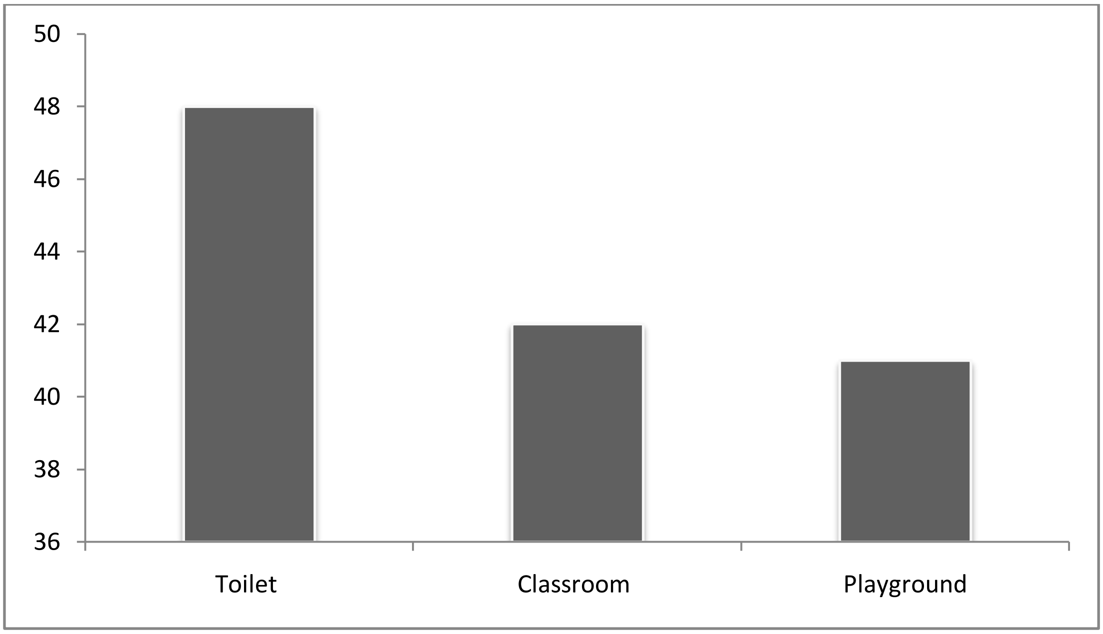


*Fig. 2:* Occurrence of eggs/larvae in soil samples with respect to sampled areas

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