

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

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7

8 **Abstract**

9 The study assessed the level of environmental contamination with ova of geohelminths in
10 primary schools in Ibarapa east local government area of Oyo state. One hundred and
11 forty-four soil samples were collected from three different spots viz toilet, classroom, and
12 playground areas in sixteen primary schools in the study area. The soil samples were analyzed
13 for the presence of helminth ova and larvae following standard procedures. 131 (91

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15 **Index terms**— geohelminths, soil contamination, sanitation, antihelminthic, control.

16 **1 Introduction**

17 The spread of geohelminthiases is often associated with behavioral or cultural practices in endemic communities
18 and are mostly found in impoverished rural areas in developing countries in the tropics (Hotez et al., 2009). These
19 diseases are part of the neglected tropical diseases and they continued to plague school aged pupils across the
20 world. Ascariasis, Hookworm disease, Trichuriasis and, many others infect several million globally (Ogbe et al.,
21 2002). To curb this scourge, the Fifty-fourth World Health Assembly urged all WHO member states to ensure
22 access to antihelminthic drugs where these diseases are endemic ??WHO, 2003). Soil-transmitted parasites are the
23 largest group of parasites that live in the soil during their development. Contamination of soil with parasite eggs,
24 infective larvae, cysts and, oocysts is a direct risk factor and public health indicator of geohelminths (Saathoff
25 et al., 2002). Risk factors and habits such as geophagia, nonuse of footwear, indiscriminate fecal and waste
26 disposal, and improper sanitary and hygiene practices promote the spread of geohelminth infections (Saka et al.,
27 2014). These predisposing environmental factors are influenced by behavior with hygiene practices topping the
28 list. Most public schools in rural communities in Nigeria do not adequately cater for toilet habits of the pupils,
29 which promotes environmental contamination with parasite stages. In some instances, the toilets are either
30 dysfunctional or non-existent, leaving the pupils to nearby bushes to defaecate when the need arises. Endemicity
31 is a function of continuous contamination of the soil and frequent contact by new hosts (Mohaghegh et al., 2017).
32 With this background, this study assessed soil contamination with geohelminth ova in primary schools in Ibarapa
33 east local government area of Oyo state as an indicator of disease endemicity.

34 **2 II.**

35 **3 Materials and Methods**

36 **4 a) Study Area**

37 The study was conducted among school-aged pupils in Ibarapa East Local Government (Fig. 1), Oyo State,
38 southwestern Nigeria. Ibarapa East Local Government is located between longitudes 7°45' North and 7°25'
39 North and latitudes 3°25' East and 3°40' East. The inhabitants are majorly farmers, while others are traders
40 and civil servants. The area had a good number of houses without toilet facilities, making the occupants visit

11 RESULTS

41 bushes, refuse dump and mountains to defecate. Few houses in the area had modern toilet facilities. Water
42 was usually a problem, especially during dry season, thereby making wells and boreholes the major sources of
43 water. Information obtained from the health department of the Local Government revealed that about 70%
44 of the children had received antihelminthic drugs in their childhood. Most of the school children go to school
45 barefooted.

46 5 b) Ethical Considerations/Advocacy Visits

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

50 6 c) Study Population and Sampling

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

56 7 d) Sample Collection

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

61 8 e) Larvae Extraction

62 Modified Baermann Culture Technique was used for the extraction of soil nematodes. About 20g of soil was
63 placed at the center of a double layer disposable paper towel on the bench. A pouch was formed containing the
64 soil sample by holding the four corners of the disposable paper towel together and wrapping it around the soil
65 sample. Rubber band was used to close the disposable paper towel pouch, and suspended in the funnel filled
66 with lukewarm water ensuring that the soil sample was covered. The apparatus was left to stand for about 72
67 hours, to allow larvae actively move out of the suspended soil samples and settled at the bottom of the funnel by
68 gravity from where it was collected with a petri dish and was viewed under the microscope using the X10 and X
69 40 objective lenses to check for the presence of nematode larvae (Barker, 1985).

70 9 f) Isolation and Concentration of Geohelminth Eggs

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

81 10 III.

82 11 Results

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

95 **12 IV.**

96 **13 Discussion**

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

105 The playground is not immuned to contamination despite being a high activity area. Even in other climes
106 (Mohaghegh et al., 2017), such level of contamination has also been reported among schoolaged pupils. The risk
107 of contracting infection on the playground may be higher than any of the other two From the results, it is safe
108 to predict that the prevalence of soil-transmitted helminthiasis in the schools will be high. Although 70% of the
109 school pupils were acclaimed to have received antihelminthics, the degree of contamination suggests this may not
110 have been effective. The recommended deworming regime by WHO is once a year, when baseline prevalence of
111 soil-transmitted helminths is over 20%; and twice a year if infection in the community is over 50% (WHO, 2019).
112 It was impossible to obtain consent for a population study as the local authorities were opposed to the collection
113 of fecal samples despite processing ethical clearance. The cultural belief that collecting such samples from the
114 pupils was a pointer to something diabolical was rampant among them, and these prevented getting actual data
115 on prevalence.

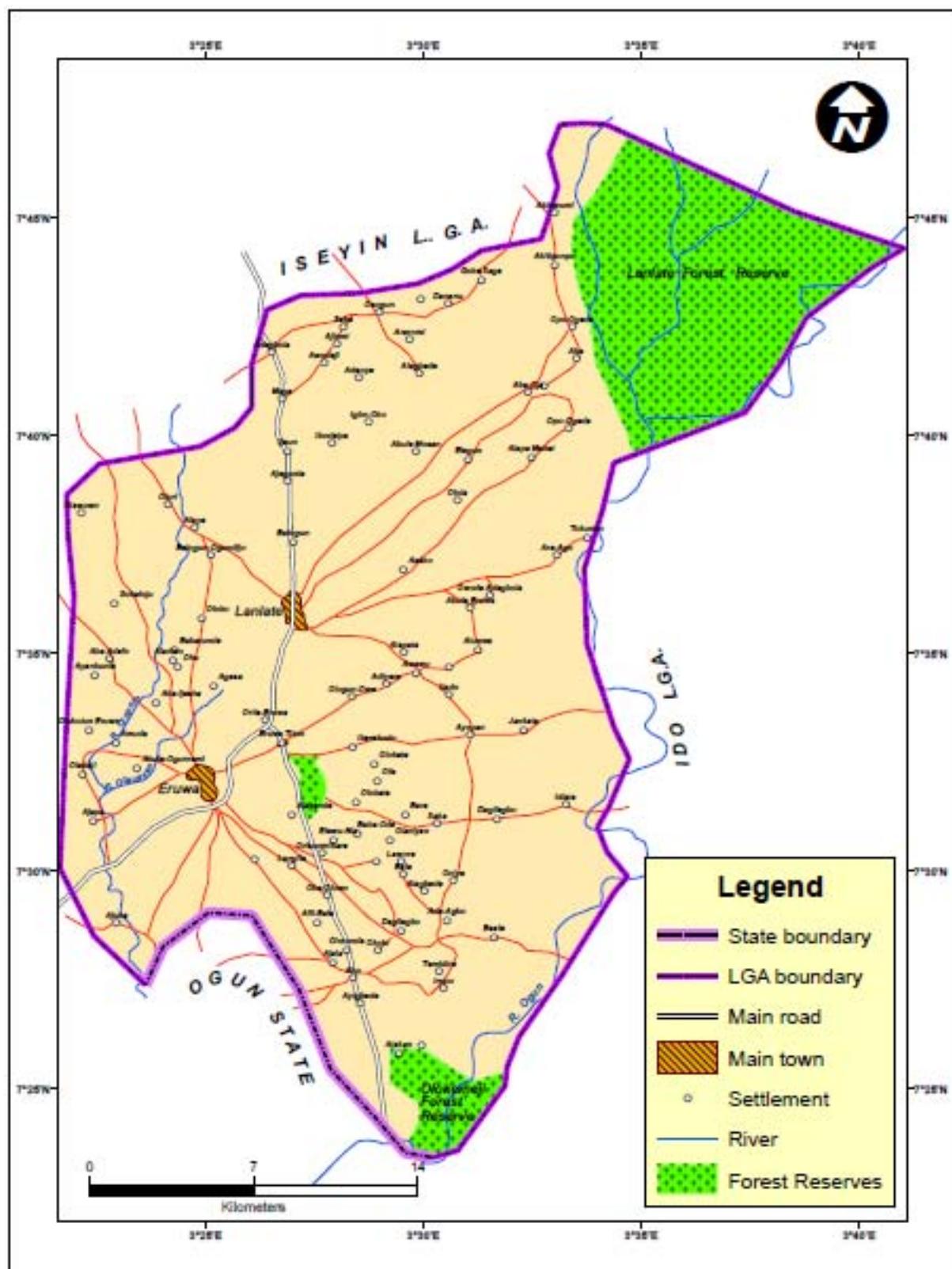
116 The three sites from which soils were sampled in each of the schools predisposed the pupils to infection.
117 Therefore infections could be easily contracted by contamination of hands or walking barefooted. Though the
118 schools had toilets, with pit latrines featuring more than the water closet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

123 The call is on the concerned authorities to urgently improve on the sanitation in all primary schools to curb
124 the rate of soil contamination and also abide by the recommended deworming regimes in endemic communities to
125 achieve control. sampled sites. Most times, the children play here unsupervised and may engage in very physical
126 plays which may, one way or the other, end up in geophagia. A very close practice to this is the habit of walking
127 barefooted. Many of the children enjoyed playing on the grounds without shoes, a comfortable practice on a very
128 contaminated surface, making it easy for hookworm infection and reinfection. ^{1 2 3}

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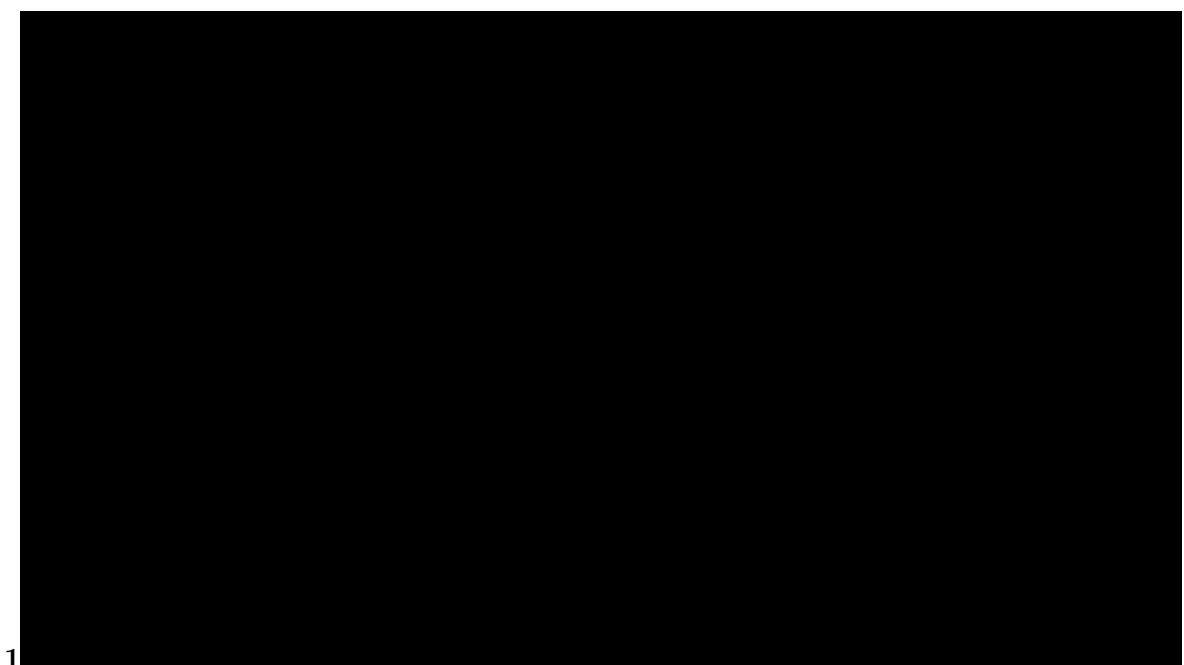


Figure 2: Table 1 :

13 DISCUSSION

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