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Evaluation of health risk in relation to geohelminths in dumpsites of Ondo Town, Nigeria

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ABSTRACT: The study evaluated the contamination level of geohelminths and the health risk in two major dumpsites at Ondo town of Ondo State. One hundred and eighty soil samples were collected from randomly selected sites through the use of quadrant between May and July, 2018 from two locations. Soil samples were analyzed for the presence of helminth ova and larvae following standard procedures. The patterns of parasite prevalence in relation to soil physiochemical parameters were determined. 168 (93.3%) soil samples were positive after analyses for different parasite stages. Epe soil recorded higher prevalence of 88 (97.8%) and the sub-soil had higher number of parasites 94 (52.2%) than the top soil 74 (41.1%). Parasite types found included hookworm (*Necator americanus*) (36.7%), *Strongyloides stercoralis* (15.6%), *Ascaris lumbricoides* (28.9%) and *Trichuris trichuria* (18.9%). The mean soil temperature and pH were 27.9 ± 0.7°C and 6.0 ± 0.5% respectively. The presence of viable soil transmitted helminths (STHs) eggs/larvae in soil suggest possible active transmission and high rate of exposure to infective agents among the inhabitants. There is a need for health education on risk associated with STH infection in the environment and public investments on sanitation that is essential to, protect individuals, control geohelminths and other sanitary related infectious diseases.

Keywords: Geohelminths; Physiochemical; Parasite; Prevalence; Soil contamination; Dumpsites; Nigeria.

1. INTRODUCTION

Soil transmitted helminthiasis are endemic worldwide. It has been described to constitute the greatest single worldwide cause of illness and disease. Poverty, illiteracy, poor hygiene, lack of access to potable water and hot and humid tropical temperature, shade, and contamination of soil with organic decomposing matter are major environmental and behavioural factors that favour the development and spread of these parasites [1]. A study revealed that *Ascaris lumbricoides* infect over one billion people, *Trichuris trichuria* infects 770 million and hookworm (*Necator americanus* and *Ancylostoma duodenale*) infects 800 million people in the world [2].

Children are at higher risk of infection than adults [3, 4]. These infections have been shown to impact negatively on the physical fitness and cognitive performance of the pupils [5]. Intestinal obstruction or rectal prolapse, granuloma, intense malnutrition, iron-deficiency, anaemia, morbidity, mortality, dysentery

syndrome, fever, dehydration, vomiting, colitis, growth retardation, vitamin A deficiency and impaired intellectual performance are the major complications associated with geohelminthic infections.

The presence of parasite eggs, infective larvae, cysts and oocysts on soils is a direct risk factor and of public health importance [6]. Endemicity of these infections is as a result of continuous contamination of the soil and regular contact by new hosts [7].

Dumpsites are land (soil) where waste are disposed uncontrolled in such a way that the environment is not protected from detrimental effects that result from these activities [8]. Municipal and Industrial solid wastes contain different potentially significant chemical constituents and pathogenic organisms that could negatively affect public health [9]. Human exposure to these polluted soils is more intense now than any other time in human existence [10]. This study is aimed at evaluating the health risk posed to the inhabitants due to the presence of geohelminths in the dumpsites.

2. MATERIALS AND METHODS

2.1. Study area

The study areas include Epe and Laje dumpsites situated in Ondo West Local Government of Ondo state. This state lies between latitude $7^0 6' 18''$N and longitude $4^0 50' 30''$E of the Greenwich meridian. The climate has the unique features of tropical wet and dry season governed by rainfall. The rainy season spans from March to November with annual rainfall and temperature of 1546 mm and 25.9ºC respectively. Ondo state has a population over 3.5 million people blessed with abundant human and natural resources [11].

2.2. Sampling locations

Epe dumpsite is geographically located on latitude $7^0 6' 42''$ N and longitude $4^0 47' 8''$ E. It is an open land along Ife road in which waste collected from various part of the town are dumped. The components of the dumpsite include metal, plastics, used papers, industrial waste, nylons, broken bottles and organic materials (food waste).

Laje dumpsite is geographically located on Latitude $7^0 4' 32''$ N and longitude $4^0 49' 2''$ E. It is an open land along Ondo State University of Medical Sciences Teaching Hospital in which waste collected from various part of the town including hospital waste are dumped. The components of the dumpsite include plastic, used paper, nylon, broken bottles, saline bags, used injection, hand gloves and bandages.

2.3. Ethical consideration/ advocacy visits

Advocacy visits were paid to the Chairman of the Waste Management Board of the Local Government to obtain permission before collection of samples.

2.4. Sample collection.

Sampling survey was conducted between May to July 2018. A total of 180 soil samples (60 soil samples for each month) were collected from all the sites. A quadrant was thrown at random on the dumpsites; hand trowel was used to collect 200 g of top-soil and 10 cm deep sub-soil samples from each quadrant twice in a month. Samples were collected between 06:00 hrs and 11:00 hrs. Each sample collected was placed in a labelled clean black polythene bags and transported to the Biology Department Federal University of Technology, Akure laboratory for analysis within 48-72 hours.

2.5. Isolation and concentration of STH eggs/larvae

Soil transmitted helminths eggs and larvae were extracted using the modified Cobb's decanting and Sieving method [12] and modified Baermann method [13]. Eggs were identified with the aid of standard guidelines [14] and Atlas of Medical helminthology and protozoology [15].

2.6. Determination of physico-chemical parameters of soil sample

Soil profile determination: particle size analysis was carried out by hydrometer method and soil temperature and pH values were obtained as described by Ogbolu et al. [16].

3. RESULTS

Out of the one hundred and eighty (180) sampled soil from the two dumpsites, one hundred and sixty-eight 168 (93.3%) soil were contaminated with geohelminths. Epe soil had higher contamination 88 (97.8%) and Laje with 80 (88.9%) geohelminths contamination. However, there was no significant difference (P>0.05) (Table 1).

Four geohelminthic parasites were found and identified; *Ascaris lumbricoides*, *Trichuris trichiura*, Hookworm and *Strongyloides stercoralis*. Hookworm had the highest prevalence of 66 (36.7%), *Ascaris lumbricoides* 52 (28.9%), *T. trichiura* eggs 34 (18.9%) and *S. stercoralis* 28 (15.6%) with the least prevalence. There was no significant difference among the geohelminths recovered. The sub-soil recorded higher number of parasites of 94 (52.2%) than the top soil 74 (41.1%) with no significant difference between the two dumpsites (P>0.05) (Table 2).

Table 1. Geohelminths contamination of soil samples in the dumpsites.

Dump-sites	Number of soil samples examined	Number of contaminated soil samples	% contaminated
Epe	90	88	97.8%
Laje	90	80	88.9%
Total	180	168	93.3%

P=0.465 (*P>0.05*).

Table 2. The prevalence of the geohelminths in soil samples from both dump-sites.

Parasites	Epe		Laje		Overall total for		Total
	Top-soil	Sub-soil	Top-soil	Sub-soil	Epe	Laje	
A. lumbricoides	20 (41.7%)	10 (18.5%)	14 (53.8%)	8 (20%)	30 (29.4%)	22 (33.3%)	52 (28.9%)
T. trichiura	6 (12.5%)	10 (18.5%)	10 (38.5%)	8 (20%)	16 (15.7%)	18 (27.3%)	34 (18.9%)
Hookworm	14 (29.2%)	24 (44%)	12 (46.2%)	16 (40%)	38 (37.3%)	28 (42.4%)	66 (36.7%)
S. stercoralis	8 (16.7%)	10 (18.5%)	2 (7.78%)	8 (20%)	18 (17.6%)	10 (15.2%)	28 (15.6%)
Total	48 (47.1%)	54 (52.9%)	26 (39.4%)	40 (60.6%)	102 (56.7%)	66 (36.7%)	180 (100%)

P =0.462 (*P>0.05*).

Table 3 shows the physico-chemical properties of Epe and Laje soil. There was significant difference (p<0.05) in physico-chemical properties recorded from the two sites. pH was higher in topsoil sample from Laje (6.06) and lower in Epe (5.89). Sand ranged from 62.08 to 69.33% and Loam ranged from 10.74 to 12.58%. Clay level was higher in Laje (25.45%) than Epe (18.63%) soil. Meanwhile, temperature of the soil in both of Epe and Laje were above room temperature (27.9ºC and 26.7ºC) respectively.

Table 3. Physicochemical properties of soil samples from the dumpsites.

		Mean ± SE	Df	t-value	p-value
pH	Epe	5.89 ±0.02	2	-4.914	0.039
	Laje	6.06 ±0.05			
Sand	Epe	69.33 ±0.88	2	6.014	0.027
	Laje	62.08 ±0.92			
Loam	Epe	10.74 ±0.64	2	-4.757	0.041
	Laje	12.58 ±0.25			
Clay	Epe	18.63 ±0.25	2	-14.071	0.005
	Laje	25.45 ±0.62			
Temperature	Epe	27.9ºC ±0.7	2	15.294	0.004
	Laje	26.7^{O}C ±1.3			

4. DISCUSSION

Soil Transmitted Helminths (STH) eggs and larvae are contaminants of soil in the developing countries [17] and their infections are transmitted through faecal-oral route. Soil is reported as the most direct indicator of risk [18]. The result of the present study showed that 93.3% of the collected soil samples were contaminated with STH eggs/ larvae. The result is similar to the other reports [18, 19], where they recorded 72% and 91% soil contamination respectively.

The trend of the relative abundance and distribution of parasites observed might have probably been due to the characteristics of the soil. It was observed that the sandy soil had the means of 69.33 ±0.88 compared to other soil types which favoured the survival of the parasites eggs and larvae as previously reported by [20]. The prevalent parasitic forms found in this study tolerates the basic soil condition; a pH of 5.89 to 6.06 and a temperature of 27.2°C which is in line to other reports that helminths eggs are very resistant in the environment and can survive in the soil for a period of three weeks and still remain infectious [21]. The temperature of the soils in the area were slightly above room temperature which is suitable for development thriving of infective stages of geohelminths. The temperature ranges agree with Amadi and Uttah [5] and Owhoeli et al. [22] who in their various findings agreed that the optimum temperature for the embryonation of soil transmitted helminthes eggs ranges from 16 ±1°C and 34 ± 1°C and as the temperature increases within this range, the development of the egg is hastened. This might be due to the effect of heat to chemical reactions occurring inside the eggs for their development.

The pH was slightly acidic tending towards the neutral point which is equally suitable for the development of the organisms. The pH ranges as observed is in line with studies which mentioned that helminth eggs are said to tolerate a large range of pH.

The recovery of geohelminths ova from refuse dumpsites revealed that human intestinal geohelminth parasites could be prevalent in the study area. The result is similar to the findings of other studies that have been reported in Nigeria by others [2, 23].

5. CONCLUSION

The widespread contamination of soil with eggs and larvae of human intestinal parasites is epidemiologically significant. Parasitic infections abound in unsanitary surroundings with constant faecal pollution of soil. This study has revealed the potential health risk of contracting intestinal helminth parasites in soil around refuse dumpsites in the study area.

Policies on the waste disposal and management should be enacted and strictly enforced by Government. Location of sanitary dumpsites should be far away from the residential areas to minimize the pollution of nearby well waters, streams and rivers should be encouraged as well as waste sorting and treatment before the disposal. Mounting public enlighten campaign on media are some of the public investments on sanitation that is essential to protect individuals, control geohelminths and other sanitary related infectious diseases.

Conflict of Interest: The author declares no conflict of interest.

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