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Prevalence of Soil -Transmitted Helminth in Three Communities of the Niger Delta Region of Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author DAG managed the literature searches, designed the study and wrote the first draft of the manuscript. Author APU performed the statistical analysis, wrote the protocol and final draft. Author HC managed the analyses of the study. All authors read and approved the final manuscript.

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ABSTRACT

Intestinal nematode parasites or soil transmitted helminths (STH) are parasitic nematodes with an essential phase of their asexual life cycle occurring in the soil, where they may persist until contact is made with a suitable host. The aim of this study was to determine the prevalence of these soil transmitted helminth parasites in selected communities (Rumuewhor, Ubimini and Elibrada) of the Niger Delta in Nigeria. 300 soil samples were collected randomly from school fields, roadsides and around residential areas in the three communities from December 2016 to May 2017. Laboratory work on collected samples was by sieving and centrifugal floatation method. Results show 56.7% of the screened samples were contaminated with ova of *Ascaris lumbricoides* and *Trichuris trichiura and* ova and larvae of hookworm (*Ancylostoma duodenale* and *Necator americanus*). *A. lumbricoides* ova was recorded in 45.16% of the samples, *T. trichiura* in 21.51% and hookworm complex in 33.33%. From the communities sampled, Rumuewhor had a prevalence of 74 %, followed by Ubimini (60%), with the least at Elibrada (40%). The prevalence by soil type was 46.24% for loamy soil, 31.18% for clayey soil and 22.58% for sandy soil, while the proportion of ova

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to larvae was 2:1. The study has highlighted the public health implications for the people who live in the communities studied and has recommended the improvement of basic environmental and sanitary conditions of the populace and the need for health education programmes.

Keywords: Soil transmitted parasites; helminths; Emohua; prevalence.

1. INTRODUCTION

Ascaris lumbricoides, Trichuris trichiura and two species of hookworm (*Ancylostoma duodenale* and *Necator americanus*) are the most common human intestinal helminth parasites that frequently co-infect the same host. In poor and developing countries of the world, intestinal helminth parasite infections have caused major public health problems constituting universal burdens [1]. Infection with an intestinal parasite does not only depend on ecological factors but also on the standard of social and economic development of the local people [2 and 3]. Intestinal helminth parasites have a direct life cycle which requires no intermediate or vector host, and an infection usually occurs through faecal pollution of soil, water and food-stuff [4, 5 and 1]. Intestinal parasites are most frequently prevalent in underdeveloped, tropical and sub-tropical regions of the world, where good sanitation and adequate water supply are lacking [6]. This implies that the prevalence of human intestinal parasites in an area is an indicator of the under development of that area. Recent updates show that infections with intestinal nematode parasites are the most prevalent human infections affecting one fourth of the world population, and are among the leading causes of disease in school-age children [7,8 and 9]. Estimates from studies suggest that *A. lumbricoides* infects over one billion people, *T. triciura* 79 million and Hookworm 740 million [9].

In the bionomics of human intestinal parasites, they do not replicate in their host, as re-infection results from contamination of soil and water with the parasites. These environments constitute the major risk factor of human exposure to the parasites in their infective life stages. This is enhanced by poor socio-economic conditions such as deficiencies in sanitary facilities, improper disposal of human excreta and illiteracy. The transmission of the parasite is possible through eating contaminated fruits, drinking contaminated water, or penetration of the larvae through the skin when individuals walk on paths contaminated with the parasite larvae [9,10 and 11]. Thus, some infections with intestinal nematode parasites are determined by behavioural - risk factors, and to some extent, climatic factors that increase the host's susceptibility to infection, survivability of the parasite and its transmission. Other researchers [2 and 12] demonstrated that soil, as the source of contamination in intestinal helminth parasite infection, is the medium for development and survival as the soil environment aids in the embryonation of the parasite and gives protection to the infective stage until contact with a suitable host is made [11]. Reported high prevalence of parasite ova in fruits and vegetable in South East Nigeria, stating that contamination of these fruits and vegetable resulted from the soil [13]. Reported high prevalence of parasites in the soil environment around Ibadan, Nigeria, stating that there was a high risk of exposure to soil-transmitted helminths, suggesting the need for apt intervention to protect the people from infection [14]. Also reported high prevalence in children whose parents were farmers and as such accompanied their parents to the farms barefooted. It has been well established that poor sanitary measures, indiscriminate disposal of faecal matter and poor personal hygiene amongst rural dwellers contribute greatly to the high prevalence of helminth parasites [15,16 and 17]. Nevertheless, it is important to know the status of each community in order to make informed decisions [2]. Stated that personal hygiene as well as differences in sanitation and socio-economic status can play a significant role in influencing local transmission of intestinal nematode parasites. The aim of this study was to evaluate the prevalence of soil transmitted helminth parasites in soil from three of the rural communities in Rivers State located in the Niger Delta of Nigeria, in a quest to assist in the surveillance and control of local parasitic infections in the area.

2. MATERIALS AND METHODS

2.1 Study Area

The present study was conducted in three (3) communities of the Niger Delta - Rumuewhor, Elibrada and Ubimini (Fig 1). The climate and the vegetation of the communities are characteristic of a tropical environment with temperatures between 22°C and 33°C (with an average temperature of 27-29°C) and two distinct seasons - the wet and the dry season. The people are predominantly farmers, with a few trading merchants and civil servants. Indiscriminate defaecation in open fields, around primary and secondary school premises, farm lands and residential areas was observed in the study areas. These conditions furnish predisposing factors to human intestinal parasites prevalence. Each community has its own Model Primary Health Centre which is fully equipped but grossly understaffed with only one or two attendants. The monthly precipitation during the study was 106.7-151.6 mm with annual rainfall of 1950.7 mm per year. The humidity was 72-84 %.

2.2 Collection of Soil Samples

Random soil samples were collected from the three communities once every month between 8 am – 11 am when the temperature of the soil environment was still suitable to accommodate the larvae and ova of parasites. Top soils were collected from a depth of approximately 2 cm from school premises, gardens, playgrounds, around homes and under economic trees with the aid of hand trowel, kept in a clean Ziploc bag, preserved by adding 10% formalin and transported to the laboratory for microscopic examination. The samples were left to dry at ambient room temperature before examination. A total of 300 (three) hundred soil samples was collected from different locations which were classified as sandy, loamy or clayey soil after soil particle analysis.

2.3 Soil Particle Analysis

Particle size analysis was by filtration method. 100 g of sample was weighed with precision balance, model number WN 3100 (minimum detection limit of 0.01 g). The samples were air dried for five days and ground using a ceramic mortar. The fractions were carefully separated into grains using filters of different diameters and weighed. Their percentage was calculated from the weight of each fraction divided by the total weighted multiplied by 100.

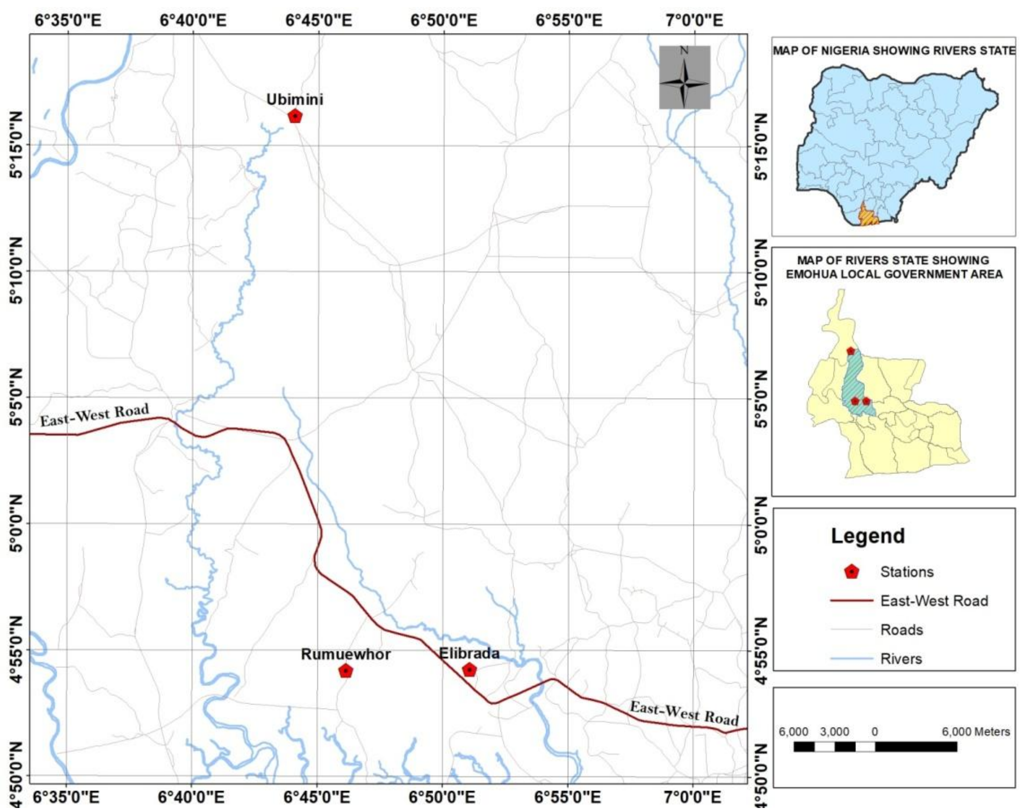

Fig. 1. Map showing study area

2.4 Sample Analysis

Parasites were detected using the sieving and centrifugal floatation methods. The soil samples were sieved using a fine sieve of 212 µm diameter. 2 grams of the sieved sample was placed into a 10 ml test tube and 3 ml of 30% sodium hypochloride solution (NaOCl) was added. After shaking vigorously, 5ml of concentrated saccharine solution was added and centrifuged at 1500 rpm for 15 minutes. After centrifuging, more saccharine solution was added to raise the meniscus and float the parasites. A cover slip was carefully placed on the top of the filled test tube for 15 minutes. After 15 minutes, the cover slip was removed and placed on a microscope slide and viewed microscopically for presence of helminth parasites using x40 objective of a compound microscope.

2.5 Statistical Analysis

Data collected was transformed to percentage frequency of occurrence. The results were tested for significance by one way ANOVA.

3. RESULTS

The result of the survey in (Table 1) showed that, out of the three hundred (300) soil samples screened, 170 (56.7%) had at least one species of parasite. The species of parasite observed in the study areas were ova of *T. trichiura* and *A. lumbricoides* and ova and larvae of hookworm complex. The result of the study revealed that soil transmitted nematode parasites were prevalent in the study areas with different contamination levels ($p < 0.05$). Rumuewhor community was the most contaminated (74%), Ubimini (60%), while the lowest was at Elibradia (40%).

The prevalence of the three types of soil nematode parasites (Table 2) was different ($p<0.05$) in the study areas, with ova of *A. lumbricoides* in 45.16% of soil samples, followed by Hookworm complex (33.33%) while the least was recorded for *T. trichiura* (21.51%). Contamination of soil with more than one parasite was observed in 45% of the samples.

Fig. 2. shows the prevalence of isolated parasites in different textural classes. Loamy soil recorded the highest prevalence of 46.24%, followed by clayey (31.18%), while sandy soil recorded the least (22.58%). However, soil type had no significant association with parasite occurrence at P = 0.989 which is > 5%. The frequency of occurrence of parasite ova and larvae in soil types (Table 3) was highest in loamy soil and was in the ratio of approximately 2:1.

4. DISCUSSION

Soil transmitted helminth (STH) parasites were found in the three communities - Rumuewhor, Elibradia, and Ubimini. This implies that intestinal helminth parasite will be prevalent in the communities and may constitute a major public health problem amongst the populace. The Rumuewhor community had a higher prevalence of soil transmitted helminth parasites than Elibradia and Ubimini, which could be attributed to better sanitary conditions of the individuals in the community, with regards to specific behaviour and practices that may influence the

Table 1. Parasite contamination of soil in the study areas

Study areas	Number of soil samples screened	Number contaminated	Percentage (%) contaminated
Rumuewhor	100	74	74.0%
Elibradia	100	40	40.0%
Ubimini	100	60	60.0%
Total=	300	170	56.7%

Table 2. Prevalence of soil transmitted helminth parasites (STP) in the study areas

Communities	No. of soil samples screened	Prevalence of parasites		Hookworm complex
		Ascaris lumbricoides	*Trichuris trichiura*	
Rumuewhor	100	19 (46.34%)	9 (21.95%)	13(31.71%)
Elibradia	100	10 (43.47%)	5 (21.74%)	8 (34.78%)
Ubimini	100	13 (44.83%)	6 (20.69%)	10 (34.48%)
Total=	300	42 (45.16%)	20 (21.51%)	31(33.33%)

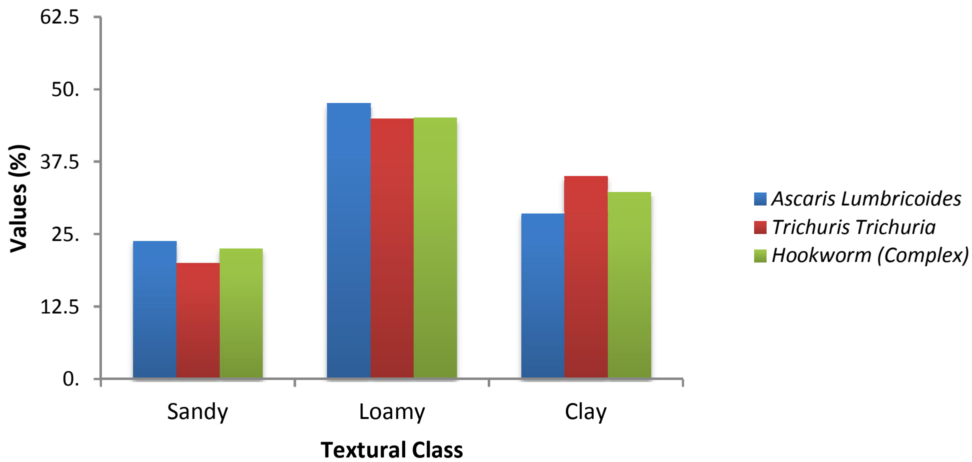

Fig. 2. Parasite prevalence based on textural class of soil

prevalence of the infection. In the entire study area, the villagers engaged in open-land defaecation system, resulting in soil contamination with helminth parasites. Thiscorroborates with [4] who also recorded helminth parasites in soil around dumpsites. The warm tropical climate of the study area supports parasite survival, spread and transmission [18, 19 and 20]. There is, therefore, a potential risk among the rural dwellers of infection with these soil transmitted helminths, especially with those whose occupations are soil-related.

Table 3. Type and frequencies of parasite recovered in soil types

Soil types	Ova (%)	Larvae (%)
Clay	20 (68.97)	9 (31.03)
Loamy	32 (74.42)	11 (25.58)
Sandy	12 (57.14)	9 (42.86)
Total	64 (68.81)	29 (31.18)

The high prevalence of *A. lumbricoides* agrees with the findings of other studies in Southern Nigeria and in the Niger Delta States [21 and 4]. [2] Stated that contamination of soil with eggs of *A. lumbricoides* may be in more than 90% of samples from the investigated areas, because *Ascaris* can survive in harsh conditions, withstand or resist chemicals and broad temperature range and several degrees of moisture, making them available for ingestion at any time by susceptible hosts. Interestingly, *T. trichiura* was unexpectedly low in spite of the similar environmental conditions for development and transmission patterns it shares with *Ascaris.* This could be as a result of the ability of *Ascaris to* resist desiccation with the presence of a lipid layer which contains ascariosides which is lacking in *Trichiura* [2 and 5].

Loamy soil is a mixture of sand, clay and a high proportion of organic matter. Organic matter prevents erosion and evaporation of soil water. It is known to increase the water holding capacity of the soil and soil rich in organic matter is a habitat of many microbes [22]. Therefore, the highest occurrence of parasites in loamy soil may be due to the suitability of the soil environment for the survival and growth of larvae and eggs. It is also possible that the soil moisture and relative atmospheric humidity provided by the humid tropical climate of the area increases the survivability of the parasites in the soil environment. This result corroborates with the findings of [23,4 and 24] on survival of parasites in soil types. In this study, clay soil also recorded a 31.8% contamination with STHs. Clay soil is believed to prevent egg dispersal by soil water due to its high water retention capacity, moderate temperature, and high cation exchange capacity [22,21]. These attributes of clay soil enable the survival of *A. lumbriciodes* and also provide a conducive environment for hatching, development and larval migration of the hookworm [12,11 and 25].

The proportion of ova to larvae was 2 : 1 in this study. The abundance of ova in a contaminated foci may be because of their protective sheath which is resistant to variations in moisture, temperature and sunlight especially in *A. lumbricoides.* It is also possible that ova can be protected in the crust of the faecal spat for a longer period than larvae. This result is consistent with those of [13,10 and 4].

5. CONCLUSION

Most of the soil samples examined in the study area were contaminated with STHs, which could be due to the unsanitary behaviour of constant faecal pollution of soil by the natives. There is therefore a need to educate the people on the implication of utilizing an open-land defaecation system and the associated risks to their health. An urgent measure to improve the sanitary health conditions could be the construction of safe, functional and accessible toilet systems. A comprehensive periodic de-worming programme may be needed to treat those already infected.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Bethony J, Brooker S, Albonico M, Geiger SM, Loukas A. Soil-transmitted helminth infections: ascarisiasis, tricuriasis and Hookworm. Lancet. 2006;367:1521-1523.
2. Amadi EC, Ebenezer A, Azuonwu O. The influence of community Ecology and behaviour on the bionomics of intestinal helminthiasis in parts of Delta, Nigeria. Nigeria Journal of Parasitology. 2010;31 (2):79-83.
3. Kitro U. Risk maps: Transmission and burden of vector born disease. Parasitol. Tod. 2000;16:324-325.
4. Chinwe NE, Owhoeli O and Omo O. Prevalence of human infecting geohelminths in soil found around refuse dumpsites in emohua local government area of Rivers State, South-South, Nigeria. Asian Journal of Biology. 2016;1(1):20.
5. Nyle CB, Ray RW. Elements of the Nature and properties of soils. (3rd edition), Prentice Hall; 2009. ISBN: 9780135014332.
6. Odikamnoro OO, Omowaye OS, Agbom MC. Soil helminthiasis on farm land in Ebonyi State, Nigeria. Universal Research Journal of Agricultural Sciences. 2013;1(5): 70-75.
7. Obiukwu MO, Onyido AE. Intestinal helminthiasis in school children (5-6years): A case study of Awka South Local Government Area, Anambra State, Nigeria. International Journal of Pharmaceutical S6ciences. 2010;2(1):69-73.
8. Nwoke EU, Ibiam GA, Odikamnoro OO, Umah OV, Ariom OT and Orji I. Examination of soil samples for the incidence of geohelminth parasites in Ebonyi North-Central area of Ebonyi State, South-east of Nigeria. Arch. Applied Science Research. 2013;5(6):41-48.
9. Oladejo SO, Nandi I, Ajibola B. Epidemiological study of tropical diseases using Geographical Information Systems (GIS) and Remote Sensing (RS). Science of African Journal. Sci. Issue, Res. Essays. 2014;2(5):238-247.
10. Amadi EC, Uttah EC. Bionomics of Geohelminth Nematodes in Contaminated Foci in parts of Abua communities, Niger Delta, Nigeria. Journal Appl. Sci. Environ. Manage. 2010;14 (2): 61-64.
11. Damen JG, Lar P, Mershak P, Mbaawuga EM, Nyary BW. A Comparative study on the prevalence of intestinal Helminths in Dewormed and Non-Dewormed students in a Rural Area of North-Central Nigeria. Journal of Medical Laboratory. 2010. 41(10): 585-589.
12. Obiukwu MO, Igbodike MC, Onyido AE. Community survey of geohelminth infection in Nnewi, Anambra State. African Journal of Science. 2009;10(1):2364-2376.
13. Hassan AA, Oyebamiji DA, Idowu OF. Spatial pattern of soil-transmitted helminthes in soil environment around Ibadan, an endemic area in South-West Nigeria. Nigeria Journal of Parasitology and Public Health Society. 2017;38(2): 179-185.
14. Mizgajska H. The Distribution and survival of eggs of Ascaris in six different natural soil profiles. Acta Parasitologia. 1993; 38:170-174.
15. Hotez PJ, Kamath A. Neglected tropical diseases in Sub-Sahara Africa: Review of their prevalence, distribution and disease burden. PLoS Neglected Tropical Disease. 2009;3:412
16. Kelechi KO, Emeka CN, Francis M, Alfreda CI, Seline O. Prevalence and pattern of soil-transmitted Helminthic infection among

primary school children in a rural community in Imo state, Nigeria. Journal of Tropical Medicine. Article ID 349439. 2015;4.
17. Ndamukong RJ, Ayuk MA, Dinga JS, Akenyi TN and Ndifordw VA. The pattern of soil transmitted nematode infections in primary school children of Kumba Health District, South-West Cameroon. African Journal of Health Science. 2000;7(3-4):103-106.
18. Saboya MI, Catala L, Ault SK, Nicholls RS. Prevalence and intensity of Infection of soil transmitted helminthes in Latin American and Carribbean Countries: Mapping at Second administration level. Pan African Health Organization; Washington DC; 2011.
19. Cromptom DW, Savioli L. Intestinal parasitic infections and urbanization. Bull WHO. 1993;71:1-7
20. Rai SK, Uga S, Ono K, Rai G, Matsumura T. Contamination of soil with helminth parasite eggs in Nepal. South East Asian Journal of Tropical Medicine and Public Health. 2000;31(3):388-39.
21. Cromptom DWT. Ascaris and ascariasis. Advances in Parasitology. 2001;48:287-375. Pub. Med.
22. WHO. First Inter-Ministerial Conference on Health and Conference in Africa: Health security through Health and Conference in Africa: Health Security through Health Environment. IMCHC/1/p8; 2008.
23. Uhuo AC, Odikamnoro OO, Aoi OC. The incidence of intestinal nematodes in Primary School in Ezzra North Local Government Area, Ebony State, Nigeria. Advances in Applied Science Research. 2011;2(5):257-262.
24. Nwaizugbo RC, Ajero CMU. Intestinal parasites in faeces deposited indiscriminately around Owerri Municipal Council of Imo State, Nigeria. Nigeria Journal of Parasitology. 2007;19: 22-26.
25. Hotez PJ, Asojo OA, Adesina AM. Ground zero for the high prevalence of helminth infections in 2010. Parasites and Vectors. 2012;5:81.

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