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Physico-chemical Parameters of Fallowing Farmland Soils as It Affects Geohelminths in Isiodu, Emohua Local Government Area, Rivers State, Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Authors IH and OO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author IH managed the analyses of the study. Author OO managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Background: This study was conducted to evaluate the physico-chemical parameters of soils in environments used for open defaecation as if affects the prevalence of geohelminthes in Isiodu Emohua, Rivers State, South South, Nigeria.

Methods: A total of 240 soil samples were collected randomly from fallowing Farmlands used for open defaecation in Isiodu Community in Emohua local Government Area, between the months of January-June 2013 and 2014 respectively. The samples were analysed for temperature, pH, organic content and Centrifugal flotation method was used to examine the samples for geohelminthes.

Results: Evaluation of the results after two variations gave an average of 74 (61.6%) of the samples as positive for geohelminthes; 22 (18.3%), 46(38.3%) and 6 (5%) for sandy, loamy and clayey soils respectively. This was statistically significant (P=.05). Physico-chemical parameters were; 27.3± 1°C, 6.1 ± .2 and 12.9 ± 3% for temperature, pH and % organic matter with eggs and larvae of

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geohelminthes recovered one hundred times; sandy: 38 (38%), Loamy: 54 (54%) and Clayey: 8 (8%). *Ascaris* spp 30 (30%), *Trichuris* spp. 16 (16%), *hookworms* 11 (11%), *Strongyloides* spp. 5 (5%), *Enterobius* spp. 2 (2%), *Trichostrongylus* spp. 2 (2%), *Meloidogyne* spp. 21 (21%), *Buracephalus* spp. 1 (1%), *Bayliascaris* spp. 3 (3%), and *Toxocara* spp. 9 (9%). **Conclusion:** Soil samples with higher physico-chemical parameters especially temperature and organic matter recorded high prevalence of the major human and plant geohelminthes in the area. Therefore direct dumping of human and other household waste to the soils at undesignated places should be discouraged.

Keywords: Isiodu; environments; geohelminths; soils.

1. INTRODUCTION

Geohelminths (soil-transmitted helminths) are a group of nematode parasites with an essential phase of their asexual lifecycle in the soil. The infections are most prevalent in tropical and sub-tropical regions of the developing world, where adequate water and sanitation are lacking [1]. A report in March 2016 by World Health Organisation indicated that more than 1.5 billion people, or 24% of the world's population, are infected with soil-transmitted helminths infections. Infections are widely distributed in tropical and subtropical areas, with the greatest numbers occurring in sub-Saharan Africa, the Americas, China and East Asia. The geohelminths together present an enormous infection burden on humanity. Helminthiasis in humans are mostly caused by; *Ascaris lumbricoides* (the large roundworm), *Trichuris trichiura* (whipworm), and the blood-feeding hookworms (*Ancylostoma duodenale* and *Necator americanus*). Helminths infections caused by soil-transmitted helminths (STHs) are among the most prevalent infections of humans who live in the developing world. The morbidity caused by STHs is most commonly associated with infections of heavy intensity. Approximately 300 million people with heavy helminths infections suffer from severe morbidity that results in more than 150,000 deaths annually [2,3]. In addition to their health effects, infections by helminths also impair physical and mental growth in childhood, thwart educational advancement, and hinder economic development. Infection thrive in communities in need of better housing, clean water, appropriate sanitation, better access to health care, education and decreased personal earnings [4]. This is typical of most rural communities and urban slums in Nigeria, where most of the inhabitants defecate in bushes and farmlands due to lack of or poor toilet facilities. Consequently, during rainfall, their feces are washed into streams and rivers which are used as a source of water for household and recreational activities [4,5].

Losses incurred by farmers as a result of infections by these helminths annually runs into billions of dollars [6]. However, many farmers, particularly in developing nations, are not aware of the existence of these nematodes, due to their usual small nature and most times losses from their nonspecific effects are misunderstood to be from other pathogenic organisms or certain environmental factors [6,7]. The infection is promoted by poor hygienic habits such as indiscriminate disposal of human and animal faeces especially in most parts of Nigeria, where large amount of human and animal waste is discharged into the soil daily leading to the seeding of the soil with pathogenic organisms including geohelminths eggs and larvae [7,8]. The processes involved in geohelminths transmission are unique, as development and survival of eggs and larval stages depend on the prevailing conditions such as soil moisture, temperature and relative atmospheric humidity [9].This study was conducted to evaluate the effects of physico-chemical parameters of soils in fallowing farmlands used for open defecation as it affects geohelminths.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in Isiodu, a town in Emohua Local Government Area of Rivers State Nigeria. It is located at 6°51′72″ North 4°53′77″ East of the Greenwich. The area lies within the tropical rain forest vegetation zone and inhabitants are mostly traders and farmers. Isiodu, Emohua features a tropical monsoon climate with lengthy and heavy rainy seasons and very short dry seasons with an average temperature range of 26ºC. Samples were collected monthly from two fallowing farmlands used for open defaecation between the months of January- June 2013 and 2014 respectively.

2.2 Ethical Clearance for the Study

Permission to conduct the study was got from the community heads. During routine visits to the community heads, the relevance of the study which was to determine the effects of soil physicochemical parameters on the prevalence and possible transmission of geohelminths in soils of environments used for open defaecation was explained. The community heads further assembled their subjects and explained same to them.

2.3 Collection of Soil Samples

Sample collections were done in the morning from between 6 am – 12 noon when the larvae of geohelminths are still active. A quadrat was thrown randomly at the defaecation sites and a sterile soil auger was used to collect 100 g of 15 cm topsoil from each quadrat point. The soil samples collected were kept in sterile black polythene bags and taken to the Animal and Environmental Biology Laboratory University of Port Harcourt, Nigeria which is about 5 kilometers away from the sites for analyses.

2.4 Examination of Soil Samples

2.4.1 Temperature

The temperature of the soils was tested with thermometer during sample collection using ClimeMET CM3011 Soil Thermometer, using a screwdriver, a pilot hole of about 5-6 inches deep was made, the thermometer was gently inserted into the hole below the soil surface and after two minutes, the thermometer was brought out and reading was recorded [9,10].

2.4.2 Soil texture

The field method of using hand was employed to determine the soil texture according to [11,12]. This was used in identifying soil textures quickly. The procedure involves determining the sand content by rubbing a small amount of soil in the palm of hand; to determine if the sand content is less than 50%, water was added to create a soil that is wet enough to roll. The soil was squeezed and rolled between the thumb and forefinger to make the longest possible ribbon. A loam soil formed only a short ribbon. Clay soils formed a much longer ribbon [11].

2.4.3 Soil pH

The reference electrode of a pocket-size pH meter was inserted into the top 1cm of the moist soil surface. The knob of the pH meter was switched on for about 30 seconds and the value of pH meter recorded. Later, the reference electrode was rinsed with distilled water that was taken to the site from the laboratory between each soil sample reading. After the reading, the knob of the pH meter was be switched off [9,10].

2.4.4 Determination of organic matter in the soil

The organic matter (carbon) was determined by ashing a 5-gram scoop of the soil sample at 360ºC for 2hours in a muffle furnace. The loss by weight of the sample during this ignition was calculated as the organic matter. Results were reported as a percentage (%) organic matter by weight in the soil [13].

2.5 Examination of Soil Samples for Eggs and Larvae of Geohelminths

2.5.1 Centrifugal flotation method

The samples were labelled and taken to the Parasitology laboratory where they were left to dry at ambient room temperature. After drying, the soil was sieved using a fine sieve (pore diameter 250 µm) in order to remove larger particles but allow small size particles including sticky helminths eggs to pass. From the sieved portion, 2 g of soil was placed into a 10 mL test tube containing 3ml of 30% sodium hypochlorite (NaOCl) solution. The tube was shaken intermittently for 1hour. Then 5ml of concentrated saccharine solution (1000 g of white sugar in 900 mL of distilled water) was added and the tubes were shaken thoroughly. The test tube was put in the centrifuge (model HW236) and set to centrifuge at 1500 rpm for 15 minutes. More sugar concentrate was added to the tube to raise the meniscus and float the eggs in order to put cover glasses on the top of the tubes and wet them by the surface of the floating solution. After allowing it to rest for 15 minutes, the cover glass was carefully removed from the top of the tubes and placed on microscope slides, the slide was examined microscopically at 40x magnification for the presence of helminths eggs/ova [7]. The eggs and larvae of human helminths were identified with reference to Atlas of Parasitology [14]. Plant nematodes were identified using atlas on the identification of plant-parasitic nematodes [15].

2.6 Data Analysis

Results obtained from the samples were entered into Ms. Excel 2007 and analyzed using standard deviation and one-way analysis of variance (ANOVA) statistical tool was used to assess significant differences in the prevalence of geohelminths. Descriptive statistics were calculated and presented in form of tables [9,16].

3. RESULTS

An average total of 120 soil samples of different textural classes were examined during the study period from the two sites for physicochemical parameters and geohelminths. Seventy-four (61.6%) of the soil samples with 27.3±1, 6.1±.2 and 12.9±3 for Temperature, pH and organic matter, were positive for geohelminths as follows; 22 (18.3%), 46 (38.3) and 6 (5%) for sandy, loamy and clayey soils respectively. Sixteen (80%) of the soil samples with 26.6±1, 6.3±.1 and 15.3±2 for Temperature, pH and organic matter were positive for geohelminths in the month of January as follows; 5 (25%), 10, (50%) and 1 (5%) for Sandy, loamy and clayey soils respectively. Twelve (60%) of the soil samples with 28.3±1, 6.3±1 and 12.6±1 for Temperature, pH and organic matter were positive for geohelminths in the month of February as follows; 4 (20%), and 8(40%) for sandy and loamy soils. No geohelminths was recovered from clayey soils. Thirteen (65%) of the soil samples with 27.3±1, 6.2±1 and 16.5±2 for Temperature, pH and organic matter were positive for geohelminths in the month of March as follows; 3 (15%), 9(45%) and 1 (5%) for sandy, loamy and clayey soils respectively. Twelve (60%) of the soil samples with 27.1±1, 5.9±.5 and 12.1±1 for Temperature, pH and organic matter were positive for geohelminths in the month of April as follows; 4 (20%), 7(35%) and 1 (5%) for sandy, loamy and clayey respectively. Nine (45%) of the soil samples with 27.6±1, 5.9±2 and 10±1 for Temperature, pH and organic matter were positive for geohelminths in the month of May as follows; 3 (15%), 5 (25%) and 1 (5) for sandy, loamy and clayey soils respectively. Twelve (60%) of the soil samples with 27.3±1, 6.1±1 and 11±1 for Temperature, pH and organic matter were positive for geohelminths in the month of June as follows; 3 (15%), 7 (35%) and 2 (10%) for clay, loamy and sandy soils respectively See Table 1.

An average total of 120 soil samples made up of sandy, loamy and clayey collected during the study period from the two sites had physicochemical parameters as follows; 27.4±.4°C, 6.0±.2 and 12.8±2 for temperature, pH and % organic matter with a total of 100 geohelminths recovered from the samples as follows; *Ascaris* spp. 30 (30%), *Trichiuris* spp. 16 (16%), hookworms 11 (11%), *Strongyloides* spp. 5 (5%), *Enterobius* spp. 2 (2%), *Trichostrongylus* spp. 2 (2%) *Meloidogyne* spp. 21 (21%), *Buracephalus* spp. 1(1%), *Bayliascaris* spp. 3 (3%), and *Toxocara* spp. 9 (9%). Physico-chemical parameters of sandy soils were 27.8°C±1, 6.0±1, and 12.6±2% for temperature, pH and % organic matter with a total of 38 (38%) geohelminths recovered as follows; *Ascaris* spp. 9 (23.7%), *Trichiuris* spp. 9 (23.7%), hookworms 4 (10.5%), *Strongyloides* spp. 2 (5.3%), *Meloidogyne* spp. 8 (21%), *Buracephalus* spp. 1(2.6%), and *Toxocara* spp. 5 (13.2%). Physico-chemical parameters of loam soils were 28±1^{0}C, 6.3±.4, and 15±1% for temperature, pH and %organic matter with a total of 54 (54%) geohelminths recovered as follows; *Ascaris lumbricoides* 18 (33.3%), *Trichiuris* spp. 5 (9.3%), hookworms 7 (13%), *Strongyloides* spp. 3 (5.5%), *Enterobius* spp 2 (3.7%), *Trichostrongylus* spp. 4 (3.7%), *Meloidogyne* spp. 11 (20.3%), *Bayliascaris* spp. 3 (5.6%), and *Toxocara* spp. 3(5.6%), while Physico-chemical parameters of clayey soils were 27±.1°C, 5.6±.1, and 11.4±2% for temperature, pH and %organic matter with a total of 8 (8%) as follows; *Ascaris lumbricoides* 3 (37.5%), *Trichiuris* spp. 2 (25%), *Meloidogyne* spp. 2 (25%), and *Toxocara* spp. 1 (12.5%) See Table 2.

An average total of 60 soil samples made up of clayey, loam and sand collected during the study period in site 1 had physico-chemical properties as follows; 27±.2°C, 6.2±1 and 12.8±2% for temperature, pH and %organic matter with a total of 47 geohelminths recovered as follows; *Ascaris* spp. 15 (31.9%), *Trichuris* spp. 7 (14.9%), hookworms 4 (8.5%), *Strongyloides* spp. 3 (6.4%), *Enterobius* spp. 2 (4.3%), *Trichostrongylus* spp. 2 (4.3%), *Meloidogyne* spp 8 (17%) and *Toxocara* spp. 6 (12.8%). Physico-chemical parameters of clayey soils were 26.8±.4°C, 6.1±1, and 11.5±2% for temperature, pH and %organic matter with 4 (8.5%) geohelminths recovered as follows; *Ascaris lumbricoides* 1 (25%), *Trichuris* spp. 1 (25), *Meloidogyne* spp. 1 (25%) and *Toxocara* spp. 1(25%). Physico-chemical parameters of loam soils were 26.9±.1°C, 6.3±.3, and 15±3 % for temperature, pH and %organic matter with 20 (42%) of the geohelminths recovered as follows; *Ascaris* spp. 7 (35%), *Trichuris* spp. 2 (10%), hookworms 1 (5%), *Strongyloides* spp. 2(10%), *Enterobius* spp. 2 (10%), *Meloidogyne* spp. 3(15%) and *Toxocara* spp. 1 (5%).While Physico-chemical parameters of sandy soils were 27.3±1°C, 6.2±1, and 12.5±3 % for temperature, pH and %organic matter with 23 (48.9%) of the geohelminths recovered as follows; *Ascaris lumbricoides* 7 (30.4%), *Trichuris* spp. 4 (17.4%), hookworms 3 (13%), *Strongyloides* spp 1 (4.3%), *Meloidogyne* spp. 4 (17.4%), and *Toxocara* spp. 4 (17.4%), See Table 3.

An average total of 60 soil samples made up of clayey, loam and sand collected during the study period in Site 2 had physico-chemical properties as follows; 27.9±1°C, 5.7±1 and 12.8±1% for temperature, pH and %organic matter with a total of 53 geohelminths recovered as follows; *Ascaris* spp. 15 (28.3%), *Trichuris* spp. 9 (17%), hookworms 7 (13.2%), *Strongyloides* spp. 2 (3.8%), *Meloidogyne* spp. 13 (24.5%), *Bayliascaris* spp 3 (5.7%) and *Toxocara* spp. 3 (5.7%) and *Buracephalus* spp. 1 (1.9%). Physico-chemical parameters of clayey soils were 27±1^{0}C, 5.1±1, and 11.3±4 % for temperature, pH and %organic matter with 4 (7.5%) of the geohelmithes recovered as follows; *Ascaris lumbricoides* 2 (50%), *Trichuris* spp. 1 (25) and *Meloidogyne* spp. 1 (25%). Physico-chemical parameters of loam soils were 28.4±1^{0}C, 6.2±.4, and 14.5±2 % for temperature, pH and %organic matter with 34 (64.2%) of the geohelminths recovered as follows; *Ascaris* spp. 11 (32.3%), *Trichuris* spp. 3 (8.8%), hookworms 6 (17.6%), *Strongyloides* spp. 1(2.9%), *Meloidogyne* spp. 8(23.5%), *Bayliascaris* spp. 3 (8.8%) and *Toxocara* spp. 2 (5.9%).While Physico-chemical parameters of sandy soils were 28.2±1^{0}C, 5.7±1, and 12.6±3 % for temperature, pH and %organic matter with 15 (28.3%) of the geohelminths were recovered as follows; *Ascaris* spp. 2 (13.3%), *Trichuris* spp. 5 (33.3%), hookworms 1 (6.6%), *Strongyloides* spp. 1 (6.6%), *Meloidogyne* spp. 4 (26.6%), *Buracephalus* spp. 1 (6.6%) and *Toxocara* spp. 1 (6.6%) See Table 4.

4. DISCUSSION

This study indicated a prevalence of (61.6%) of geohelminths in the soil samples of the study area with Loamy soil having the highest prevalence of 38.3%. Equally, a temperature of 27.3±1 C, pH of 6.1±.2 and 12.9±3 organic matter were noted. These findings agree with reports from studies by [5,7,10,17] who recorded geohelminths eggs in soils with temperature ranges from 16 ±1°C and 34 ± 1°C and as the temperature increases within this range, the development of the egg is hastened. The pH and organic contents of the samples were equally within the ranges recorded by [9,18]. The physicochemical parameters of the soils during the study were almost at the same level. The high percentage of soil samples in the study area positive for geohelminths indicates a continuous deposition of human, plant and animal wastes in the environment. The Soils in the months of January- March recorded the presence of geohelminths between 60-80% with the least prevalence of 45% occurring in the month of May. This could be attributed to more outdoor activities like farming and gathering of firewood which takes place these months and encourages open defaecation. The 38.3% of Loamy soils positive for geohelminths had a very high prevalence of 54% of the organisms while 5% clayey soils had the lowest prevalence of 8%, this could be attributed to a higher organic content of Loamy soils and its ability to retain, humus, nutrients and moisture while still allowing excess water to drain away thereby giving the geohelminths access to oxygen for survival in the soil [9,19].

Table 1. Monthly soil physico-chemical parameters as it affects prevalence of geohelminths in the soils of Isiodu

Months	Average no. soil sampled	Soil Physico-chemical parameters			% No. soil samples positive for geohelminths			% Total
		Temperature (°C)	pH	(%) organic matter	Sandy	Loam	Clay	
January	20	26.6±1	6.3±1	15.3±2	5 (25)	10 (50)	1 (5)	16 (80)
February	20	28.3±1	6.3±1	12.6±1	4 (20)	8 (40)	-	12 (60)
March	20	27.3±1	6.2±1	16.5±2	3 (15)	9 (45)	1 (5)	13 (65)
April	20	27.1±1	5.9±.5	12.1±1	4 (20)	7 (35)	1 (5)	12(60)
May	20	27.6±1	5.9±2	10±1	3 (15)	5 (25)	1 (5)	9 (45)
June	20	27.3±1	6.2±1	11±1	3 (15)	7 (35)	2 (10)	12 (60)
% Total	120	27.3±1	6.1±.2	12.9±3	22 (18.3)	46 (38.3)	6 (5)	74 (61.6)

Table 2. Prevalence of geohelminths in Relation to Physico-chemical parameters of soils in Isiodu during the study

Soil types	Soil Physico-chemical parameters			% No. Geohelminths										%Total
	Temperature (°C)	pH	(%) organic matter	*Ascaris* spp.	*Trichuris* spp.	hookworms	*Strongyloides* spp.	*Enterobius* spp.	*Trichostrogylus* spp.	*Meloidogyne* spp.	*Buracephalus* spp.	*Bayliascaris* spp.	*Toxocara* spp.	
Sand	27.8±1	6.0±1	12.6±2	9 (23.7)	9 (23.7)	4 (10.5)	2 (5.3)	0	0	8 (21)	1 (2.6)	0	5 (13.2)	38 (38)
Loam	28±1	6.3±.4	15±1	18(33.3)	5 (9.3)	7(13)	3 (5.5)	2 (3.7)	2 (3.7)	11 (20.3)	0	3 (5.6)	3 (5.6)	54 (54)
Clay	27±1	5.6±1	11.4±2	3 (37.5)	2(25)	0	0	0	0	2 (25	0	0	1 (12.5)	8 (8)
%Total	27.5 ±1	6.0±.2	12.8±2	30 (30)	16 (16)	11 (11)	5 (5)	2(2)	2 (2)	21(21)	1 (1)	3 (3)	9 (9)	100

Table 3. Prevalence of geohelminths in relation to physico-chemical parameters of soils in site 1 during the study

	Soil Physico-Chemical Parameters			(%) Types of Geohelminths Recovered								
Soil Types	Temperature (°C)	pH	(%) Organic Matter	*Ascaris* spp.	*Trichuris* spp.	hookworms	*Strongyloides* spp.	*Enterobius* spp.	*Trichosrtrogylus* spp.	*Meloidogyne* spp.	*Toxocara* spp.	(%) Total
Clay	26.8±.4	6.1±1	11.5±2	1 (25)	1(25)	0	0	0	0	1 (25)	1 (25)	4 (8.5)
Loam	26.9±.1	6.3±.3	15±3	7(35)	2(10)	1 (5)	2 (10)	2 (10)	2 (10)	3 (15)	1 (5)	20(42.6)
Sand	27.3±1	6.2±1	12.5±3	7(30.4)	4 (17.4)	3 (13)	1 (4.3)	0	0	4 (17.4)	4 (17.4)	23 (48.9)
(%)Total	27±.2	6.2±1	12.8±2	15 (31.9)	7 (14.9)	4 (8.5)	3 (6.4)	2 (4.3)	2 (4.3)	8(17)	6 (12.8)	47

Table 4. Prevalence of Geohelminths in Relation to Physico-Chemical Parameters of Soils in Site 2 during the study

	Soil Physico-Chemical Parameters			(%) Types of Geohelminths Recovered								
Soil Types	**Temperature (°C)**	**pH**	**(%) Organic Matter**	***Ascaris* spp.**	***Trichuris* spp.**	**hookworms**	***Strongyloides* spp.**	***Meloidogyne* spp.**	***Buracephalus* spp.**	***Bayliascaris* spp.**	***Toxocara* spp.**	**(%) Total**
Clay	27±1	5.1±1	11.3±4	2 (50)	1(25)	0	0	1 (25)	0	0	0	4 (7.5)
Loam	28.4±1	6.2±.4	14.5±2	11(32.3)	3(8.8)	6 (17.6)	1 (2.9)	8 (23.5)	0	3(8.8)	2(5.9)	34 (64.2)
Sand	28.2±1	5.7±1	12.6±3	2(13.3)	5(33.3)	1 (6.6)	1(6.6)	4 (26.6)	1 (6.6)	0	1 (6.6)	15(28.3)
(%)Total	27.9±1	5.7±1	12.8±1	15(28.3)	9 (17)	7(13.2)	2 (3.8)	13(24.5)	1(1.9)	3 (5.7)	3 (5.7)	53

The high prevalence of *Ascaris* spp., *Meloidogyne* spp, *Trichuris* spp. in this study may be as a result of their ability to tolerate different soil types and levels of physicochemical parameters and persist longer in the environment [7,20]. Equally, high levels of *Ancylostoma duodenale, and Toxocara* spp were recorded.

The parasites were observed 53 times in site 2 as against 47 in site 1 which could be as a result of the slight difference in temperature and pH of the sites. The same number of *Ascaris* spp. was observed in both sites while site 2 recorded higher number of *Meloidogyne* spp, *Trichuris* spp.

More organisms were recovered from sandy soils in site one while in site two loamy soils had more of the geohelminths this may be due to the observation of higher temperatures in these soils in the two sites which confirms reports by [7,10, 19] that development geohelminths stages is hastened with increase in soil temperature.

5. CONCLUSION

Soil samples with higher physicochemical parameters especially temperature and organic matter recorded high prevalence of the major human and plant geohelminths in the area. Therefore, open defaecation and direct dumping of human and other household waste to the soils at undesignated places should be discouraged.

6. RECOMMENDATIONS

Direct defaecation into soils should be discouraged.

The People should observe proper personal hygiene to reduce or eliminate the spread of *Ascaris* and *Trichuris* species whose prevalence in the soil was high.

Further studies should be carried out in the area to ascertain the level of geohelminths prevalence in the inhabitants.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. De Silva NR, Brooker S, Hotez PJ,Montressor A, Engels D, et al. Soil transmitted helminth infections: Updating the global picture. Trend Parasitol. 2003;19:547–541.
2. Crompton DWT. Hookworm disease: Current status and new directions. Parasitology Today. 1989;5:1-2.
3. Montresor A, Crompton DWT, Gyorkos TW, Savioli L. Helminth control in school-age children: A guide for managers of control programmes. Geneva: World Health Organization; 2002.
4. Omorodion OA, Nmorsi OP, Isaac C, Ogheneovo U, Oijiangbe AA. Distribution of intestinal parasites among school-age children in Delta and Edo States of Nigeria. Parasitol United J. 2012;5:1-6.
5. Eze NC, Owhoeli O, Oweh O. Prevalence of human infecting geohelminths in soil found around refuse dumpsites in Emohua Local Government Area of Rivers State, South-South, Nigeria. AJOB. 2016;1(1):1-7.
6. Nicol JM, Turner SJ, Coyne DL, et al. Current nematode threats to world agriculture. In: Genomics and Molecular Genetics of Plant–Nematode Interactions (Jones JT, Gheysen G, Fenoll C, eds), 21–44. Heidelberg: Springer; John TJ, et al; 2011.
7. Owhoeli Ovutor, Imafidor Helen, Grace DB. Awi-waadu. Assessment of Physico-chemical Parameters of Soils in Fallowing Farmlands and Pit Toilet Environments as it Affects the Abundance of Geohelminths in Emohua Local Government Area, Rivers State, Nigeria. ARRB. 2017;14(3):1-10.
8. Uhuo CA, Nwanchor K, Umene DA, Ogbanshi ME, Nwele D, Ebiam GA, Azi SO, Helminth parasites of fruits and vegetables planted in crop and landscape managent Garden College of Agricultural Sciences, Ebonyi State University abakaliki, Implication for Public Health. J. Biol., Agric. and Healthcar. 2013;3(9):9-11.
9. Owhoeli Ovutor, Imafidor Helen, Grace DB. Awi-waadu. Assessment of Physico-chemical Parameters of Soils in Fallowing Farmlands on the Abundance of Human Infecting Geohelminths in Mgbuitanwo Emohua, Rivers State, Nigeria. Journal of Advances in Biology & Biotechnology. 2017;15(3):1-8.
10. Amadi EC, Ettah EC. Impact of physicochemical factors of contaminated foci on the survival of geohelminths in Abua Communities, Niger Delta Nigeria. J.

Appl. Sci. Environ. Manage. 2010:14 (2):61-64.
11. Rowell D. Soil science. Methods and Aplication, Longman Scientific and Technical, New York; 1994.
12. McInnes KJ. Soil heat. In JH. Dane, Topp GC, editors, Methods of soil analysis. Part 4. Physical Methods, Soil Science Society of America Book Series No. 5 SSSA, Madison, WI. 2002;1183–1199.
13. Storer DA, A simple high sample volume ashing procedure for determination of soil organic matter. Comm. Soil Science and Plant Analysis. 1984;15:759-772.
14. Cheesbrough M. District laboratory Practice in tropical Countries, Part 1 (2nded). Cambridge University Press. 2005;194-202.
15. James GB, Manuel MO, Paul DL, Irma T DL. Identification of plant-parasitic nematodes. Comstock publishing associates Ithaca and London; 2011.
16. Legesse W, Gebre-Selassie *S.* Sanitary survey of residential areas using Ascaris lumbricoides ova as indicators of environmental hygiene, Jimma, Ethiopia Ethiop. J. Health Dev. 2007;21(1):18-24.
17. Otto GF. A study of the moisture requirement of the eggs of the home dog, humans and pig Ascaris. Am J Hyg. 1929;10:497-520.
18. Etewa SE, Abdel-Rahman SA, Abd El-Aal NF, Fathy GM, El-Shafey MA, Ewis AM. Geohelminths distribution as affected by soil properties, physicochemical factors and climate in Sharkyia governorate Egypt. J Parasit Dis. 2016;40:496-504.
19. Paller VG, de Chavez ER. Toxocara (Nematoda: Ascaridida) and other soil-transmitted helminth eggs conataminating soils in selected urban and rural areas in the Philippines. Scientific World Journal. 2014;2014:386232.
20. Ziegelbauer K, Speich B, Mäusezahl D, Bos R, Keiser J, Utzinger J. Effect of sanitation on soil-transmitted helminth infection: Systematic Review and Meta-Analysis. PLoS Med. 2012;9(1):e1001162.

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