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SOIL PARASITE CONTAMINATION OF PUBLIC PLACES WITHIN LOKOJA METROPOLIS, KOGI STATE

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ABSTRACT
The study which was conducted within Lokoja metropolis, aimed at assessing the rate of soil contamination of school playgrounds, markets and recreational parks with Soil Transmitted Helminths (STH). A total of one hundred and sixty soil samples were collected from eight different sites and examined for various parasite stages using Zinc Sulphate floatation technique. The overall rate of soil contamination was 50.6% and the rate of contamination with STH was higher (80%-100%) in markets situated along the river bank whereas only one third (30%) of the samples collected from Mammy market and Lugard beach had STH. The species of STH encountered in the study were: Ascaris lumbricoides, Ascaris bovis, Taenia saginata, Strongyloides sp and Fasciola sp. The most frequently occurring STH were Ascaris lumbricoides, T.saginata and Fasciola sp. Mammy market contributed to the bulk of the Fasciola sp recovered from the soil samples. However, variations in distribution of STH across sites did not statistically differ significantly (χ^2 = 159.65; P≥0.05). The findings suggest a need for a strategic intervention to improve the sanitary status of public places in the city.
Keywords: Soil contamination, STH, Niger-Benue River Valley, Lokoja, Nigeria

INTRODUCTION

Helminths are globally associated with poor sanitation particularly in impoverished communities and are among the most notable infections plaguing both humans and livestock. Several research reports have shown that anywhere there is poverty or inadequate sanitary facilities, four helminthes of notable public health importance are present in the population. These are: *Ascaris lumbricoides, Trichuris trichiuria, Ancylostoma* species *and Taenia* species (Veercruysse, *et. al.,* 2011). Schistosomiasis is also a common public health problem associated with low standard of sanitation ranks second to malaria in terms of human morbidity (Gashaw, *et.al,* 2015) but its distribution is very focal in nature.

Globally, over one billion people are estimated to be infected annually with one or more of these gastrointestinal parasites (WHO, 1998). Majority of these helminthes have been reported with high prevalence rates across Nigeria (Mohammed *et. al.*, 2011) over the years and there seem to be no reduction in the rates been reported despite control efforts. Inadequate and poor sanitary facilities have been reported to be responsible for the wide distribution of helminthic parasites especially in the tropics and subtropics (Odugbemi, *et.al,* 2015). Transmission of helminths in most communities has been alluded to poor environmental sanitation (Mohammed *et. al.*, 2016) largely due to improper disposal of faecal wastes; a condition that still prevails in most emerging urban centers as a result of constant rural-urban migration.

The study area has in recent times become home to a significant population of internally displaced persons (Ukoje, *et al.,* 2014) and had also recorded outbreaks in gastroenteritis in some parts of the state. These events could significantly influence the level of parasite soil contamination especially since sanitation and proper housing remains a problem in the state (Yaro, *et al.,* 2018) as in any other emerging city in the tropics.

The role of public places such as recreational parks, playgrounds and markets as potential reservoirs of helminth parasites have also been suggested as a key factor in the steady presence of the "big three" (Roundworms-*Ascaris* species; Hookworms-*Ancylostoma species* and Whipworms-*Trichuris trichiuria*) in the human populations (Krause *et. al.,* 2015; Adekeye *et. al.,* 2016).

This study was undertaken to determine the prevalence of helminth eggs and probably protozoal cyst and oocyst especially those which represent a risk for human health in public places and children's playgrounds.

MATERIALS AND METHODS

Study Area

The study was conducted within Lokoja metropolis, along the length of the Niger and Benue River Basin. The town is geographically located between latitude 7° 45' 27.56" - 7° 51' 04.34" N and longitude 6°41' 55.64" - 6°45' 36.58" E of the equator (Adeoye, 2012). The annual rainfall pattern is 1150mm. The annual rainfall commences in April and reaches its peak in July; a short break occurs during the month of August, then the rain comes again, but finally declines between the months of September and October each year. The average temperature of the area is 24^0C during the rainy season and 39^0 C in the months of dry seasons (November-March).

The major occupation of residents especially those along the Lower Niger River Basin is fishing and farming. Irrigated fields of vegetables and staple crops such as Maize cover the entire length of the River Basin. The town has witnessed a massive upsurge in urbanization and subsequently population growth since its creation as the headquarters of Lokoja local Government in 1976 and as state capital of Kogi State in 1991. There has been an upsurge in population growth in the town over the years and has recently had a massive influx of internally displaced persons from surrounding states from the middle belt region of the country. These events has led to acute shortage of decent accommodation for inhabitants. This could largely be responsible for the reason why substantial proportion of residents in Lokoja live in slum areas along the river valley, lacking basic sanitary facilities. Thus, defecation on open farm lands and behind dense vegetation is a popular practice and these conditions are predisposing factors to many parasitic and other diseases.

Sample collections and Laboratory analysis

Soil samples were collected between December 2015 and May 2016 from eight sites. Five of the sites were areas where intense human activities occur along the lower Niger and Benue River Basin. These were Old Market, Pata Market, Water Board Authority, Lugard Beach and Ganaja ferry site. The other sites were two primary schools; a Government owned school (Ganaja Local government Educational Area (LGEA) Primary School) and a privately owned (Faith Academy, Fentolu). The Water Board Authority also sited along the River Basin was selected because of the crucial role it plays in water supply for residents. The Lugard Beach and Ganaja ferry sites are major recreational areas in the City.

Twenty soil samples were collected from each site, giving a total of 160 soil samples for the entire study. In each collection approximately 100g was collected from 2cm ground depth using a sterile metal trowel. The collections were done in the morning hours from 6.00 am—10am, when the larvae and eggs of geo-helminths are still active. The soil samples collected were kept in plastic bags and transferred to the laboratory. Except for the samples collected from Ganaja ferry site which were sandy soil, samples from all other sites were mainly loamy.

The Zinc Sulphate Floatation Method as described by Stojčević *et al.,* 2010 with a little modification was used to recover parasites. Twenty (20) /grams of the soil sample was mixed thoroughly with distilled water and sieved using a net mesh to remove larger coarse particles. The filtrate was centrifuged at 1500 rpm for 2 minutes and Zinc Sulphate solution (specific gravity 1.18) was added to the resultant sediment. The mixture was allowed to stand for 3 minutes with a cover slip on the tube to collect any floating cyst or egg. The cover slip was then removed and place on a slide a drop of iodine solution and examined under a microscope at x10 and x40 objectives. Parasites were identified with the aid of standard guidelines (Cheesbrough, M., 2000; Chiodini *et al*., 2003). Any ova, cyst or larvae found were counted and recorded.

Statistical analysis

Data was entered and checked for entry errors using statistical analysis. This was performed using SPSS software version 21 for windows (SPSS Inc., Chicago, IL, USA). Simple proportions, means and standard deviation were performed on the cleaned data. The rate of soil sample contamination was determined using the following formula: r= Number of soil examined x100
Total samples

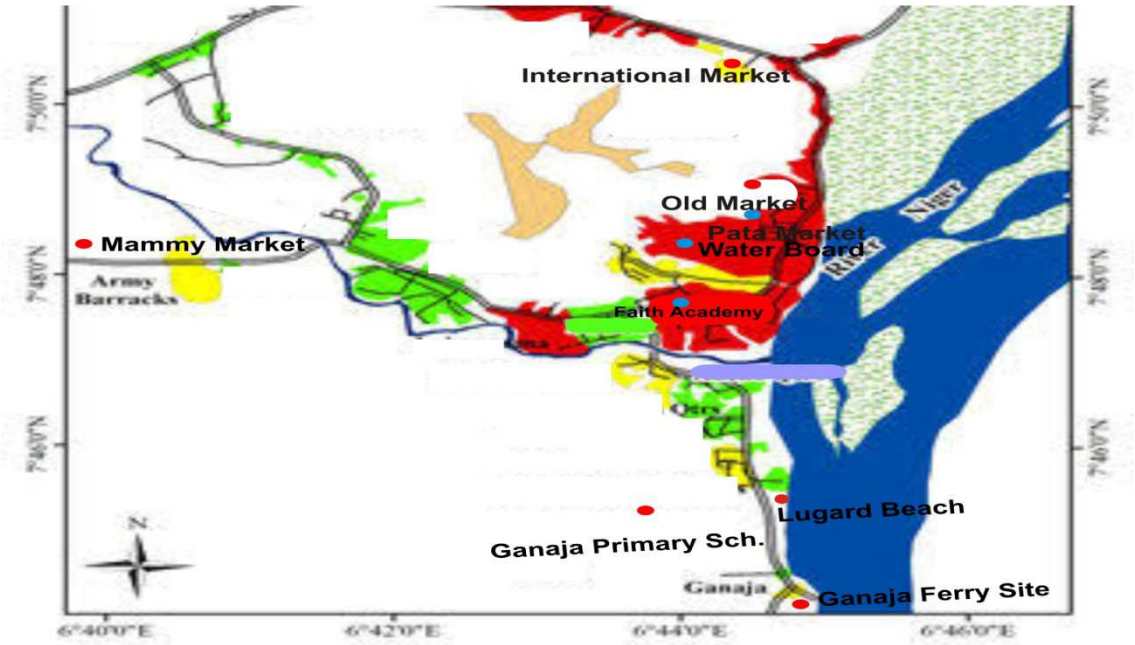

Figure 1: Map of Lokoja showing the soil sampling sites

Source: Adopted and Modified from Lokoja Topographic Map, Sheet 247, 2008

Legend

Sampling sites

River

RESULTS

Out of 160 soil samples collected, 81(50.63%) had at least one helminth specie (Table 1). The soil samples collected from the markets were the most contaminated (26.25%) with parasite as observed in Table 1. All the soil samples collected from Pata market had at least one specie or more species of parasites followed by old market where 80% of the soil samples had parasites. Soil samples collected from Ganaja ferry landing, a recreational site, had the least soil parasite 5 (3.125) contamination (25%). Half of the samples collected from the Ganaja LGEA Primary school, a public school were contaminated with soil transmitted helminth (STH) and likewise the Water Board area.

Seven helminth species were encountered during the entire study [Figure 2]. One third of the positive soil samples examined contained *A. lumbricoides* [31.8%]. It was also the only parasite recorded in Faith Academy [Table 2]. The roundworm was the most frequently observed soil parasite in all the sampling sites and Ganaja ferry site [Table 2]. Strongyloides was only recorded in nine soil samples and four [44.4%] of the soil samples were collected from Old market while *T.trichiuria* was encountered only in Pata market [75%] and Water Board area (25%) [Table 2]. *Taenia sp* (15.0%) and *Fasciola* species (12.5%) closely followed the roundworms in frequency of occurrence in soil samples. *Fasciola species* was most commonly observed in soil samples collected from mammy market.

Table 1: Frequency of soil parasite contamination across sites

Site	Number of samples	Number of positive samples (%)	Total number of eggs	Mean (S.D)
Recreational centers				
Ganaja Ferry	**20**	5(3.125)	44	8.8 ±1.48
Lugard Beach	**20**	6(3.75)	43	8.6±2.40
Markets				
Pata market	**20**	20(12.50)	114	22.8±3.42
Old market	**20**	16(10.00)	86	17.20±3.27
Mammy market	**20**	6(3.75)	52	10.40±1.67
Schools				
Faith Academy	**20**	8(5.00)	32	6.40±2.88
Ganaja LGEA Primary school	**20**	10(6.25)	53	10.60±2.30
*Water Board	**20**	10(6.25)	105	21.0±2.54
Total	**160**	**81(50.63)**	**529**	**66.12±28.95**

Table2: Prevalence of parasites from source of soil sample

Parasite Type	Samples with parasite (%)								Total. N=160
	Ganaja Ferry Site	Lugard Beach	Pata Market	Old market	Mammy Market	Faith Academy	Ganaja Primary School	Water Board	Number of samples positive (%)
A.lumbricoides	2(3.9)	3(5.9)	1 1(21.6)	13 (25.5)	4(7.8)	5 (9.8)	8(15.7)	5(9.8)	51
A.bovis	3(13.6)	2(9.1)	8(36.4	2(9.1)	0	0	4(18.2)	3(13.6)	22
Taenia sp	7(29.2)	1(4.2)	5(20.8)	8(33.3)	0	0	3(12.5)	0	24
T.trichiuria	0	0	6(75)	0	0	0	0	2(25)	8
Strongyloides sp	0	0	3(33.3)	4(44.4)	1(11.1)	0	0	1(11.1)	9
Fasciola Sp	3(15.0)	4(20.0)	2(10.0)	2(10.0)	5(25)	0	3(15.0)	1(5.0)	20

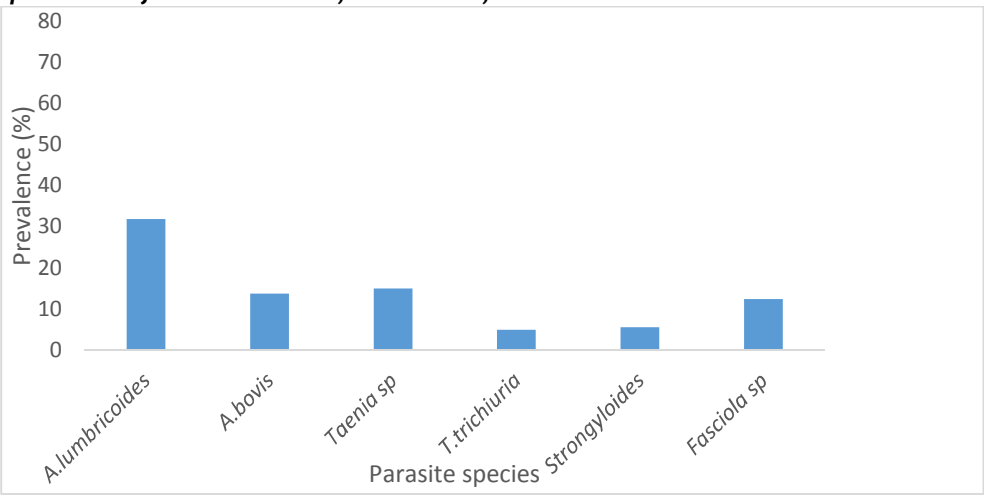

Figure 2: Distribution of Parasite Species in Soil Samples of public places within lokoja metropolis, Kogi State.

DISCUSSION

Soil contamination with nematodes is the most direct indicator of risk for soil transmitted helminths. The overall contamination rate of soil samples (50.63%) in the present study is indicative of the public health risk posed by STH in the study area. This is lower than rates reported by Hassan *et al.*, 2017 where a 67% contamination rate was obtained in Ibadan, Southwest Nigeria and Mohammed *et al.*, (2011) who estimated of 68.1% in Abuja.

The high level of soil contamination of especially Pata and Old markets in this study portrays considerable risks to individuals who live and work in these areas. Both markets are situated along the river bank with people constantly ferrying goods back and forth the market and surrounding communities. These goods most often are perishable items such as vegetables and fruits which are often consumed raw. Vegetable farmers ferrying in goods to the markets habitually lay off load their produce from the shanty canoes to the bare soil at the river bank and engage in wholesale transactions to vegetable traders. Several studies have reported the potential of these raw vegetables in transmission of intestinal parasites to human populations (Mohamed *et. al.*, 2016; Simone-Oke, 2014; Idahosa, 2011).

The presence of *Ascaris lumbricoides* in all the sampling sites and selective prevalence of the animal forms (*A. bovis* and *A. caninum*) only further confirms the role of indiscriminate disposal of human animal wastes in the transmission of STH infections. Except for the Faith Academy and the Water Board authority which had toilets all other sampling sites had no toilets. The location of the water Board is at the lower part of the River bank where run offs from Old and Pata markets can easily contaminate the soil and even unground water in the Water Board area. The unavailability of toilets in other sampling sites could have encouraged indiscriminate defecation which most likely contaminated the environments. Furthermore the banks of the River valley where the markets (Old and Pata markets), Water Board and recreational sites are located are evergreen with lush grass all year around; attracting herds of cattle and hence the high presence of *A. bovis* and *Fasciola* sp in these sites. However, all of these variations in rate of soil contamination across sites did not statistically differ significantly (χ^2 = 159.65; $P \geq 0.05$).

CONCLUSION

The present study shows that the presence of *Ascaris* species both human and bovine forms and *Taenia* sp. was highest followed by *Strongyloides*. *Trichuris* was the least. This pattern is not is slightly different from earlier reports of high *Ascaris* prevalence followed by *Trichuris* and hookworm and *Strongyloides* (Badaki, *et al.*, 2005; Ogbolu *et al.*, 2011; Nwoke *et al.* 2013; Shitta *et al.*, 2017). A strategic environmental sanitation programme focusing on public places and incorporating health education in the study area is pertinent to improving sanitary status of the city.

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