DISTRIBUTION OF HELMINTH EGGS ISOLATED FROM SOIL IN BARKIN LADI MARKET, BARKIN LADI LOCAL GOVERNMENT AREA, PLATEAU STATE

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Abstract

Soil Transmitted Infections (STIs) are caused by Soil Transmitted Helminths (STH) which are very common in developing countries such as Nigeria. These infections are referred to as Neglected Tropical Diseases which are important public health problems. Twenty five (25) soil samples were collected from five different sites of Barkin Ladi market between January and February 2022. Flotation and sedimentation methods were used for the sample analysis. Eggs of 3 helminths were identified namely *Ascaris lumbricoides, Ancylostoma duodenale* and *Trichuris trichiura*. The highest in o;inkj j mn kj k ,m nm., n, occurrence was *Ascaris lumbriocoides* (38.10%) followed by *Ancylostoma duodenale* (33.33%). The lowest was *Trichuris trichiura* (28.57%). Out of the 25 soil samples examined 20 (80%) were positive for eggs of helminths. The site from which the highest helminth egg occurrence was observed was around the refuse dump site followed by the area where vegetables are sold (23.81%). The site of lowest helminth egg occurrence (9.52%) was where meat is sold. It is important to employ measures that will reduce transmission of these helminth eggs to humans such as avoiding keeping of farm produce especially vegetables on the bare floor as well as thorough washing of fresh fruits and vegetables with salt and running water before consumption.

Keywords: Eggs, Barkin Ladi, Contamination, Helminth eggs, Sanitation, Soil.

Introduction

According to Gilles, Cook and Zumla (2003), soil transmitted helminthes (STH) also known as geohelminthes are intestinal worms infecting humans and are transmitted through contaminated soil. The World Health Organization (WHO, 2013) stated that the main soil that transmitted helminthiasis include infections with roundworm (*Ascaris lumbricoides*) hookworms *(Ancylostoma duodenale* and *Necator americanus*) and whip worm (*Trichuris trichiura*). In addition, Imalele, Offiong, Ukam, Urimaneh and Utibe (2021) stated that soil-transmitted helminths are found worldwide with a public health concern to both man and animals. Paller and Chavez (2014) also stated that soil is a potential source of human diseases caused by numerous soil transmitted helminth parasites.

According to WHO (2017), poor water and sanitation practices or conditions are a major risk factor for the distribution, infection and prevalence of STH. In addition, transmission of diseases caused by STH is enhanced by poor socio-economic conditions, deficiencies in sanitary facilities, improper disposal of human faeces, insufficient supplies of potable water, poor personal hygiene, and lack of education (Agbom, Odikamnoro & Omowaye, 2013). Unfortunately, children in developing countries are the most vulnerable group to these infections since they usually play within the grounds (Patel, Kazura, Hotex, King & Blanton, 2004).

According to Amoh, Sing, Stenton and Riddy (2017) over 1.5 billion people are infected with STH globally and Molyneuex (2017) stated that collectively, the STH infections is the largest contributor to the disease burden of Neglected Tropical Diseases (NTDs).

Soil transmitted helminths are transmitted by eggs that are passed in the faeces of infected people. In areas that lack adequate sanitation, these eggs contaminate the soil (WHO, 2023).

Soil plays a major role in the distribution and prevalence of STH (Eppig, Fincher & Thormhill, 2010) because it is one of the main reservoirs of helminth eggs. Badaki, Shitta, Labija and Agwuja (2018) explained that soil contaminated with nematodes is the most direct indicator of risk for soil transmitted helminths. According to Badaki et al (2018), contamination of market soils with STH poses a high risk to individuals who frequent the market such as traders, buyers and vegetable farmers. Many of the vegetable farmers tend to offload their vegetables on the bare ground and there is a high risk of transmission of intestinal parasites to the human population especially those who consume such vegetables raw.

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Quite a number of factors influence soil contamination and they include humidity and temperature. For instance, Lurcain (2014) stated that *Ancylostoma* egg requires warm temperature and high humidity to survive in soil.

Troub (2014) explained that there is significance in the rate of discovery of eggs from soil within areas that are moist and shady compared to open sunny areas with vegetation.

This study was aimed at investigating the distribution of helminth eggs that were isolated from soil in Barkin Ladi market.

Methodology

Study Area

The study was carried out in Barkin Ladi market. Barkin Ladi is a Local Government Area in Plateau North Senatorial Zone of Plateau State, Nigeria. Its headquarters is in Gwol. The GPS coordinates are Latitude: $9^0$31`59.99``N and Longitude: $8^0$53`59.99``E.

Sample Collection

Five (5) soil samples each were collected from five different locations in Barkin Ladi market, making a total of twenty-five (25) samples. The samples sites for the collection were: Entrance of the market (Site A), the area where vegetables are sold (Site B). The area where meat is sold (Site C). The area where staple food such as rice, beans, maize, potatoes are sold (Site D). Lastly, around the refuse dump was designated as Site E.

A sterile metal spade was used to collect about 500 grams of soil and transferred immediately into clean, sterile sample containers then transported to the Microbiology Laboratory of Plateau State Polytechnic, Barkin Ladi. Sample collection was done in the morning hours. The sample bottles were properly labelled.

Sample Processing

The Modified Environmental Protection Agency (EPA) method which is the combination of flotation and sedimentation as employed by Amoh (2014) was used. The method involved the following steps:

1) Five (5) grams of soil sample was weighed and mixed thoroughly with 50ml of distilled water.
2) The mixture was sieved into a container
3) The suspension was transferred into a one litre container and allowed to settle overnight.
4) The next day, the supernatant was poured out as much as possible, leaving the sediments at the bottom of the container.
5) Sediments were transferred into 10ml sterile centrifuge tubes.
6) The container was rinsed with sterile water while the rinsed water was added to the centrifuge tubes to ensure complete transfer of the eggs.
7) Centrifugation was done at 1000 revolutions per minute (rpm) for 3 minutes.
8) Supernatant was gently decanted and about 1ml of Zinc Sulphate solution was added to the sediment remaining at the bottom of the centrifuge tubes.
9) A sterile spatula was used to stir and homogenize the mixture which was centrifuged again at 1000 rpm for 3 minutes.
10) The supernatant containing the eggs was poured into a 2L container and diluted with about 50ml of distilled water, then allowed to settle for about three hours.
11) Centrifugation was repeated by first pouring off the supernatant and transferring the sediment into centrifuge tubes then centrifuging at 1000 rpm for three minutes.
12) One (1) ml of buffer solution was added.
13) One (1) ml of ethyl acetate was added to the sediment, shaking was done occasionally, letting out the gas.
14) The mixture was centrifuged at 2000 rpm for three minutes.
15) Finally as much as possible of the diphase supernatant was poured off leaving about 1ml of sediment for microscopic analysis. Eggs of helminths were identified with the aid of a light microscope using x10 then x40 objective.

Statistical Analysis

Pearson's Chi-square analysis at $p>0.05$ was calculated to determine significance levels.

Results

Sites B and E had all the samples contaminated with helminth eggs giving a percentage contamination of 100% each. However, site E had a total of 15 helminth eggs while site B had a total of 10 helminth eggs. Site D had 4 samples (out of 5) contaminated with helminth eggs giving a percentage contamination of 80%. There were 7 helminth eggs identified. The lowest contamination was seen in sample sites A and C where 3 out of the 5 samples (60%) were contaminated. However, site C had a lower number of eggs (4) than site A (6 eggs).

The results are seen in table 1, Chi-square analysis shows that there is no statistical difference in the results obtained at $p>0.05$.

Table 1: Frequency of Helminth Eggs Isolated from Soil Across Sites in Barkin Ladi Market

Site	No. of samples	No. of positive samples (%)	Total No. of eggs observed.
A	5	3 (60)	6
B	5	5 (100)	10
C	5	3 (60)	4
D	5	4 (80)	7
E	5	5 (100)	15
TOTAL	25	20 (80)	42

Table 2: Distribution of helminth eggs isolated from soil sample site in study area

Soil Sample site	Ancylostoma duodenale	Trichuris trichiura	Ascaris lumbricoides	Total(%)
A	2	2	2	6 (14.29)
B	3	1	6	10 (23.81)
C	1	1	2	4 (9.52)
D	4	3	-	4(16.67)
E	4	5	6	15(35.71%)
TOTAL	14(33.33%)	12(28.57%)	16(38.10%)	42 (100%)

From Table 2, three different helminths were isolated which were *Ancylostoma duodenale Trichuris trichiura* and *Ascaris lumbricoides*. *Ascaris lumbricoides* had the overall highest occurrence of 15 (33.33%). The least in occurrence was *Trichuris trichiura* (28.57%). It is worthy of note that Sample site D did not have any *Ascaris lumbricoides* eggs. There was no significant difference in the occurrence of helminth eggs from soil samples in the study area (p=0.481).

Discussion

The results obtained in this study showed that out of the twenty-five (25) soil samples collected, twenty (20) were contaminated with various parasites. This gave a percentage contamination of 80% which is higher than that obtained by Badaki et al (2018) in Lokoja. It is also higher than the contamination of 67% reported by Hassan et al (2017) in Ibadan, as well as that reported by Mohammed et al (2011) in Abuja. A study by Oyewole and Simon-Oke (2022) in Ifedore district in Southwest Nigeria showed that 79.2% of the soil samples examined were positive for the presence of helminth larvae and ova. This high contamination shows that the risk of infection by STH to individuals who frequent Barkin Ladi market is high as such, desperate measures must be taken to reduce this.

Oniya, Kareem and Afolabi (2023) in their study of Shasha market, Oba-ile in Akure explained that the market displayed poor sanitation as soil samples from all the premises harboured one parasite stage or the other with hookworm larvae accounting for 36.58% of stage found and seen in all soil samples across the points of collection.

Considering the five sites from which soil samples were taken the highest contamination (35.7%) occurred around the refuse dump in the market. This is obvious because refuse of different types including human wastes are dumped there. This finding is similar to what was reported by Imalele et al (2021) in Calabar where intensity of STH in soil was significantly higher in dumpsites compared to playground and toilet areas. They also reported that contamination by ova/larvae of STH in dumpsite soils (79%) was higher than that of farmlands (52%).

Three helminths were isolated from soil in this study namely: *Anycylostoma duodenale*, *Trichuris trichiura* and *Ascaris lumbricoides*. The highest in occurrence was *Ascaris lumbricoides* (38.1%) followed by *Ancylostoma duodenale* (33:33%) while the least was *Trichuris trichiura* (28.57%). In some other studies conducted by other researchers, the three helminthes were also isolated. Badaki et al (2018) encountered seven (7) helminth species in their study. Simon-Oke (2020) and Imalele (2023) isolated for (4) helminthes (including the three isolated in this study). They also reported that *Ascaris lumbricoides* was the most frequently encountered soil helminth.

Conclusion

Soil transmitted helminth infections remain a major public health challenge in tropical countries. The present study has shown that markets remain a public place where these helminth eggs are prevalent. Public awareness on a regular basis is important to improve the sanitary status of our markets. Environmental sanitation is also necessary and should be enforced by the relevant authorities.

Farmers and traders should not keep their produce on the bare soil in order to prevent contamination by the helminth eggs. In addition, consumers of fresh vegetables should wash them with salt and running water so that they do not become infected.

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