Determination of Larva of Intestinal Parasites in Soil Samples from selected Dump sites within the University College Hospital, Ibadan

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Abstract: Soil transmitted parasites are known common chronic human infection globally that has been recognized to be of public health importance majorly in developing countries, including Nigeria. This study was conducted within the University College Hospital, Ibadan to determine the prevalence of intestinal parasites in soil samples from 10 selected dumpsites within the hospital. A total of 200 top soil samples were collected from ten selected dumpsites within the University College Hospital, (U.C.H.) Ibadan, Oyo State, for macroscopic and microscopic examination using a descriptive cross-sectional study approach. The result recorded a high prevalence of parasites in the study sites. Of the 200 soil samples examined, 122 (61.0%) soil samples were positive for one or more parasites, and these included; Hookwork 60 (49.2%), Strongyloide Stercoralis 14 (11.5%), *Trichomonas hominis* 44(36.1%); *Gardia lambia* 1(.8%); *Balantidium coli* 2(1.6%) and ova of *Ascaris lumbricoides* 1(0.8%). The result also indicated the dictates of seasonal variation in the prevalence of parasites in the examined soil samples. It further showed that refuse dump sites located in different parts of the University College Hospital (UCH) poses great public health challenge to the population. The study therefore recommends that environmental and public health awareness should be intensified and scavengers and dumpsite workers should be encouraged to use personal protective gears at the sites, to reduce the risk of parasitic infestation and exposure to contracting parasitic larval in the soil, which has a resultant short and long term health effects.

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1.0 Introduction

Soil is a highly dynamic, ecologically complex and diverse living entity that is formed as a result of various biological and climatological interactions with the earth's bedrock (David and Charles, 2010). However, human activities such as increased urbanization, disposal of untreated waste, open defecation, dumping of industrial waste, accidental pollution and leakages, inadequate treatment and safety management of chemicals and toxic waste results in loss of the structural and biological properties of the soil layers, and thus the term soil pollution (Zaware, 2014), an instance of which is seen as dumpsite. Dumpsites are waste depositing land (soil) areas where uncontrolled waste disposal activities occur in such a way that the environment is not protected from the detrimental effect that arises from these activities (Waste Atlas, 2014). However, the ecological balance of any ecosystem gets affected due to the widespread contamination of the soil (Zaware, 2014) in various forms, such as the accumulation of parasitic organisms leading to degradation of soil quality, reduce crop yield and the quality of agricultural products, and thus negatively impact the health of humans, animals and the ecosystem (Nagajyoti *et. al.,* 2010). Municipal, industrial and medical wastes contain a variety of potentially significant chemical constituents and pathogenic organisms that could negatively affect public health, air, soil and groundwater qualities (Adedosu *et. al.,* 2013). Such pathogenic organisms found in solid waste include parasitic nematodes, protozoa and other microorganisms (Adeolu and Tope, 2012). The parasitic nematodes whose infective stages can embryonate in the soil are soil transmitted helminths (STHs) (David and Charles, 2010). These parasitic nematodes represent a serious threat to humans, animals and plants. Soil-transmitted helminths can cause a range of symptoms including intestinal manifestations (diarrhoea and abdominal pain), general malaise and weakness, impaired cognitive and physical development, and chronic intestinal blood loss which can lead to anaemia (World Bank, 1993).

Furthermore, the deposition of human faeces along with refuse dump contaminates the soil with eggs and helminthic larvae of different parasites, which in turn constitute a potential risk of infection to

human being, especially, dumpsite workers, refuse collectors and children, in most developing countries, especially in sub-Saharan Africa (World Bank, 1993). Nyarango, *et al.* (2008) reported that poor sanitary condition of latrines which lack water supplies and a frequent presence of piles of garbage provides a fertile environment for transmission of intestinal parasites. There are billions of free living nematodes that lives in the soil and are involved in ecological processing and nutrient recycling. Larval of intestinal parasite are the infective stages of some intestinal parasite that can be found in the soil including that of refuge dump site contaminated with faeces (Adesewa and Morenikeji, 2017). Most of these larval are parasitic for various animals. Host are infected by coming in contact with this infective stage of parasite that lives in soil, and infective stages of parasite either egg or larval can be transmitted to a person either by ingestion or penetration. However, transmission via fecal contamination, and ingestion of contaminated food are the primary means of spread of most intestinal parasites (Okyay *et. al*., 2004).

However, the development of parasitic larval in the soil, and its transmission to people requires some favourable conditions, such as moderate temperature, a high percentage of humidity, and certain chemical and biological conditions such as type of soil, aeration, light which favour the development of eggs and prolong their survival (Ciarmela *et. al*., 2002). Futhermore, some factors such as poor conditions of living, uncaring social system, inadequate refuge, sewage disposal and unhealthy living habit together with favourable environmental conditions further supports the continual existence of these infective larval in the soil, especially that of refuse dump site. In places where animal waste are sprayed on vegetable as fertilizers or washing of these vegetable with soil contaminated water just before taken to the market can transmit environmental resistant stages of parasitic larval (KimChristy, 2002). Crompton reported that the risk of intestinal parasite was higher among the inhabitants of towns in developing countries, especially those living in the slums where there is poor disposal of garbage, poor health system and overcrowding (Crompton, 1993). Intestinal parasites can also spread in areas with poor sanitation and was reported to be more common in tropical developing countries. Parasitic intestinal infestation can often resulted in outbreaks when several people have symptoms at the same time this is especially likely if many people come in contact with the same supply of contaminated food, water or soil. Infection transmitted by larva of intestinal parasites in the soil and soil transmitted helminthic are chronic human infections worldwide (Brooker *et. al*., 2006).

The World Health Organization (WHO) estimates that 3.5 billion people worldwide are infested with some type of intestinal parasite and as many as 450 billion of infested people are sick and children was reported to be most frequently infected. Also, intestinal parasites, invade and inhabit the intestine thereby causing discomfort to the host. They have been shown to cause poor appetite, intestinal abnormalities, poor absorption or increased loss of nutrients (WHO, 2004).

This study therefore aimed at determining the larva of intestinal parasites from the soil samples collected from selected dump sites within university college hospital, Ibadan, by representing the incidence of larval of intestinal parasite in various refuse dump site within U.C.H. environments.

2.0 Materials And Methods

2.1 Sampling Location

University College Hospital (U.C.H.) is in the South Western parts of Nigeria, and it is located in Ibadan North Local Government area of Oyo State. It is a tertiary health centre with different categories of students. These students include those of School of Medical Laboratory Sciences, School of Nursing and Medical Students of the University of Ibadan. This hospital has a staff capacity of over five thousand and has a residential area accommodating over two thousand of its work force. Increase in the number of workforce, students and with the staff willingness to live within the U.C.H. communities leading to overcrowding of the residential area with students, staff, their families and relatives. Moreover, the residential area though provided with toilet facilities but due to old age of the hospital, it is faced with problems of old decaying and spoilt toilet facilities.

Also, there is no regular supply of pipe borne water and also there is increase in the number of hospitalized patients and there is no provision of accommodation for patients relatives coupled with lack of accessibility to public toilet. This makes occupants of these residential house and patients relatives to defecate openly in gutters, open sites and fields.

Furthermore, patients' relatives dump their refuge generated in several sites within the hospital environment, and, defecates openly in the refuse dump site. Also, occupants of these residential areas throw away their waste in waste collection bins, which are in turn collected and dumped in open sites without treatment or incinerated to kill larvae or eggs of any parasite that may contain in the refuse dump site.

2.2 Study Site

Top soil samples used for this study were collected from 10 dumpsites situated within the University College Hospital communities. The dumpsites includes; Alexander Brown Hall dump site, School of Nursing dump site, UCH incinerator, Virology dump site, Institute of Medical Research and Training (IMRAT) dump site, Accident and Emergency dump site, Chapel Church dump site, Circular road dump site, PSM dump site and Angola dump site. These sites were selected for study because they are parts of the hospital environment as well as residential areas to most of the staff members and the waste deposited in various sites are generated by the hospital staff and patient relations.

2.3 Study Design

A descriptive cross-sectional study composed of collection of top soil samples from refuse dump site in various locations within the University College Hospital (UCH) environments was conducted.

2.4 Selection Of Dumpsites And Collection Of Soil Samples

Soil samples were collected from the 10 selected refuse dump site at about 6 to 7 am in the morning when the soil is still presumed wet. Top soil were scrapped using a hand shovel, and the samples were collected into sterile universal container, and clearly labeled to indicate name, soil colour, location, and types. Soil were collected 10 times from each site were collected in triplicates. The various soil samples were transferred to the parasitology laboratory section of UCH immediately after each collection, for processing and examination. A total of one hundred soil samples were examined from period of September to December (dry season) and another 100 soil samples from the same locations were also examined between the period of January to March (wet season), which allowed for seasonal comparison.

2.5 Macroscopic And Microscopic Examination

Macroscopic examination was done by assessing the appearance, colour, texture and nature of the soil in each dump site with the naked eyes. The microscopic examination of the soil was done using Baermann apparatus according to the method described by (Cort *et. al.,* 1922; Garcia and Bruckner, 1993). The Baermann was assembled by clamping a glass funnel fitted with rubber tubing and with a stopper to prevent free flow of water. Warm water was heated in an electric plastic heater and a thermometer was used to check the temperature of the water until a temperature of 40^0C was achieved. The warm water was poured into the tunnel almost filled.

The soil samples was mixed together thoroughly with the aid of an applicator stick in the universal container and small quantity of the soil was put in a small sieve of about 1mm mesh. The sieve containing the soil was placed in the funnel so that the water level is just above the lower surface of the sample in the sieve and was left for about 1 hour to allow the larval to migrate from the soil into the warm water in the funnel. The stopper was released and about 15ml of the fluid was withdrawn from the funnel into a centrifuge tube, and centrifuged. The supernatant fluid was pipetted off with the aid of a sterile dropper pipette and the sediment was examined by suspending a few drops on a sterile microscopic slide and the preparation was covered with a covered glass and examined under a light microscope using x10 and x40 objectives with iris diaphragm closed sufficiently to give a good contrast. Most of the separation stage was repeated to obtain maximal yield of larval.

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 20. Data were analysed using frequencies, proportions and graphical representations.

3.0 Results

3.1 Incidence of larval of Intestinal parasites in soil during the dry season

Table 1 indicates the incidence of intestinal parasites in the examined soil samples from the different study sites that tested positive for intestinal parasites during the dry season. A total of 34 (27.9%) soil samples out of the 100 soil samples examined between September to December (dry season), tested positive for different parasitic larval. Of the 10 soil samples collected from the School of Nursing dump site, 6(17.6%) tested positive for the larval of intestinal parasite, while Chapel Church dump site, Circular road dump site, PSM dump site and Angola dump sites had the least number 2(5.9%) of soil samples that tested positive for parasites larval (Table 1).

3.2 Incidence of larval of Intestinal parasites in soil wet season

Table 2 reports the incidence of intestinal parasitic larva in the studied soil samples from the study sites during the wet season. A total of 88 (72.1%) soil samples out of the 100 soil samples collected from the January to march 2009 (wet season), tested positive for larval of different intestinal parasites. It was observed that, all the 10 top soil examined from each of Alexander Brown Hall dump site, UCH incinerator, Virology dump site and, PSM dump site tested positive for larva of intestinal parasite, while only 6 of the 1o examined soil sample

in Chapel Church tested positive to the larval of intestinal parasites (Table 2).

3.3 Distribution of Parasites in Soil Samples in both wet and dry season.

Figure 1 shows the distribution of parasites in the ten different dumping sites in both wet and dry season. Of the 200 soil sample examined, a total of 122 soil samples representing 61%, were positive for parasites in the following proportion; Larval of hookworm isolated in both seasons were 60 (49.2%), Strongyloides stercoralis 14(11.5%), Ascaris lumbricoides ova 1(.8%), Giardia lambia 1(.8%) of Trichomonas hominis 44(36.1%), and Balantidium coliz (1.6%). Furthermore, The Pearson chi-square values indicated a statistical difference in the rate of parasite recovery between wet and dry season, with chi-square value of $x^2 = 61.286$, and P -value p = 0.000.

Table 1. Incidence of larval of Intestinal parasites in soil of refuse dump site at University College Hospital during the dry season

Location of refuse dump site sample	Number of soil sample examined	Number of sample positive	Percentage Number of soil sample positive	Number of Soil sample negative	% number of soil sample negative
Alexander brown hall	10	4	11.8%	6	9.1%
School of Nursing	10	6	17.6%	4	6.1%
UCH Incineration	10	5	14.7%	5	7.6%
Virology	10	3	8.8%	7	10.6%
Imrat	10	3	8.8%	7	10.6%
Accident and Emergency	10	5	14.7%	5	7.6%
Chapel Church	10	2	5.9%	8	12.1%
Circular road	10	2	5.9%	8	12.1%
PSM	10	2	5.9%	8	12.1%
Angola	10	2	5.9%	8	12.1%
Total Number	100	34	27.9%	66	84.6%

Table 2. Incidence of larval of Intestinal parasites in soil of refuse dump site at University College Hospital during the wet season

Location of refuse dump site	Number of soil sample examined	Number of sample positive	Percentage Number of soil sample positive	Number of Soil sample negative	% number of soil sample negative
Alexander brown hall	10	10	11.4%	0	0%
School of Nursing	10	9	10.2%	1	8.3%
UCH Incineration	10	10	11.4%	0	0%
Virology	10	10	11.4%	0	0%
Imrat	10	9	10.2%	1	8.3%
Accident and Emergency	10	8	9.1%	2	16.7%
Chapel Church	10	6	6.8%	4	33.3%
Circular road	10	9	10.2%	1	8.3%
PSM	10	10	11.4%	0	0%
Angola	10	7	8.0%	3	25.0%
Total Number	100	88	72.1%	12	15.4%

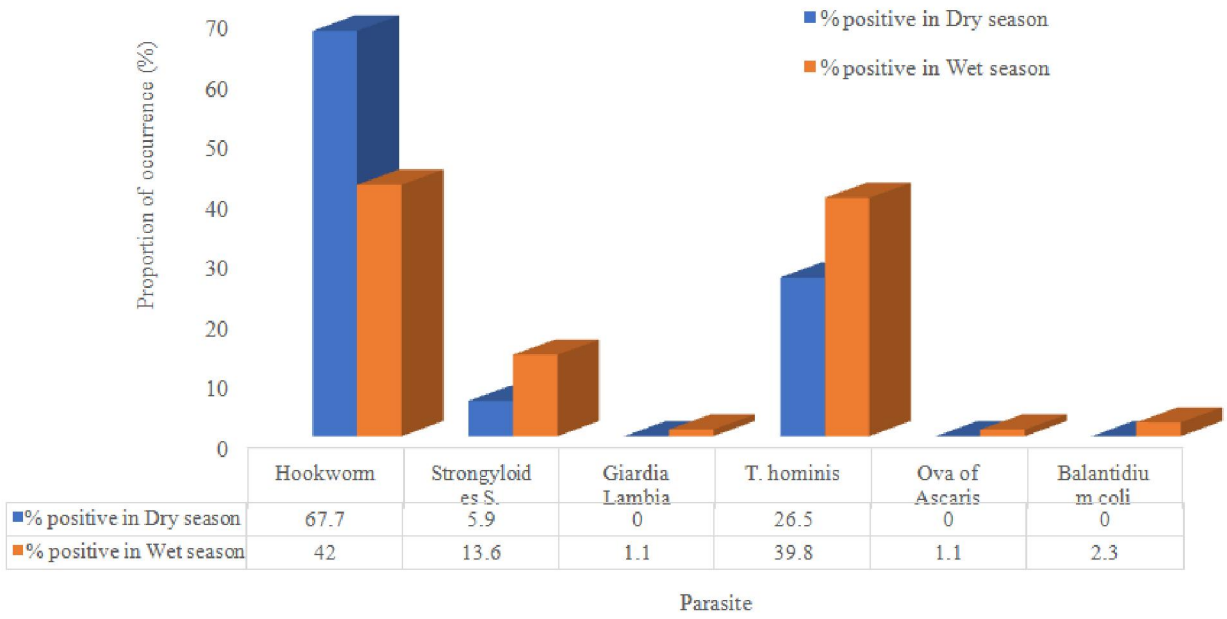

Figure 1: Distribution of Parasites in Soil Samples in both wet and dry season.

4.0 Discussion

Intestinal parasites are cosmopolitan in distribution, with a resultant negative impact on human well-being, especially people with constant and direct contact with contaminated soil, which has shown to be the medium of transmission of parasites egg and larval. Majority of such parasites are known chronic human infections worldwide, and as a result are recognized as an important health problem, particularly in developing countries, including Nigeria (Kafle *et. al.*, 2014). However, the high prevalence of infection caused by soil transmitted parasites are often attributed to poverty, illiteracy, improper sanitation awareness and management, and other different aspects of human related activities.

The University College Hospital (UCH) community is known with Increased number of workforce, students, and desire of the workforce to live within the U.C.H. communities. These has in turn led to overcrowding of the residential area, increased waste generation, collection and dumping of untreated waste in open sites, and open defecation in gutters within the hospital community by occupants of residential house and patients relatives, as a result of old, inadequate, and improperly managed toilet facilities in the hospital premises. However, the untreated waste collected and dumped in open sites without treatment or incinerated to kill larvae or eggs of any parasite further contaminate the soil of various dumpsites within the hospital community, which have been known to be a means of livelihood for people, especially those who collect waste for economic purposes. The study was therefore determined prevalence of larva of intestinal parasites in collected soil samples from 10 selected dump sites within the University College Hospital, Ibadan between September 2008 and March 2009, using Bearmann's apparatus. The Bearmann's apparatus indicated a recovery rates of 122(61.0%) contaminated top soil with parasites, out of 200 soil sample examined, including protozoans' parasites as well as ova of Ascaris lumbricoides. Such high incidence of parasites recorded in the dry season 34(27.9%) and 88(72.1%) in the wet season from the 10 different refuse dump site therefore suggests that the risk of contracting parasitic infection within UCH environment is very high when one visit this dump sites. This report could also be attributed to open defecation and disposal on the dumpsites. This report is in agreement with the work of Nyarango *et. al.*, (2008), that poor sanitary conditions of latrines which lack water supplies and a frequent presence of piles of

garbage provides a fertile environment for transmission of intestinal parasite. The observed significant difference (x2 = 61.286, P = 0.000) in parasite distribution in examined top soils samples between dry seasons (34 of the 100 top soil tested positive for parasites infection), and wet season (88 of the 100 top soil tested positive for parasites infection) suggests that soil moisture content has a play in the availability and prevalence of intestinal parasites in dumpsites. This also suggests that larval of Intestinal parasites in the soil such as those of hookworm or strongyloides, are very sensitive to extreme conditions such as heat and drying.

5.0 Conclusion And Recommendation

The overall prevalence of 61% recovery rate in this study inferred that intestinal parasites are present in most of the refuse dump sites within the University College Hospital. This prevalence is very high, and this suggests that a greater number of people are at the risk of parasitic infection. Thus, an effective waste treatment prior to deposition, and proper sanitation within the hospital communities should be given urgent attention, in the interest of maintaining good health for all. Furthermore, as a result of the public health importance of the parasites isolated in this study, it is recommended that well planned waste management and health education programs will go a long way to reduce the potential epidemic risks posed by these refuse dump sites in UCH.

Also, scavengers and dumpsite workers should be encouraged to use personal protective gears at the sites, to reduce the risk of parasitic infestation and exposure to contracting parasitic larval in the soil, which has a resultant short and long term health effects.

Furthermore, staff, patients relatives, and occupants of UCH resident should be educated on the need to maintain a high level of personal hygiene by ensuring that they have less contact with refuse dump site and should not defecate or throw faeces in dump sites.

Also, the hospital management should focus their attention on its decaying structures and equipment by repairing spoilt toilet and warn out water system, adequate water supply should be provided for resident and patient relatives and visitors to the hospital.

In conclusion, prompt incineration of refuse, treating of dump sites with insecticides and chemicals as well as provision of good toilet facilities, adequate water supply will bring a long lasting solution to the ranging problem posed by parasites.

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