INVESTIGATING THE POSSIBLE SOIL TRANSMITTED HELMINTHES PARASITES AND THE PHYSICOCHEMICAL PARAMETERS IN SOIL OF A MAJOR DUMPSITES IN ORU IJEBU IGBO, OGUN STATE

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CERTIFICATION

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DEDICATION

This project is dedicated to Almighty God, the fountain of wisdom, knowledge and understanding. Also to our ever caring parents for their contributions, love, care and immeasurable commitments and struggle to make us get educated. May God Almighty reward them for their efforts. AMEN

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ABSRACT

A parasite is an organism that lives in another organism, called the host, and often harms it. It depends on its host for survival. 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. 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. Soil sample 40g was collected at each sampling point with the aid of a 0.75m2 quadrant thrown at random and with a soil auger at depth 0-15cm. The temperature of the soils was measured in situ. Samples were collected in labelled air tight polythene bags and immediately transported to the laboratory for analysis. Sampling was done in the first three weeks of September, 2018. Soils samples from the field were analysed for moisture content, soils to be analysed for helminths were kept moist in polythene bags pending time of analysis and the remaining soils were transferred into a plastic tray for air drying; large clods of soil were broken to speed up drying. The soil was passed through 2mm sieve to remove stones and other unwanted materials, crushed and ground into fine powder using mortar and pestle and then analysed for pH, temperature, Exchangeable acidity and electrical conductivity. The overall prevalence of soil helminthes was found to be low at the dumpsite because among the nine sample areas analysed only three has high prevalence of the helminthes parasites.

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CHAPTER ONE

1.0 INTRODUCTION

A parasite is an organism that lives in another organism, called the host, and often harms it. It depends on its host for survival. Without a host, a parasite cannot live, grow and multiply. For this reason, it rarely kills the host, but it can spread diseases, and some of these can be fatal. Parasites, unlike predators, are usually much smaller than their host and they reproduce at a faster rate. Parasites live on or in other organisms and thrive to the detriment of their host. Many different parasites can affect humans, and they can pass on diseases such as malaria and trichomoniasis. Many different parasites can affect humans, and they can pass on diseases such as malaria and trichomoniasis. The parasite uses the host's resources to fuel its life cycle. It uses the host's resources to maintain itself. Parasites vary widely. Around 70 percent are not visible to the human eye, such as the malarial parasite, but some worm parasites can reach over 30 meters in length. Parasites are not a disease, but they can spread diseases. Different parasites have different effects (Anderson et. al., 2013).

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).

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. Soil pollution is a phenomenon characterized by the loss of the structural and biological properties of the soil layers as a result of numerous human and natural factors. Human activities that cause pollution include increased urbanization, disposal of untreated waste, indiscriminate use of agrochemicals, unscientific mining, dumping of industrial waste, accidental pollution and leakages, inadequate treatment and safety management of chemicals and toxic waste. As urbanization increases and human population grows, there is a need to manage the waste produced from human activities and this has led to the creation of dumpsites (Basuni et. al., 2012).

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. The ecological balance of any ecosystem gets affected due to the widespread contamination of the soil. Accumulation of heavy metals can degrade soil quality, reduce crop yield and the quality of agricultural products, and thus negatively impact the health of humans, animals and the ecosystem (Bethony et. al., 2006).

1.1 Aim and Objectives

This study aims at investigating or assessing the helminth parasite prevalence and physicochemical parameters in dumpsite soil in Ijebu – Igbo.

CHAPTER TWO

2.0 LITERATURE REVIEW

Soil transmitted helminthiasis are diseases caused by a group of helminthes with direct life cycle through the soil environment to man and domestic animals. The life cycle usually involves soil contamination with eggs or larvae of parasitic worms excreted by man and domestic animals, development of the eggs or larvae to infective stages and infection of man or animals either by the oral-route or active penetration of the skin (Cheesebrough, 2006). Oral-route transmission is facilitated by the use of contaminated household items, eating contaminated food or with dirty fingers. It has also been suggested that houseflies (Musca domestica) may facilitate the contamination of household items and food stuff. Playing in a dirty environment especially where there are unhygienic practices and sanitation is below standard facilitate transmission (Headlee, 2003).

Eating unwashed fruits and putting contaminated fingers in the mouth especially by children who play in the soil or with domestic animals lead to oral-route infection, playing in the soil equally leads to larval penetration of the skin (Karagiannis-Voules et. al., 2015). The major soil transmitted helminthes in Nigeria include *Ascaris lumbricoides, Trichuris trichiura, Ancylostoma duodenale, Necator americanus, Strongyloides stercoralis, Enterobius vermicularis,* and *Toxocara species*, A. *duodenale* and N. *americanus* which together cause hookworm infection, and *Strongyloides stercoralis* are transmitted by direct skin penetration while the rest gain entry by oral-route (Knopp et. al., 2012). *Enterobius* spp. may also be transmitted by auto-infection as a result of children

scratching the anus and putting the fingers in their mouths or eating with unwashed hands (Cheesebrough, 2006).

2.1 Soil Transmitted Helminths

The pathogenic organisms that can be found in solid waste include parasitic nematodes, protozoa and other microorganisms. Parasitic nematodes represent a serious threat to humans, animals and plants. The parasitic nematodes whose infective stages can embryonate in the soil are soil transmitted helminths (STHs). 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. Helminth infection is a major cause of disease burden among children in developing countries especially in sub-Saharan Africa (Garn et. al., 2013).

Ascariasis is diagnosed by the demonstration of its eggs or adult worms in faeces either using the naked eye or nurture microscopy. The fertile ovum is broadly oval, has a thick shell with an outer coarse warty albuminous coat stained yellow or brown in the intestine, while the adult worms can be observed by direct examination of stool. It measures about 60 to 70 micron in length by 40 to 50 micron in width. The unfertilized eggs are more elongated and less regularly oval in shape. They contain amorphous substances and lack the well-defined (decorticated) round found in the fertilized eggs (Pullan, 2014).

While several *coprological* methods are used in egg microscopy, the various *coprological* methods are based on the principle of egg concentration in a liquid medium

or slide preparation of thick smears. Concentration methods are based on the relative specific gravity between the liquid media and helminth eggs. Where the specific gravity of the media is greater, eggs concentrated at the surface but where it is lesser eggs concentrate by gravity (Strunz et. al., 2014). Besides, concentration can also be achieved by centrifugation. Ascaris eggs are concentrated by saturated sodium chloride flotation technique at the specific gravity of 1.200. In addition kato cellophane thick smear technique (KTS) is the best slide preparation method. Both methods are efficient, easy to prepare and relatively inexpensive and the KTS is fairly easier to use as it permits examination of large number of samples per unit time (Lai et al., 2015).

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. 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).

2.1.1 Different method of examination of stool for soil transmitted helminth

Hemogram: Eosinophilia (>600 µL or >6% of the thin-layer chromatography) may be used as a marker of STH infection. Many studies have shown a correlation between STH infection and eosinophilia that is usually observed in about 47% cases of ascariasis, 78% cases of trichuriasis and 82% cases of strongyloidiasis, up to 60% cases of hookworm infection. Low hemoglobin of ≤5 g/dl (60%) and low ferritin (33%) concentration (due to iron deficiency anemia) may be seen in patients with hookworm infestation (Adedosu et. al., 2013).

Occult blood test: Occult blood in stool in patients with severe anemia due to chronic hookworm infection has been used as a surrogate marker.

Other samples: In case of ascariasis, hookworm or S. sterocoralis, during the larval migration phase of infection, diagnosis can be made by finding the larvae in the sputum or gastric washings. In ascariasis, charcot-Leyden crystals and eosinophils may be found in the sputum.

Endoscopy: In the case of S. stercoralis, most common endoscopic findings, which are usually incidental, are ulceration, bleeding, duodenal spasm, mucosal edema, thickened duodenal folds. In case of hookworm infection also upper digestive endoscopy plays an important role (Adeolu and Tope, 2012).

2.1.2 Transmission and Life Cycle of Soil-Transmitted Helminthes

A number of factors are involved in the transmission of helminth parasites. The eggs of soil-transmitted helminthes and or their larvae must be present in the environment and in a viable condition. The environment is contaminated when eggs or larvae reach the soil in human faeces. When the human environment is contaminated man becomes exposed to these infective agents (Ugbomoiko et al., 2009). The parasites thrive well in places and communities where poverty is entrenched so that safe systems of sanitation and sewage disposal are unavailable to protect the people. The climate must favour the rapid embryo nation of the eggs to produce the infective second-stage larvae. The higher the degree of environmental contamination with eggs and larvae of soil-transmitted helminthes, the higher the prevalence in such communities (Maikai et. al., 2008). According to Asaolu (2004), apart from soil and sewage, most household items, vegetables and paper money are equally contaminated by helminth eggs especially A. lumbricoides. The eggs gain entry into man orally or by inhalation of contaminated air in the environment. Young children and adults are more at risk of ingesting eggs through playing on the ground in defaecation areas and through eating soil contaminated with eggs. Poor personal hygiene by some adults at toileting especially not washing hands or fruits before eating can place them at risk of ingesting eggs of A. lumbricoides (Malicki et. al., 2001).

2.1.3 Factors Affecting Transmission

Numerous factors affect transmission of *helminthiasis*.

i. Personal hygiene

Personal hygiene and bad habit at defaecation are the strongest factors. Bad habits at menstrual periods especially the use of unsanitary items contaminated with human excreta and larvae in the soil. The use of napkin that is not changed Non-removal of wet napkins may lead to autoinfection in babies. Other predisposing factors include the use of unclean soil contaminated feeding bottles, plates, cups and other utensils. According to Dobardzic (2002) it is not uncommon to encounter households where almost all usable items are contaminated by the helminthes eggs especially those of Ascaris lumbricoides cleaning the ear and the eye with contaminated fingers and tissues equally leads to transmission of *helminthiasis*. Indiscriminate defaecation in the rural areas around houses and playgrounds of children enhances transmission by increasing rate of contamination in the environment. Consumption of contaminated fast foods such as smoked fish and meat (suyas) bean cakes etc. are good sources of infection (Ugbomoiko and Ofoezie, 2007).

Several categories of human behaviour have been shown to encourage helminth transmission. Of particular importance is a toilet habit: such as indiscriminate defecation in bushes and other surroundings, improper cleaning after using the latrine, infrequent wearing of foot-wears and eating unwashed vegetables and fruits (Mabaso et. al., 2004).

ii. Occupation

Occupation is a factor in terms of exposure to helminth infection. For instance, farmers who farm in lands where there is indiscriminate defaecation of human faeces are known to be exposed to infective egg/larvae of soil-transmitted helminthes. The farmer

who uses untreated sewage water for cropping and human excreta as manure has been shown to be exposed to helminth infection (Truscott et. al., 2014). Workers in conservancy services and unmasked sewage workers unmasked especially night soil men may inhale helminthes egg. Chicken dressers, abattoir workers (butchers), Morticians and mortuary attendants may be contaminated by helminth larvae or worms leaving the dead bodies or carcass because as soon as death occurs parasites and larvae crawl out through any available opening of the dead animal so that they will not be buried or roasted with their host. Commercial drivers or road transport workers who stop randomly to eat in hotels are at risk of ingesting helminth ova (WHO, 2001).

iii. Educational background

Education has been known to be very important in the life of every individual. Health education including personal hygiene is taught in schools. Importance of sanitation to reduce environmental contamination is also included in the curriculum. Sanitation to reduce environmental contamination is also included in the curriculum. Low prevalence among educated and skilled workers has been reported as well as among those whose standard of living is high (Ugbomoiko and Ofoezie, 2007). The individuals with sound educational background live in good houses with modern facilities such as water and W.C. (WHO, 2001)

2.1.4 Management of Soil transmitted helminth

i. Hygiene

Hygiene such as the practice of keeping yourself and your living and working areas clean, in order to prevent illness and disease of parasitic origin especially soil transmitted helminthes are important. Practice of food hygiene and personal hygiene such as washing of hands and food preparation under hygiene conditions are also important (Vercruysse, 2012).

ii. Health Education

Health education is a very important tool for creating awareness and mobilizing community members against disease transmission. Several health education programmes emphasize the importance of enlisting children and teaching them good hygiene methods early in life. In order to achieve this goal health education has been included in the curriculum of primary school and secondary schools in many developing nations including Nigeria to create awareness on the importance of personal hygiene and sanitation (Ziegelbauer et. al., 2012). Countries like Malaysia have started continuous health education to students, teacher, parents and the community to increase awareness of the relationship between infections with worms and personal hygiene and other health promoting habits like washing hands, wearing shoes, and use of toilets have also been included. At P.T.A. meeting in schools, importance of early and effective treatment of gastrointestinal diseases is being emphasized. Posters, pamphlets and pictorial fliers on the

appearance, life cycle, transmission, effects and simple preventive measures against intestinal worms are used as teaching aids (Anderson, 2013).

2.2 Control of Soil Transmitted Helminths

2.3.1 Environmental Control of Soil-transmitted Helminthes

This is essential in every country especially the underdeveloped and developing countries of the world. The first step is to determine the level of contamination of the soil and sites and the helminth eggs most involved. Several studies imply that there is a direct relationship between rate of infection and poverty probably due to lack of safe systems of sanitation and sewage disposal (Baker and Ensink, 2012). The situation is worse when the climate favours the rapid embryonation of eggs and development of infective second-stage larvae. The risk of eating or drinking contaminated food and water is much greater in such environments. There is also evidence in such areas that eggs may be inhaled and eventually swallowed as part of windborne dust particles. The group most at risk of environmental contamination with soil transmitted helminthes are children and young adults who ingest eggs while playing and who defaecate indiscriminately (Deribe et. al., 2012).

Although helminthe eggs in the soil are under serious stress from environmental factors such as sunlight, desiccation and predators, sufficient quantity always survive to perpetrate transmission in endemic areas. Other sources of contamination of the environment with helminth eggs include use of untreated waste water for crop and the use of human excrement night-soil as fertilizers, domestic poultry especially long range birds

that eat adult female worms can contaminate the homestead. Viability is retained despite passage through the bird's alimentary tract (Urquhart, 2003).

The type of soil and the depth at which the eggs are buried are said to influence the survival of the larvae within the egg shells. Though, W.H.O. (2007) reported that sandy soil is less supportive of the survival of infective eggs than clay soils. When the eggs are on the surface of the soil, the life-span is 21-29 days. Those eggs at a depth of 100mm to 200mm as long as one and half years and those at 400-600mm deep two and half years. Domestic poultry that have eaten adult female worms can spread eggs around their homestead and viability is retained despite passage through the bird's alimentary tract (Urquhart, 2003). Children and people of all ages are at risk from ascariasis in regions where human excrement (night soil) is used as fertilizer for crops. Some vegetable like radish leaves, spinach and some onions were found to be most heavily contaminated, while only three types were found to be free from eggs (Kobayashi et al., 1994). Untreated waste for crop irrigation was prohibited when it became necessary to reduce the level of contamination of soil-transmitted *helminthiasis* especially *ascariasis*. Consequently, the prevalence which was 35% dropped to 1% between 1948 and 1960. Environmental contamination by soil transmitted *helminthiasis* is a problem that needs serious solution in our communities (Figures 2.1, 2.2, 2.3, and 2.4).

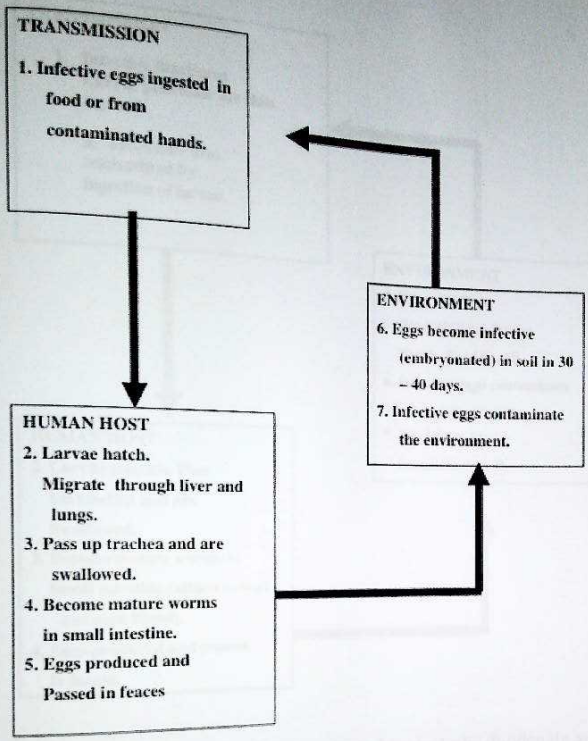

Fig. 2.1: Transmission and life cycle of *Ascaris lumbricoides* (Cheesebrough, 2006)

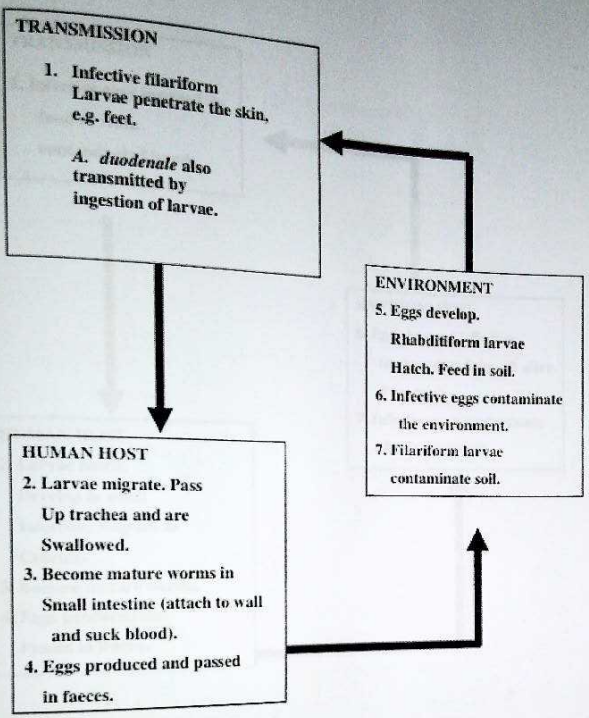

Fig. 2.2 Transmission and life cycle of hookworms: Ancylostoma duodenale and Nectar *americanus*. (Cheesebrough, 2006)

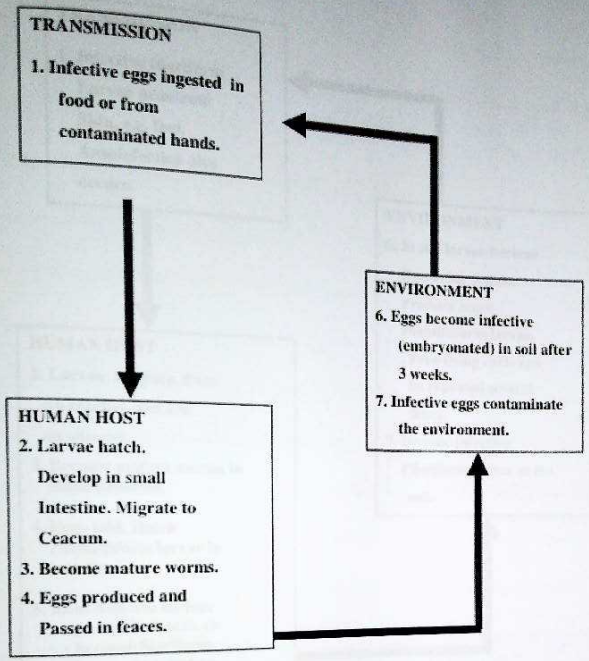

Fig. 2.3 Transmission and life cycle of *Trichuris trichiura*. (Cheesebrough, 2006)

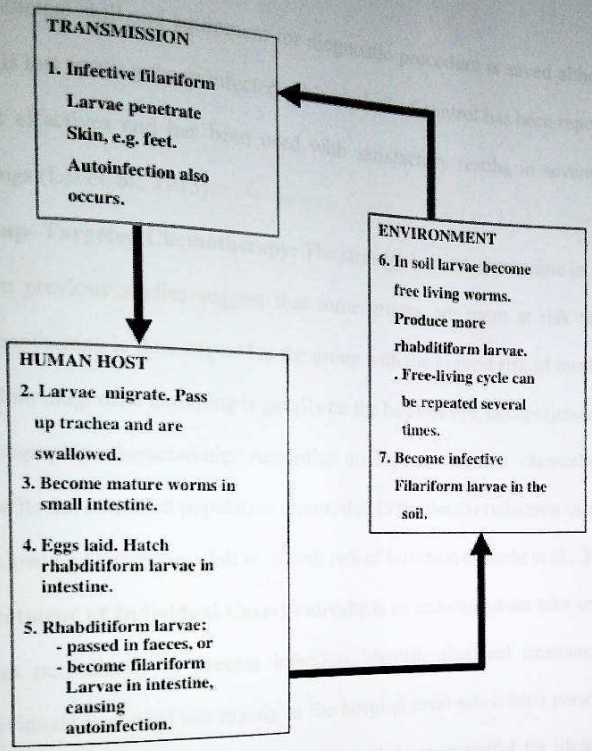

Fig. 2.4 Transmission and life cycle of strongyloides stercoralis. (Cheesebrough, 2006).

2.3.2 Drug Control of Soil-transmitted Helminthes

Chemotherapy

i. **Mass Chemotherapy:** The strategy is most appropriate in areas where existing knowledge suggest that all groups are at equal risk of infection. Treatment is thus, given to all members of the population without prior laboratory diagnosis. The cost

of technical skill and equipment for diagnostic procedure is saved although some cost is lost treating the uninfected. This method of control has been reported as the most effectives and has been used with satisfactory results in several endemic settings (Lai et. al., 2015).

ii. **Group- Targeted Chemotherapy:** The strategy is most appropriate in population when previous studies suggest that some groups are more at risk than others. Chemotherapy is thus targeted at the group with the highest risk of morbidity after random diagnosis. Grouping is usually on the basis of age, occupation or any other demographic characteristic. According to reports targeted chemotherapy also benefits the untreated population groups due to the drastic reduction in community egg load and subsequent fall in overall risk of infection (Asaolu et al., 2002).

iii. **Treatment of Individual Cases:** Individuals in endemic areas take anthelmintic drugs periodically to prevent infection. Identification and treatment of these individuals is carried out mainly at the hospital level when such persons present with symptomatic complaints. This approach is most useful for identifying and treating individuals predisposed to infection with heavy worm burden in a community because it is only severe symptomatic manifestations often associated with very heavy infections that encourages individuals to go to hospitals for alternative treatment. In spite of the selective nature of hospital cases, it also helps to reduce overall community egg load (Ofoezie et al., 2002).

i. **Orthodox**

The drugs which are used for expelling worms are known as *anti-helmintics*. The ideal *anti-helmintics* is one which effectively kills or expels the particular worms for which it is used, is not injurious to the host in the dose required, is easily administered, is active against larval and immature stages and is cheap. No single anthelmintic can kill all the worms even the intestinal worms though near all lead to reduction in morbidity. Nematodes and trematodes, which have digestive tract respond similarly to many drugs although susceptibility to specific drugs and mode of action vary greatly (Grimes et. al., 2014).

Pyrantel Pamoate (anthelmintics) was seen to be effective against A. *lumbricoides* only when given in a single dose. Observation did not show it to be particularly effective to hookworms neither has it been proved to be effective against Trichuris trichiura. Deworming annually or biannually was said to be insufficient especially in areas where rates of transmission and re-infection were high as in the case in most endemic areas in Malaysia. Very often only school children are treated (Pullan et. al., 2014).

2. **Herbal**

Herbs are generally a safe way to strengthen and tone the body's systems. As with any therapy, it is important to work with your health care provider on getting your problem diagnosed, before you start any treatment. Many of the herbs used to treat intestinal parasites have toxic side effects and should be administered under supervision. Some of the drugs used by herbal specialists include garlic (*Allium sativum*), barberry (*Berberis vulgaris*), *goldenseal* (*Hydrrastis canadensis*) (Strunz et. al., 2014).

Plant-based anti-helmintic formulations have been accepted in China where they now serve as an important alternative to the treatment of complications especially *biliary ascariasis*. The major ingredients for the formulation of traditional Chinese medicine (TCM) are derived from plants. Detailed information on the type of plants has been described by several workers (Malicki et. al., 2001). The traditional herbs are said to be taken singly or in combination with the recent *orthodox antyhelminthic* drugs (Karagiannis et. al., 2015). Recent studies have shown that the efficacy of only TCM when compared with a combination therapy has a slight advantage because it is associated with reduced episodes of vomiting thus reducing electrocyte imbalance and the risk of dehydration (Deribe et. al., 2012).

2.3.3 Drugs of Choice:

Mebendazole: Cure rate is said to be 90% in *enterobiasis*. The drug is active against *E. vermicularis* that live in the intestinal lumen. A small. Toxicity is negligible when given in single dose. It is not to be given to children below two years of age.

Alternative Therapy: These include pyrantel. Pyrvinium available in Canada. Ivermectin and Albendezole a newer drug. *Antiparasitic* Agent prophylaxis. This can only serve as part of a comprehensive programme to eradicate infection from a community such as a child's home in which infection is widespread. It is recommended that a single dose of anti *helmintic* may be given to everyone in the family on three or more occasions two weeks apart in conjunction with the general hygienic measures (Mabaso et. al., 2004).

CHAPTER THREE

MATERIALS AND METHOD

3.1 Study Area

This study was conducted in Akeula solid waste dumpsite (ASWD) located at 6°57north - 4°00'east and 6.950°north- 4.000°east, Ijebu-North LGA, Ogun State. ASWD has been active since 2006, relieving 36000tonnes of municipal wastes in area of 14hectares. Sawmills, residential buildings, markets, block industries, schools, churches are located within thirty meter radius of the dumpsites.

Figure 3.1: Map of Akeula's Dumpsite Oru – Ijebu, Ogun State.

(www.google.com)

3.2 Soil Sampling and Preparation

The study area was divided into 9(nine) sampling sites (A-H and the Control area) and a total of twelve samples were collected from each site. Soil sample 40g was collected at each sampling point with the aid of a $0.75m^2$ quadrant thrown at random and with a soil auger at depth 0-15cm. The temperature of the soils was measured in situ.

Samples were collected in labelled air tight polythene bags and immediately transported to the laboratory for analysis. Sampling was done in the first three weeks of September, 2018. Soils samples from the field were analyzed for moisture content, soils to be analyzed for helminths were kept moist in polythene bags pending time of analysis and the remaining soils were transferred into a plastic tray for air drying; large clods of soil were broken to speed up drying. The soil was passed through 2mm sieve to remove stones and other unwanted materials, crushed and ground into fine powder using mortar and pestle and then analyzed for pH, temperature, Exchangeable acidity and electrical conductivity.

Activities in each sampling site within the study area were observed. Site A and B had sorted and burnt waste materials while newly brought in wastes were dumped in site C and D. Site E and F was the sorting region where the scavengers stored the recyclable materials such as plastics bottles, aluminum cans, broken tiles, iron rods, plastics chairs, Site G was covered with wastes deposited for a longtime, while site H was a newly opened section for dumping activities; (Plates A-H) while control area site is where the sawmilling activities takes place.

3.3 Laboratory Analysis

3.3.1 Physico-chemical parameters of soil

The moisture content was measured before air drying the soil samples and estimated in percentage (%). Five grams of soil sample was transferred into previously weighed curvette, followed by the weighing of both the curvette and soil sample (A gram). It was spread across the dish which was then put in an oven and continuously weighed as possible to minimize loss of moisture. It was then dried and after, it was dried, it was removed from the oven and was placed in a dessicators. The sample was cooled at room temperature for about 30minutes and was weighed until there was a constant weight (B gram).

The moisture content was then determined by using the standard method.

$$\% \text{ moisture} = B - C/A$$

Where A = Sample weight in grams

B = Weight of curvette + Sample before drying

C = Weight of curvette + Sample after drying

3.3.2 pH of soil

The pH of soil was measured in the supernant suspension of 2:2; 1-5grams of soil samples was weighed, Added 1-5ml of distilled water and was then shaked vigorously for about 2-3minutes and allowed to settle, the hand helds pH meter was use to take the readings.

Temperature of soil was measured in degree Celsius (°C); 1-5grasm of soil samples was weighed, added 1-5ml of distilled water and was then shakes vigorously for about 2-3minutes and allowed to settle, the Mercury thermometer was used to take the readings.

3.3.3 Exchangeable Acidity

10.0grams fresh sieved soil was weighed into a 100ml extraction cup, 25ml KCL was added, stirred and allowed to settle for 30minutes. The moisture content was determined to separate subsample. It was filtered through a bunched and was then washed with five successive 25ml aliqous of KCL for a total of 150ml KCL per soil sample. Added 5 drops of phenophthalein for the filteration and titrated with 0.1N NaOH to the first permanent pink and end point, the volume of NaOH solution used was recorded. Repeated step 4 for a blank solution of 150ml KCL, also washed through a buncher funnel. The volume of NaOH used was recorded.

Exchangeable acidity (cmol/kg) = (NaOHdiff/W) × (0.1mmolH+/mlNaOH) × (0.1cmolH+/mmolH+) × (10^3g soil/kg soil)

Where: NaOH diff= ml of NaOH added to sample filtrate less ml of NaOH added to blank solution.

3.3.4 Electrical Conductivity

1-5grams of soil samples was weighed, added 1-5ml of distilled water and was then shaked vigorously for about 2-3minutes, and allowed to settle, the hand held E.C meter was used to take the readings.

3.3.5 Helminths Analysis

The soil samples were checked for helminth using Zinc Sulphate centrifugal floatation method. Five grams of soil + distilled water was mixed thoroughly. The suspension was filtered to remove coarse particles while the filterate was centrifuged at 1500rpm for 5minutes and the supernant was decanted. Sediments was mixed with 15ml saturated Zinc Sulphate solution in a centrifuge tube filled to the brim and allowed to stand for a few minute with cover slip superimposed on the tube. The soil sample was centrifuged at 2500rpm for 5minutes, then the cover slip was lifted onto a microscope glass slide and examined for the presence of parasites eggs and larvae under ×40 objective lens.

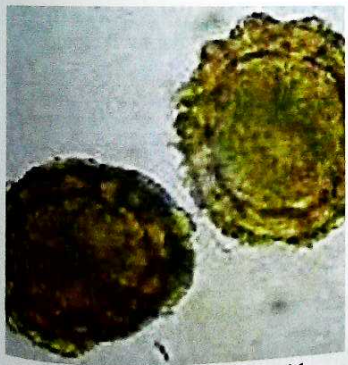

Figure 3.1: Ascaris Lumbricoides

Figure 3.1: Strongyloides Stercorals

CHAPTER FOUR

RESULT

The physicochemical parameters of the soil samples are presented below in Table 4.1, 4.2 and 4.3.According to table 4.1, the PH values of the top soil ranges from 8.21-10.13.The PH values of the top soil were found to be greater than the PH of the control (8.23) except from sample F which has a PH value of 8.21.At the middle and base layer, the PH values were greater than the PH value of the control 7.65 and 8.00 respectively.

Also, the values of the moisture content of the soil (Top, Middle, Bottom) of the studied area ranged from 1.65-11.68 according to (Table 4.1).The moisture content values of the top soil (5.30) were found to be greater than that of the control (2.14) except for sample E which it's the moisture content value was below the value of the control.

According to Table 4.1 also, the values of the temperature (Top, Middle, Bottom) ranges from 27.9-29.5^{0}C the temperature value of all the top soil were found to be lower to the value of the control which was 28.9^{0}C. At the middle, all the soil sample value were that of the control value except for sample B, E and G. (Table 4.1)

Table 4.1, shows the value of the electrical conductivity (EC) of the soil in the study area (Top, Middle, Bottom) ranges from 150-311 µs/cm.The value of EC of the top soil were found to be lower than the value of the control which was 166µs/cm except for sample A which has a value greater than the value of the control which was 196µs/cm, at the middle and base layer which has a greater value than the control which was 122-144µs/cm respectively.

For exchangeable acidity, the values ranges from 0.0049mol/g-0.1678mol/g (Table 4.1).The value of the top layers was less than that of the control which was 0.00501mol/g except for the sample F and H which were found to be greater than the control value which was 0.00503mol/g and 0.00606mol/g respectively. At the middle layer, all the values of the control were greater than the value of the middle sample which was found to be 0.01005mol/g. At the base, most of the value of the samples were found to be greater than the control Area which was lower to the control area which were 0.0079mol/g and 0.0049. From Table 4.2, after the analysis of the helminthes parasites, it was discovered that soil samples from the study area F which has the highest prevalence of the *Ascaris lumbricoides* (n = 8), followed by Area H (n = 7) and Area C (n = 6). For the *Strongyloides stecorals* for all the top layers been examined, the value ranges from 0-2 including the control which has the value of 1.

e 4.1: Result for physicochemical Parameter

Moisture Content			PH			Temperature (°C)			Exchangeable Acidity (mol/g)			Electrical Conductivity		
TOP	MIDDLE	BOTTOM	TOP	MIDDLE	BOTTOM	TOP	MIDDLE	BOTTOM	TOP	MIDDLE	BOTTOM	TOP	MIDDLE	BOTTOM
2.14	19.24	15.48	8.23	7.65	8.00	28.9	28.5	28.5	0.00501	0.01005	0.0121	166	122	144
5.30	4.98	2.30	8.67	9.04	8.71	28.4	28.4	28.4	0.00112	0.035	0.0079	176	150	181
2.02	2.42	1.92	8.85	8.65	8.76	28.5	28.5	28.5	0.0070	0.0105	0.0316	163	311	196
11.68	5.03	2.93	8.27	8.15	8.59	28.5	28.3	28.4	0.455	0.1217	0.0103			
7.26	2.79	1.21	8.40	8.46	8.92	28.4	28.4	28.4	0.175	0.00055	0.00759			
1.65	1.32	2.01	9.13	9.05	10.13	28.4	28.5	28.5	0.0186	0.0309	0.1678			
27.79	2.83	1.90	8.21	8.72	9.89	28.1	27.9	27.9	0.00503	0.0233	0.0233			
3.97	4.33	4.48	8.89	8.89	8.99	28.3	28.1	28.1	0.00307	0.0205	0.0049			
21.22	1.34	1.76	9.15	9.01	9.26	28.0	28.6	28.6	0.00606	0.00545	0.0302			

TABLE 4.2: Physicochemical Parameters in Relations to Helminthes Parasites in the Study Area.

SAMPLE AREA	MOISTURE CONTENT MEAN±SD	PH MEAN±SD	TEMP(0C) MEAN±SD	EXCHANGEABLE ACIDITY MEAN±SD	ELECTRICAL CONDUCTIVITY MEAN±SD	ASCARIS LUMBRICOIDES	STRONGYLOIDES STERCORALS
CT	12.3±0.4	18.0±1.5	28.6±2.7	0.0091±0.0001	144±10.5	2	1
A	4.19±0.05	8.81±1.3	28.4±2.5	0.044±0.002	169±12.2	5	2
B	1.5±0.01	8.7±1.2	28.5±2.51	0.014±0.001	223.3±9.7	2	0
C	5.5±0.04	8.6±1.2	28.4±5	0.121±0.02		6	1
D	3.14±0.03	8.8±1.2	28.4±2.4	0.023±0.002		7	1
E	1.1±0.009	9.01±1.3	28.0±2.51	0.014±0.001		2	1
F	10.23±0.3	8.5±1.2	28.0±2.0	0.004±0.0001		8	2
G	2.5±0.015	8.82±1.2	28.4±2.1	0.002±0.0001		2	1
H	7.23±0.25	9.11±1.3	28.2±2.1	0.04±0.002		7	1

Table 4.3: Helminthes Prevalence

Area	**Ascaris *lumbricoides*** 5grams of each sample	**Strongyloides *Stecorals*** 5grams of each sample
Ct	2	1
A	5	2
B	2	0
C	6	1
D	7	1
E	2	1
F	8	2
G	2	1
H	7	1

Table 4.4: Distribution and prevalence of helminthes in soil samples within Akeula dumpsite

Area	Number examined	Ascaris lumbricoides (%)	Strongyloides stecoralis (%)
Ct	9	2(22.2)	1(11)
A	9	5(56)	2(22)
B	9	2(22.2)	0(0.0)
C	9	6(67)	1(110
D	9	7(77)	1(11)
E	9	2(22.2)	1(11)
F	9	8(89)	2(22)
G	9	2(22.2)	1(11)
H	9	7(77)	1(11)
TOTAL	81	43(53)	10(12.3)

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Discussion

Helminthes are mostly found in the soil with high moisture contents, low temperature, slightly alkaline condition (www.google.com). In this analysis, according to table 4.1, the moisture content varies from (1.65-11.68), at the top of the moisture content values and that of the control which aids or support the existence or survival of the helminthes (Ascaris lumbricoides), unlike the analysis conducted by the department of Pre-ND science and technology, Kano State Polytechnics where the moisture contents was very low at the top layer of the soil examined and this leads to low prevalence of the helminthes area C,F,H, at the top layer has high prevalence of the Helminthes (Table 4:2). The alkalinity of the soil ranges from 7.0-14 for the analysis alkalinity varies from 8.21-10.23 (Table 4.1)which shows the high alkalinity in the soil examined for the mean PH of the control site, it was 18.0 which is out of scale this is probably affected the prevalence of helminthes in the control area top (Table 4.3) and for other areas, like Area C,F has little alkalinity contents which support the high prevalence of helminthes, other that has low alkalinity like area G, has low prevalence of helminthes due to other unfavorable physicochemical properties. (Table4.3), unlike the Kano polytechnics analysis where high alkalinity was discovered which led to low prevalence of helminthes. The values of temperature ranges from 27.9-29.5 (Table 4.1) which shows high temperature for the survival of helminthes Area C,F,H where prevalence of Helminthes are high has high

moisture contents which aids and support their prevalence (Table 4.3) compared to the Ibadan Polytechnics analysis year 2008, with low temperature and high moisture contents which made almost all the areas examined has high prevalence of Helminthes. The values of Electrical conductivity ranges from (150us/cm-311Us/cm) with the control sites having the lowest value. This indicates a higher amounts of soluble salts (Table 4.1). In the analysis of the Kano polytechnics the electrical conductivity values ranges from 10us/cm-540us/cm, this also indicates high amount of soluble salts. The ability of exchangeable cations is one major soil property that controls the fate of ionically charged contaminants in soils. Exchangeable acidity increases with the higher pH of 7.0. However, the present's results shows higher values of pH which Aids exchangeable acidity that ranges from 0.0049-0.1678 (Table 4.1). The value of the top layer is less than that of the control except for Area F, which values was greater than that of the control site value. The high value of exchangeable acidity doesn't support the survival of Helminthes parasites. Same occurred in the Kano Polytechnics analysis which ranges from 0.002-0.105, this affected the prevalence of the helminthes parasites. According to this analysis, the prevalence of Helminthes is low on the dumpsite (Akeula) because out of the nine areas analyzed (Ascaris lumbriocoides) and all has low prevalence of the other Helminthes (Stronglyloides stecorals) (Table 4.2)

5.2 Conclusion

This study was carried out to investigate the helminthes parasite in soils from Akeula dumpsite, Oru. The overall prevalence of soil helminthes was found to be low at

the dumpsite because among the nine sample areas analyzed only three has high prevalence of the helminthes parasites.

5.3 Recommendations

Scavengers and dumpsite workers should be encouraged to use personal protective gears at the site to reduce the risk of helminthes infestation. Citing of residential buildings and social amenities close to dumpsites should be discouraged as dumpsites often have a high elevation due to accumulated refuse and this can support the movement of pollutants to residential area with short and long term health effects.

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