PREVALANCE OF SOIL PARASITE ON PRIMARY SCHOOL PLAYING GROUND

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BEING A PROJECT SUBMITTED TO THE

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CERTIFICATION

This is to certify that this project work was carried out by **Abdulrahman Amotulbasit Olayemi** with Matriculation Number **19/06/0054**, **Gbemisola Victoria Oluwafunmilayo** with Matriculation Number **19/06/0038** and **Okeremu Miracle Janet** with Matriculation Number **19/06/0059** in the Department of Science Laboratory Technology, School of Science, Abraham Adesanya Polytechnic, Ijebu - Igbo, under my supervision.

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DEDICATION

This project is dedicated to the Almighty God, the Alpha and Omega for life, wisdom, knowledge and understanding, for his grace throughout our programme.

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Glory be to God Almighty, the lover of our souls, the alpha and Omega, our helper for his mercy and grace over our life for making this project a success, praise be to His Holy name.

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ABSTRACT

This study explored the prevalence of soil parasite among primary school pupils in Ijebu Igbo and Ijebu Ode community of Ogun State. Soil samples were collected randomly in five primary schools, 4 schools in Ijebu Igbo and 1 school in Ijebu Ode. 3 soil samples were taken from each of the 5 sample points. A total of 15 soil samples were collected altogether from these points and returned to the laboratory in black polythene bags for the analysis of soil physical and chemical characteristics and presence and number of helminth eggs. Out of the 15 soil samples examined, the number of *Ascaris spp.* detected was 12 (90%) and *T. trichiura* was 3 (15%). Each of the study sites had different contamination rate for *Ascaris spp.* and *Trichuris spp.* The entire collected soil sample showed positive for *Ascaris spp.* Zenith Group of Schools n=3, Tubal group of schools, n=1, Higher Grace Nursery and Primary school n=2, Parent Pride Group of Schools n=2 Solid Academy Nursery and Primary school n=1. Where else, for *T. trichiura* the contamination was slight lower than that of *Ascaris spp.* The results of the present study showed that the soil in the environment at Ijebu Igbo and Ijebu Ode was contaminated with *Ascaris spp* and *T. trichiura*. The presence of contaminant STHs eggs plays an important role affecting the health of the pupils. Hence, an educational campaign on adverse effects of T. trichiura and A. lumbicoides infections in schools need to be constantly encouraged by the health authorities to practise good sanitary habits to reduce parasitic infections.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Soil-transmitted helminths are intestinal parasites of humans transmitted through contaminated soil. They are considered neglected tropical diseases found mainly in areas with warm and moist climates where living condition and personal hygiene are poor (W.H.O, 2020).

Infectious diseases caused by soil transmitted helminth (STH) remain issues of major importance and are the most common diseases in humans, affecting up to an estimated 2 billion people (de Silva et al., 2003). STH proliferation occurs in soil in unsanitary environments, in which STH eggs in human or animal faeces develop and cause faecal oral infection (Balen et al., 2011). Surveys of soil contamination of STH eggs have been conducted in many countries, especially in developing countries in South America and Asia (Korkes et al., 2009) have reported a recovery rate of 7-20% for *Ascaris spp.* and hookworm eggs in urban slums in Brazil. In suburban areas in Indonesia (Uga et al., 1995), a fishing village in Thailand (Chongsuvivatwong et al., 1999), and surrounding fields and houses in Nepal (Rai et al., 2000), 20-83% of *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworm eggs have been recovered from soil. STH infection is concern both in developing and developed countries. STH infection in developed countries is mainly caused by imported cases from tropical countries and larva migrans is caused by Toxocara canis or Toxocara cati (Holland & Smith, 2005). Larva migrans caused by *Toxocara spp.* has been given special attention owing to its high prevalence, pathogenicity, and wide distribution area.

1.2 Statement of problem

Soil-transmitted helminthiasis is classified by the World Health Organization (WHO) as one of the neglected tropical diseases (NTDs) (W.H.O, 2020) and are among the most prevalent NTDs (James et al., 2018). Soil-transmitted helminth (STH) infections are endemic in 166 countries worldwide (Pullan et al., 2014) with a global burden of more than 3 billion people occurring mainly in sub-Saharan Africa, South and North America, China, and East Asia (W.H.O, 2020). These infections mainly affect the poorest and most deprived communities which are characterized by poor sanitation, lack of potable water, inadequate health facilities, poor housing, overcrowding, and squalid environment (Midzi et al., 2014).

Nigeria has been identified as the country with the highest burden of soil-transmitted helminthiasis (STH) in sub-Saharan Africa. Soil-transmitted helminthiasis is caused by ingestion of eggs of *Ascaris lumbricoides* and *Trichuris trichiura* or by active penetration of the skin by larvae of *Ancylostoma duodenale* and *Necator americanus* (hookworms) in the soil (W.H.O, 2020). Infections with these parasites are known to be associated with hepatosplenomegaly and portal hypertension, chronic inflammation, gastrointestinal problems, anaemia, and depletion of nutrients in children, thereby leading to adverse effect on physical and cognitive development (W.H.O, 2020). School-aged children (SAC) harbour the highest prevalence and intensity of helminth infections in sub-Saharan Africa (SSA) (Hotez et al., 2009).

Currently, control measures adopted in Nigeria consist of treatment once annually with either albendazole or mebendazole for STH infections and praziquantel for schistosome infections. This programme is achieved through school-based deworming (SBD) carried out by the State Ministries of Health in collaboration with the Federal Ministry of Health Nigeria (FMoH), WHO, and other nongovernmental organizations (NGOs). This programme (Givewell, 2018) offers treatment of all school children in the country. Due to the poor environment as well as poor hygiene behaviour by individuals, reinfection occurs rapidly after treatment. Therefore, there is a need for constant surveillance to determine the current infection status and geographical overlap between soil-transmitted helminths. This study investigated the current status of soil-transmitted helminth in some selected communities in Ogun State, Nigeria.

1.3 Aim and objectives

The aim of this study is to determine the prevalence of soil parasite among primary school pupils in Ijebu Igbo and Ijebu Ode community of Ogun State.

CHAPTER TWO

LITERATURE REVIEW

2.1 Parasitic Infections

Parasitic infections cause a tremendous burden of disease in both the tropics and subtropics as well as in more temperate climates (Mavridou, et al. 2018). Of all parasitic diseases, malaria causes the most deaths globally. Malaria kills more than 400,000 people each year, most of them young children in sub-Saharan Africa (Shretta et al., 2018).

The Neglected Tropical Diseases (NTDs), which have suffered from a lack of attention by the public health community, include parasitic diseases such as lymphatic filariasis, onchocerciasis, and Guinea worm disease (Mavridou, et al. 2018). The NTDs affect more than 1 billion people worldwide, largely in rural areas of low-income countries. These diseases extract a large toll on endemic populations, including lost ability to attend school or work, stunting of growth in children, impairment of cognitive skills and development in young children, and the serious economic burden placed on entire countries (Mavridou, et al. 2018).

A parasite is an organism that lives on or in a host organism and gets its food from or at the expense of its host. There are three main classes of parasites that can cause disease in humans: protozoa, helminths, and ectoparasites (Mavridou, et al. 2018).

2.1.1 Prorozoa

Protozoa are microscopic, one-celled organisms that can be free-living or parasitic in nature (Dar et al., 2020). They are able to multiply in humans, which contributes to their survival and also permits serious infections to develop from just a single organism. Transmission of protozoa that live in a human's intestine to another human typically occurs through a fecal-oral route (for example, contaminated food or water or person-to-person contact). Protozoa that live in the blood or tissue of humans are transmitted to other humans by an arthropod vector (for example, through the bite of a mosquito or sand fly) (Dar et al., 2020).

The protozoa that are infectious to humans can be classified into four groups based on their mode of movement:

- Sarcodina – the ameba, e.g., *Entamoeba*
- Mastigophora – the flagellates, e.g., *Giardia, Leishmania*
- Ciliophora – the ciliates, e.g., *Balantidium*
- Sporozoa – organisms whose adult stage is not motile e.g., *Plasmodium, Cryptosporidium*

2.1.2 Helminths

Helminths are large, multicellular organisms that are generally visible to the naked eye in their adult stages (Saberi et al., 2018). Like protozoa, helminths can be either free-living or parasitic in nature. In their adult form, helminths cannot multiply in humans. There are three main groups of helminths (derived from the Greek word for worms) that are human parasites:

- Flatworms (platyhelminths) – these include the trematodes (flukes) and cestodes (tapeworms).
- Thorny-headed worms (acanthocephalins) – the adult forms of these worms reside in the gastrointestinal tract. The acanthocephala are thought to be intermediate between the cestodes and nematodes.
- Roundworms (nematodes) – the adult forms of these worms can reside in the gastrointestinal tract, blood, lymphatic system or subcutaneous tissues. Alternatively, the immature (larval) states can cause disease through their infection of various body tissues

Some consider the helminths to also include the segmented worms (annelids)—the only ones important medically are the leeches. Of note, these organisms are not typically considered parasites (Saberi et al., 2018).

2.1.3 Ectoparasites

Although the term ectoparasites can broadly include blood-sucking arthropods such as mosquitoes (because they are dependent on a blood meal from a human host for their survival), this term is generally used more narrowly to refer to organisms such as ticks, fleas, lice, and mites that attach or burrow into the skin and remain there for relatively long periods of time (e.g., weeks to months) (Saberi et al., 2018). Arthropods are important in causing diseases in their own right, but are even more important as vectors, or transmitters, of many different pathogens that in turn cause tremendous morbidity and mortality from the diseases they cause.

2.2 The parasitic worms

Helminthiases are parasitic worm infections that cause morbidity to their host. They infect man and animals, causing stunted growth and a substantial threat to health. Helminths infection is a huge challenge, both in developing and developed countries due to their continuous contamination of the environment with their eggs and larvae (Nalule et al., 2013). Helminths diseases are one of the most neglected among the healthcare systems. Its neglect could be as a result of it chronic and asymptomatic nature of infection, particularly at an early stage. Helminth infections can, however, cause severe debilitation, morbidity and economic loses among human and livestock. The most common helminths are the soil-transmitted helminths (STH) or intestinal nematodes, filarial worms, schistosomes and onchocerciasis worm. The life cycle of a parasite worm could be very complex, with multiple hosts for different stages; moreover, a major adaptive uttermost parasitism of a worm is a complex life cycle involving trophic transmission (Kasl et al., 2018). The developmental life-cycle of some helminths (soil-borne nematodes) such as Strongyloides and Hookworms have a free-living stage (rhabditiform larvae) and a parasitic stage (filariform larva) which may require a different host or environment.

2.2.1 Symptom and diagnosis of helminths

The symptoms of helminths depend on some factors which should be considered during diagnosis. The factors include: the type of worm infection, the duration of infection, the area of infection and the worm burden in the host. The common symptoms of helminthiases are: abdominal pain, diarrhoea, malnutrition, fatigue, enlarged liver and spleen, gastrointestinal inflammation, pneumonitis, blindness, eosinophilia, bowel obstruction, anaemia, vomiting, constipation, lymphedema, weight loss, itchy skin and or anus (Manke et al., 2015). Long-term exposure to helminths and the worm burden in the infected person is directly related to morbidity and severity of the disease, in almost all kinds of worm infections. There are ranges of diagnostic tools for helminthic infection, which include:

i. ***Fecal egg examination***: the parasite (s) is identified by microscopically examining the eggs in the faeces of the host, for instance in the case of *Haemonchus contortus, Ancylostoma duodenale, Hymenolepis diminuta* and schistosomes infection

ii. ***Antigen test***: parasites produce enzymes, hormones and waste that activate the immune response of the host. This response is a biomarker that could be quantified and qualify but this area of diagnosis is still undeceveloped

iii. ***Serological assay***: the serum of the host is examined for the parasite-specific antibodies, Echinococcosis can be diagnosed using this technique

iv. ***Nucleic Acid-based Diagnosis***: every organism carries unique DNA sequences. This diagnostic probe is sensitive and specific. It is developed to identify and isolate DNA sequences of different species of parasite.

v. **Urine examination:** uses point-of-care circulating-cathodic-antigen (POC-CCA) urine test or microscopically examining parasite eggs in host urine, commonly used as a diagnostic tool for Schistosomiasis.

vi. ***other tools***: could involve physical examination of infected areas, confirmation of parasite hydatid cysts in the tissue of the host in the case of Echinococcosis (Oliveira et al., 2018).

2.2.2 Prevalence of helminthiases

The prevalence of helminth is high in tropical and subtropical areas of the world (WHO, 2017); and it is more likely to increase with global climate change especially in the area of poor social infrastructures and lack of sanitation. Hotez et al. (2006), reported an estimate of 187 million people suffers from Schistosomiasis in Sub-Saharan Africa, India, China, East Asia and the Americas. Taylor et al. (2010), reported 90% of the estimated 120 million cases of lymphatic filariasis was caused by *Wuchereria bancrofti* in about 83 countries in Africa, Asia, South and Central America. In 2010, it was estimated globally; 819.0 million (95% Credible Interval (CI), 771.7–891.6 million) were infected with *A. lumbricoides*, 464.6 million (95% CI, 429.6–508.0 million) are infected with *T. trichiura*, and 438.9 million people (95% CI, 406.3–480.2 million) cases of hookworm was reported (Pullan et al., 2014).

It was also documented that helminths undergo adaptation and evolutionary changes due to climatic change or resistance to anthelmintic drugs (Hotez et al., 2016). The adaptation of helminths to this hash environment, encourage the high prevalence of the parasites in the pandemic regions.

2.2.3 Common drugs and resistance of helminths

Helminths are categorized into three major groups: nematodes (roundworms), trematodes (flukeworms), and cestodes (tapeworms). Almost all these parasites could be treated and the level of infection could be reduced below clinical significance with one or a combination of the following categories of anthelmintic drugs: benzimidazoles, macrocyclic lactones, levamisole, piperazine and amino-acetonitrile derivatives (Aremu et al., 2012). However, the resistance of helminths to these drugs has been recorded in some literature which is common in the field of veterinary medicine (Prichard, 2008).

The resistance of helminths to drugs poses health complications to both man and animals worldwide. The knowledge of the genetics and mechanisms of helminths resistance to drugs is essential to prevent resistance, to newly developed anthelmintic drugs, to reduce the spread of resistant parasites and to better manage parasite control at all stages of their lifecycle (Prichard, 2008). The resistance of gastrointestinal nematodes and also in others parasites worms such as liver fluke was documented to be high in ruminant (Morgan et al., 2013). It is, therefore, necessary for parasitological exploration of the mechanisms of anthelmintic resistance in other to develop alternative treatment approaches and drugs for the control of helminths. The main strategies leading to the discovery of new anthelmintic drugs were mainly based on the screening of new drugs via an *in vitro* and *in vivo* test systems (James et al., 2009).

2.2.4 Alternative cure and drug resistance

Resistance to each of the categories of anthelmintic drugs has been reported and there is a need for new drugs with different mechanisms of action (James et al., 2009). Plants produce a broad spectrum of secondary metabolites or phytochemicals which aid in several biological activities including the defence of the plant against pests and diseases. The major classes of phytochemicals include phenolic, alkaloids and terpenoids compound. These phytochemicals make some plants a good source of remedy for ailments. Plant secondary metabolites have been successfully used in ethnomedicine and are generally used for: insecticide, piscicidal, molluscicidal, antimicrobial, antiparasite and other ailments. The global demand for herbal medicines is rapidly on the increase (Kuria et al., 2012). The out-of-pocket spending on complementary health services and herbal products was estimated to US$83.1 billion in 2012 and US$14.8 billion in 2008, in China and the United States of America respectively (Qi Z. and Kelley, 2014).

A relative number of medicinal plants have been reported to possess anthelmintic activity in modern medicine and also utilized by folk ethnic groups worldwide. Several medicinal plants have been identified following the folk medicine claims and the isolated phytochemicals have been scrutinized for their anthelmintic activities in the search for novel anthelmintic drugs (Yellasubbaiah et al., 2015). There are several promising results obtained from *in vitro* and *in vivo* studies of antihelmintic medicinal plants but few or none of these results was translated into clinical practice (Wink, 2012). In this review, focus is on parasitic worms and its prevalence.

2.3 Burden of soil-transmitted helminths

2.3.1 Morbidities associated with soil-transmitted helminthiasis

Despite the near-ubiquitous nature of soil-transmitted helminths on a global scale, it is hard to assess the true burden due to these infections as limited research has been carried out to investigate the morbidities associated with them (Nagpal et al. 2013). Furthermore, due to the chronic and subtle nature of most morbidities commonly associated with these parasites, communities might view the symptoms as a normal condition rather than one to be reversed. Hence, they might not report the symptoms if asked, or sense any need to seek treatment even though these infections might have long-term negative impacts on their health: physical and cognitive development as well as work productivity (Eppig et al. 2010). Single-species infections with soil-transmitted helminths can cause symptoms ranging from abdominal pain, dysentery and physiological abnormalities in the intestinal tract to anaemia, pruritus, skin eruptions and impairment of the development of cognitive abilities. For S. stercoralis infections, which are especially neglected, symptoms such as severe abdominal pain, blood in the stool, cough and skin eruptions have been reported (Becker et al. 2011). The level of morbidity is strongly correlated to the numbers of worms the host harbours and individuals afflicted with multiparasitism arguably experience increased morbidities compared to people with single species infections (Brooker 2010). It is estimated that 300 million people worldwide suffer from severe morbidity due to soil-transmitted helminths, which also causes 10,000-135,000 deaths annually (Lustigman et al. 2012). Globally, years of life lost (YLLs) due to A. lumbricoides infections alone is at 204,111 (Lozano et al. 2012). The presence of soil-transmitted helminths in the host can also increase nutrient loss, frequently in the form of blood loss in the faeces, or by causing diarrhoea. Different nutrients are critical for specific immune functions and defenses. When an individual is deficient in any of them, a disruption in the immune integrity will result and eventually lead to increased susceptibility to infections (Malafaia et al. 2009). In terms of macronutrients, proteins are essential for antibody and interleukin formation (Malafaia et al. 2009), while lipids and carbohydrates play important roles in T cell production and function (Gershwin et al. 2000). In addition, a range of micronutrients has also been associated with healthy immune functions. Vitamin A guards the integrity of the epithelium in the respiratory and gastrointestinal tracts. A deficiency in vitamin A results in an increased risk for diarrhoeal infections (Katona-Apte 2008). Both vitamins C and E are antioxidants, which scavenge free radicals and protect the body from oxidative damage. Vitamin E also enhances cell division and interleukin production in naive T cells (Maggini et al. 2010). Zinc plays an important role in neutrophil and natural killer cell functions and complement activity. A deficiency in zinc suppresses antibody production and decreases the counts of T and B cells (Maggini et al. 2010). Iron is associated with cell-mediated immunity as well as neutrophil function and hence, a lack of this element will also reduce immune defenses against infections (KatonaApte 2008). Several studies investigated the nutritional status of individuals infected with soiltransmitted helminths. In communities where food resources are scarce, stunting (low height-for-age), wasting (low body mass index-for-age) and anaemia are common indicators for undernourishment used for such assessments (FAO 2012).

Finally, anaemia and undernutrition, associated with multiparasitism were investigated in northern Rwanda. Children and adolescents, aged 5-20 years, were grouped into different multiparasitism profiles and their height, weight, haemoglobin concentration and A. lumbricoides, hookworms, T. trichiura and S. mansoni infection status were assessed. The study revealed that the levels of multiparasitism and infection intensities in this region were lower compared to other regions in sub-Saharan Africa. Subsequently, none of the multiparasitic infection profile was found to be significantly associated with stunting and being anaemic. However, the odds of being wasted were two times higher for children with simultaneous infection of at least two helminth species of moderate to high intensity as compared to children with mono-infection of low intensity or no infection (Mupfasoni et al. 2009). Soil-transmitted helminth infections have also been shown to retard the cognitive development of infected children. Studies suggest that different intestinal helminth infections have distinct impacts on a child's cognitive development and children with multiparasitism suffer worse cognitive outcomes than children infected with a single helminth infection (Eppig et al. 2010). In the Philippines, Ezeamama and colleagues (2005) reported, in a cohort of children, prevalences of 92%, 74% and 46% for T. trichiura, A. lumbricoides and N. americanus, respectively. These infections were shown to be significantly associated with reduced performance in cognitive tests. Another study in Jamaica illustrated that when T. trichiura infections were cleared in children, gains in auditory short-term memory, and the scanning and retrieval of long-term memory could be observed (Nokes et al. 1992). Similarly, in Indonesia, children were shown to have improved learning ability, eye-hand coordination, and cognitive test scores after A. lumbricoides infections were removed with chemotherapy (Hadidjaja et al. 1998). However, a recent randomized controlled trial in Sri Lanka concluded that cognitive test scores did not increase despite a reduction in soil transmitted helminth infections due to successful school-based deworming (Ebenezer et al. 2013). Studies attempting to correlate reduced school performance and physical fitness with soil-transmitted helminth infections have also been conducted. While children performed better in school after treatment of T. trichiura infections in a study in Jamaica (Simeon et al. 1995), another study in Guatemala showed that getting rid of A. lumbricoides infections did not lead to improvements in school performance (Watkins et al. 1996). In Kenya, studies have highlighted that reduced physical fitness was correlated with soil-transmitted helminth infections and treatment of these infections led to improved physical fitness in school-aged children (Bustinduy et al. 2011). However, another study in Côte d'Ivoire found no such correlations. Of note, the prevalence and intensity of soil-transmitted helminth infections in that study were very low (Müller et al. 2011). Due to the limited and sometimes conflicting findings regarding the impact of soil-transmitted helminth infections on cognition, school performance and physical fitness, only morbidities such as anaemia due to hookworm, rectal prolapse due to T. trichiura, and bile duct or intestinal obstruction due to A. lumbricoides, have been well established and recognized within the scientific community (Lustigman et al. 2012). Indeed, under the Global Burden of Disease Study (GBD), the collective disability weight of intestinal nematode infections, which include soil-transmitted helminthiases, is a mere 0.03 on a scale from 0 (perfect health) to 1 (death) (Salomon et al. 2012).

2.3.2 Estimating the global burden of soil-transmitted helminthiasis

Understanding the burden of a disease can be challenging, but its public health importance cannot be emphasized enough. Quantifying the burden of soil-transmitted helminth infections will allow evidence-based decision-making for the allocation of limited health care resources (Nagpal et al. 2013). The first attempt to estimate the burden due to these parasitic worms using the concept of disability-adjusted life years (DALYs), the universal currency for quantifying ill-health, was performed by Murray and colleagues (1994) under the GBD Study in the 1990s (WB 1993). By defining a disability weight for each unique disease and then weighting the years lived with this disability, they were able to estimate the years lost due to the disability. DALYs have since been used effectively to quantify disabilities and pre-mature deaths associated with most diseases (Chan 1997). In 1990, all high intensity soil-transmitted helminth infections were given a disability weight of 0, but intestinal obstruction due to A. lumbricoides, rectal prolapse due to T. trichiura, and anaemia due to hookworm were assigned disability weights of 0.463, 0.116, and 0.024, respectively (Mathers et al. 2007). Based on these weights, A. lumbricoides, T. trichiura, and hookworms were calculated to cause a loss of 4.2, 0.9 and 3.9 million DALYs, respectively, giving a collective burden of 9.0 million DALYs (Murray & Lopez 1994, Murray et al. 1994). Within the community of experts on soil-transmitted helminthiases, a re-calculation was attempted on grounds of underestimation by the GBD Study. This gave rise to an estimate of 10.5, 6.4 and 22.1 million DALYs due to A. lumbricoides, T. trichiura and hookworm infections, respectively, resulting in a more substantial collective burden of 39.0 million DALYs (Bundy 1994). The much higher burden of hookworms was attributed to anaemia, especially in women of reproductive age. Murray and colleagues (1994) previously classified hookworm-induced anaemia under anaemia, instead of soil-transmitted helminth infections. Most of the DALYs were concentrated in the school-aged population, as they have the highest prevalence and infection intensity of soil-transmitted helminths, and a younger person with a permanent disability would incur more years lost than an older person (Chan 1997). The GDB was conducted again in 2010 to provide more comprehensive updates of the burden estimates for a wider range of diseases and conditions (Murray et al. 2012). In this study, A. lumbricoides, T. trichiura and hookworm were calculated to have 1.3, 0.6 and 3.2 million DALYs, respectively, giving a collective burden of 5.2 million DALYs (Lozano et al. 2012). One of the limitations of the DALY estimates for soil-transmitted helminth infections is that it is almost impossible to assign accurate individual disability weights to each species due to the worldwide presence of multiparasitism. The use of quality adjusted life years (QALYs) has thus been promoted to more comprehensively capture the impact of soil-transmitted helminth infections on infected individuals. QALY values are calculated based on health-related quality of life (QoL) questionnaires administered to infected communities. QoL-related visual analogue scales and the short European quality of life (EuroQoL 5D) questionnaire are deemed to give a multidimensional illustration of the impact of a given condition, including soil-transmitted helminthiasis (King 2010). However, studies testing the validity of the concept of QALYs to account for morbidity due to soil-transmitted helminth infections are inadequate. These QoL questionnaires are very general and more suitable for the developed world and therefore, their applicability in rural communities, especially ethnic minority groups with certain strong cultural preferences, is questionable. Their effectiveness in detecting subtle and chronic morbidities due to soil-transmitted helminthiasis is still unclear. Indeed, when standardised QoL questionnaires were used in an attempt to assess self-rated quality of life and burden of soil-transmitted helminth infections in Yunnan province, the cultural unsuitability of these tools was noted. In such a case, the perception, and hence the reported outcome is not an accurate reflection of the reality (Ziegelbauer et al. 2010). Before the morbidities associated with chronic soil-transmitted helminth infections are better defined, it will be difficult to give an accurate estimate of the public health burden due to these diseases. As much as we need an improved algorithm to calculate the public health burden of soil-transmitted helminth infections, we must also find new tools to assess morbidities, which are caused by or could potentially be associated with them.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study Area

The study was conducted in Ijebu Igbo (6° 58' 0" N, 4° 0' 0" E) and Ijebu Ode (6° 49' 15" N, 3° 55' 15" E), two towns in Ijebu North Local Government and Ijebu Ode Local Government respectively in Ogun State, Nigeria. The language of communication among dwellers in this communities is largely Yoruba.

3.1 Sample collection

Soil samples were collected randomly in five primary schools, 4 schools in Ijebu Igbo and 1 school in Ijebu Ode. The Schools where the samples were collected are: Zenith Group of Schools located at Atikori, Ijebu Igbo Tubal group of schools located and Higher Grade Nursery and Primary at Idode Area in Ijebu Igbo, Parent Pride Group of Schools located at Oke Agbo, Ijebu Igbo, Solid Academy Nursery and Primary School located at Ijebu Ode. 3 soil samples were taken from each of the 5 sample points. A total of 15 soil samples were collected altogether from these points and returned to the laboratory in black polythene bags for the analysis of soil physical and chemical characteristics and presence and number of helminth eggs.

3.2 Laboratory Analysis

About 2 grams of soil sample was emulsified in 10 ml distilled water and strained through two layers of gauze in a funnel. The filtrate was centrifuged at 1000 (rpm) for 7 minutes. The supernatant was discarded, and the sediment was suspended in 7 ml of formalin (10%) and allowed to stand for 10 minutes. Next, 3 ml of ethyl alcohol was added to the suspension and vortexed. The stopper was then removed and centrifuged at 1000 (rpm) for 7 minutes. The tube was allowed to rest in a stand for 5 minutes. Four layers consisting of ethyl plug of debris, formalin and soil sediment containing STHs (from top layer to bottom layer) was used for observation under the microscope. The plug of debris was detached from the side of the tube with the aid of a glass rod and the liquid was poured off leaving a small amount of formalin for suspension of the sediment. It was poured on a clean glass slide, covered with coverslip and examined under the microscope after mixing with a drop of formalin (Al-Khames' et al., 2014). The positive samples were calculated using formula as described by Rai et al., 2000 as stated below:

$$\text{Positive (\%)} = \frac{\text{Number positive samples}}{\text{100\% Total of samples}} \times 100$$

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Result

Out of the 15 soil samples examined, the number of *Ascaris spp* detected was 12 (90%) and *T. trichiura* was 3 (15%). Each of the study sites had different contamination rate for *Ascaris spp* and *Trichuris spp*. The entire collected soil sample showed positive for *Ascaris spp*. Zenith Group of Schools n=3, Tubal group of schools, n=1, *Higher Grade* Nursery and Primary school n=2, Parent Pride Group of Schools n=2 Solid Academy Nursery and Primary school n=1. Where else, for *T. trichiura* the contamination was slight lower than that of *Ascaris spp*. Only three sites of collection were positive; Zenith Group of Schools n=2, Higher Grade Nursery and Primary n=1 Solid Academy Nursery and Primary n=2.

Table 4.1: Occurrence of Soil Transmitted Helminths (STHs) at each site

S/N	Sample Site	*Ascaris spp.*	*T. trichiura*
1.	Zenith Group of Schools	3	2
2.	Tubal group of schools	1	0
3.	Higher Grade Nursery and Primary school	2	1
4.	Parent Pride Group of Schools	2	0
5	Solid Academy Nursery and Primary school	1	2

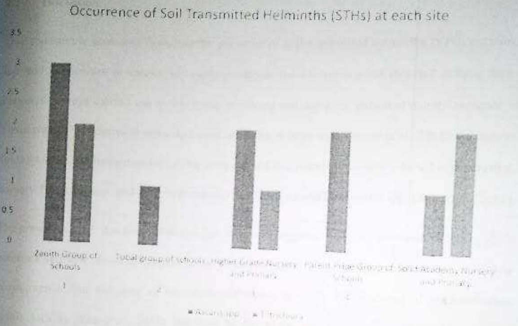

Figure 4.1 Occurrence of Soil Transmitted Helminths (STHs) at each site.

4.2 Discussion

This soil sample screening indicated the presence of soil transmitted helminths (STHs). *Ascaris spp.* and *T. trichiura* in various soil types collected. Hookworm was not detected in these areas. Previous surveys carried out in Malaysia involving soil samples, indicated mainly presence of Toxocara (9.1%) species in urban and rural areas due to stray dogs (Azian et al., 2008) and another findings indicated more than half of the stray cat and dog populations were infected with parasites, namely Toxocara spp. and Ancylostoma spp., an Isospora and Spirometra spp. (Zain et al., 2015).

The prevalence of Ascaris lumbricoides infection suggests that the problems of unhygenic practises and low level of sanitation were not restricted to age group in the studied area. The demographic data indicated no significant difference between the incidence of geo helminthes in this locality (Yap et al., 2012) This may be due to the fact that there were low level of health education about factors influencing transmission of soil transmitted helminthes for the students, teachers and parents of pupils of the schools.

5.1 Conclusion

The results of the present study showed that the soil in the environment at Ijebu Igbo and Ijebu Ode was contaminated with *Ascaris spp.* and *T. trichuro*. The presence of contaminant STHs eggs plays an important role affecting the health of the pupils. Hence, an educational campaign on adverse effects of T. trichiura and A. lumbicoides infections in schools need to be constantly encouraged by the health authorities to practise good sanitary habits to reduce parasitic infections. The role of domestic animals can be of additional risk in transmitting STHs. The screening of soil samples can be also used as a quality control to check the sanitation conditions in the environments.

5.2 Recommendation

Based on the result gotten from this research, Anti-intestinal helminth infection campaign should be conducted in the study area so as to reduce the prevalence of infection. Prompt control programmes against these parasitic infections should commence. There is a need for integrated periodical education and mass treatment with an antihelminthic drug to effectively control intestinal helminth in the study area. The long term prevention and control of parasitic diseases will include economic development and improvements in water supplies, sanitation, health education and socio-economic status. Additional studies on control of parasitic diseases should be carried out and these should be coordinated with and integrated into epidemiological research so that the maximum benefits can be derived in the country. There is also a need for public health awareness programs, hygienic and adequate treatment of food to reduce the incidence of intestinal parasitic infections.

REFERENCES

Al-khamesi, M.B. (2014). Isolation and Diagnosis of Parasites from Different Soils in Baghdad City, Journal of AlNahrain University 17: 155-161.

Balen, J., Raso, G., Li, Y.S., Zhao, Z.Y., Yuan, L.P., Williams, G.M., Luo, X.S., Shi, M.Z., Yu, X.L., Utzinger, J. & McManus, D.P. (2011). Risk factors for helminth infections in a rural and a peri-urban settings of the Dongting Lake area, People's Republic of China. International Journal for Parasitology 41: 1165-1173.

Chongsuvivatwong, V., Uga, S. & Nagnaen, W. (1999). Soil contamination and infections by soil-transmitted helminthes in an endemic village in southern Thailand. Southeast Asian Journal of Tropical Medicine and Public Health 30: 64-67.

Cobb N.A. Estimating the nematode population of the soil. Agric Tech Bur Pl Ind. 1920;1:19–24

Dar, S. A., Shah, F. A., & Wali, A. (2020). Protozoan Parasites of Cold Water Fishes of Jammu and Kashmir. Curr. Rese. Agri. Far, 1(2), 4-7.

de Silva, N.R., Brooker, S., Hotez, P.J., Montresor, A., Engels, D. & Savioli, L. (2003). Soil-transmitted helminth infections: updating the global picture. Trends in Parasitology 19: 547-551.

FAO (2012) Undernourishment around the world in 2012. Rome, Food and Agriculture Organization of the United Nations.

Fenwick A, Figenschou BH (1972) The effect of Schistosoma mansoni infection of the productivity of cane cutters on a sugar estate in Tanzania. Bull World Health Organ 47, 567-572.

Givewell, "School-based deworming in Cross River State, Nigeria," 2018, February 2020, https://www.givewell.org/files/DWDA%202009/DtWI/Deworm_the_World_Cross_River_State_PMCV_report_October_2018.pdf.

Holland, C.V. & Smith, H.V. (2005). ToxocaraThe Enigmatic Parasite. Cambridge: CABI Publishing, pp. 162-165, pp. 253-255.

Korkes, F., Kumagai, F.U., Belfort, R.N., Szejnfeld, D., Abud, T.G., Kleinman, A., Florez, G.M., Szejnfeld, T. & Chieffi, P.P. (2009). Relationship between intestinal parasitic infection in children and soil contamination in an urban slum. Journal of Tropical Pediatrics 55: 42-45.

Mavridou, A., Pappa, O., Papatzitze, O., Dioli, C., Kefala, A. M., Drossos, P., & Beloukas, A. (2018). Exotic tourist destinations and transmission of infections by swimming pools and hot springs—a literature review. International journal of environmental research and public health, 15(12), 2730.

Musabayane N (2000) Management of rural drinking water supplies and waste using the participatory hygiene and sanitation transformation (PHAST) initiative in Zimbabwe. Schriftenr Ver Wasser Boden Lufthyg 105, 81-87.

Murray CJL, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, Ezzati M, Shibuya K, Salomon JA, Abdalla S, Aboyans V, Abraham J, Ackerman I, Aggarwal R, Ahn SY et al. (2012) Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 380, 2197-2223.

N. Midzi, T. Mduluza, M. J. Chimbari et al., "Distribution of schistosomiasis and soil transmitted Helminthiasis in Zimbabwe: Towards a national plan of action for control and elimination," PLoS Neglected Tropical Diseases, vol. 8, no. 8, article e3014, 2014.

Nagpal S, Sinclair D, Garner P (2013) Has the NTD community neglected evidencebased policy? PLoS Negl Trop Dis 7, e2238. Needham C, Kim HT, Hoa NV, Cong LD, Michael E, Drake L, Hall A, Bundy DA (1998) Epidemiology of soil-transmitted nematode infections in Ha Nam Province, Vietnam. Trop Med Int Health 3, 904-912.

P. J. Hotez and A. Kamath, "Neglected tropical diseases in sub-Saharan Africa: review of their prevalence, distribution and disease burden," PLoS Neglected Tropical Diseases, vol. 3, no. 8, article e412, 2009.

Pullan RL, Brooker SJ (2012) The global limits and population at risk of soil-transmitted helminth infections in 2010. Parasit Vectors 5, 81.

R. L. Pullan, J. L. Smith, R. Jasrasaria, and S. J. Brooker, "Global numbers of infection and disease burden of soil transmitted helminth infections in 2010," Parasites & Vectors, vol. 7, no. 1, p. 37, 2014.

Rai, S.K., Uga, S., Ono, K., Rai, G. & Matsumura, T. (2000). Contamination of soil with helminth parasite eggs in Nepal. Southeast Asian Journal of Tropical Medicine and Public Health 31: 388-393.

S. L. James, D. Abate, K. H. Abate et al., "Global, regional and national incidence, prevalence and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990 – 2017: a systematic analysis for the global burden of disease study 2017," The Lancet, vol. 392, pp. 1789–1858, 2018.

Saberi, R., Sharif, M., Sarvi, S., Aghayan, S. A., Hosseini, S. A., Anvari, D., ... & Daryani, A. (2018). Is Toxoplasma gondii playing a positive role in multiple sclerosis risk? A systematic review and meta-analysis. Journal of neuroimmunology, 322, 57-62.

Shretta, R., Liu, J., Cotter, C., Cohen, J., Dolenz, C., Makomva, K., ... & Feachem, R. (2018). Malaria elimination and eradication.

World Health Organization, "Prevention and control of schistosomiasis and soil transmitted helminthiasis. Report of a WHO Expert Committee," Technical Report Series No 912, World Health Organization, 2012, February 2020, https://www.who.int/intestinal_worms/resources/who_trs_912/en/.

World Health Organization, Investing to overcome the global impact of neglected tropical diseases, World Health Organization, 2015, February 2020

World Health Organization, Accelerating work to overcome the global impact of neglected tropical diseases: a roadmap for implementation: executive summary, World Health Organization, 2012, February 2020, https://apps.who.int/iris/handle/10665/70809.

World Health Organization, Working to overcome the global impact of Neglected Tropical Diseases: First WHO Report on Neglected Tropical Diseases, World Health Organization, 2010, February

Yap P, Fürst T, Müller I, Kriemler S, Utzinger J and Steinmann P. Determining soil-transmitted helminth infection status and physical fitness of school-aged children. Journal of Visualized Experiments 2012;66:3966-3973.