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PREVALENCE OF PATHOGENIC INTESTINAL PARASITES IN SOLID WASTE DISPOSAL IN DU DISTRICT, JOS SOUTH LOCAL GOVERNMENT AREA, PLATEAU STATE, NIGERIA

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ABSTRACT
Pathogenic intestinal parasitic infections area significant public health in Nigeria, particularly in areas with poor sanitation and hygiene practices. The waste contamination of soil with pathogenic intestinal parasite is a common occurrence in many parts of the country including Plateau State. The Rahwol Kanang Du district in Jos South Local Government is affected by this issue, given the prevalence of pathogenic intestinal parasite. The aim of this was to determined the prevalence of pathogenic intestinal parasite in waste contamination in soil in Rahwol Kanang, Du district, Jos South LGA. Objectives: To isolate and identify the species of pathogenic intestinal parasites present in waste contamination of soil in the study area. To determine the prevalence, identify the risk factors associated with the transmission of pathogenic intestinal parasites in the study area. Materials and methods: the waste contaminated soil samples randomly collected were analysed by parasitologically methods, using sedimentation and centrifugation techniques data analysed using chi-square technique, p.value set at 0.05. Cases of multiple human pathogenic intestinal parasite ova and larvae were commonly encountered in the waste contaminated soil samples. The prevalence rate of 108(45.0%) was recorded in Rahwol Kanang waste. Contaminated soil rate from the different points were are as follows: POA(42.5%), POB(45.0%), POC(40.0%), POD(47.5%), POE(45.0%), POF(50%). The pathogenic intestinal parasite ova and larvae and their prevalence rates in the study area as follows: Ascaris lumbricoide 56(51.86%), Hookworms 22(20.37%), Trichuris trichiuria 16(14.81%), Strongyloide stercoralis 8(7.41%), and Entrobius vermicularis 6(2.5%). Conclusion: The present study revealed the prevalence of ova and larva of pathogenic intestinal parasite in the study area is serious public health concern in the community. There is need for improved sanitation and hygiene practices, proper waste management, public education, regular monitoring and surveillance of waste contamination to prevent transmission and outbreak of intestinal parasitic infection. Recommendation: improve sanitation and hygiene, health education and waste management.

Keywords: Prevalence, Pathogenic, Intestinal parasite, solid waste.

Introduction

Household waste is generally defined as unwanted materials from human and animals that can be solid-semi-solid, liquid or gaseous materials usually seen as useless, worthless and of house released into environment (Amadi et al., 2020, Omang, et al., 2021). Examples of wastes include Municipal solid waste, household trash, industrial solid wastes, human bodily wastes (blood, tissues, urine spuntum, and faeces), and hazardous wastes. These wastes have created a very serious negative impact on environment and human health causing air and water pollution, degradation of land, loss of biodiversity, blockage of drainages, flooding which are capable of leading to wide spread of infectious and non-infectious disease to human to include, helminthasis, typhoid, diarrhea, cholera, malaria, tuberculosis, hepatitis and other plagues (Ifeoluwa, 2019, Omang et al.,2021).

Intestinal parasitic infections are widely disseminated all over the world and pose hazard to the public health and cause various complications. Infections with medically important parasites are closely linked with circumstances such as poverty, poor personal hygiene, poor environmental hygiene, lack of sanitation, overcrowding, unsafe water, lack of toilet facilities, open defecation and urination especially in developing countries. (Ajithaet *et al.,* 2020). Tefera *et al*., 2014 cited in Gofum *et al.,* (2022) observed that these parasites continue to be of great importance to humans due to the adverse effects on both health and development of infected individuals and the large community. Intestinal parasitic infections is one of the major health problems in developing countries. It has been estimated to affect about 3.5 billion people globally and 450 million people are thought to be ill as a result of such infections with the majority being children (Khan et al., 2020).

Parasitic infections especially those that are soil transmitted or geo-helminthes are favored by some factors such as climate, environmental degradation, occupation, source of water, foods, poor sanitation facilities in developing countries, poverty, tourism, rising number of refugees and immigration from heavily contaminated areas has contributed to the prevalence of intestinal parasites in a community (Arora & Arora 2012). Soil transmitted or geo-helminthes parasites include *Ascaris lumbricoides, Hookworms spp Trichuris trichiuria* (whip worm) *strongyloides stercolaris*, *Enterobius vermicularis* (Pinworm) *Giradia lamblia, Schistosome mansoni, Hymenolepis nana, Taenia species, and Entameoba hisolytica* (Khan et al., 2020, Gufom et al., 2022).

Parasites also have the capacity to develop drug resistance like bacteria and vectors transmitting certain parasite infections that have developed insecticide resistance. Therefore, parasite infections present enormous challenges (Arora & Arora, 2008, 2012). Human and animal excreta have been implicated in the transmission of many diseases such as *Ascariasis, schistosomiasis, hook-worm, trichuriasis, strongylodiasis, cryptoporidoasis,* cholera, typhoid, amoebiasis, hepatitis and polio. The human excreta transmitted diseases pre-dominantly affect children in the poorest and deprived communities with poor access to clean water, sanitation and hygiene in tropical and sub-tropical areas, with the highest prevalence reported from sub-sahara Africa, China, South America and Asia (W.H.O. 2023).

World Health Organization has estimated that nearly 890 million children of all ages are living in areas where these intestinal parasites are transmitted easily, with 275 million being pre-school children and 615 million of school age. The prevalence rate of

intestinal parasitic infection, in some poor communities can be over 90% and with 300 million suffering severe impairment because of high burdens. These are widely distributed in tropical and sub-tropical areas, with the greatest number occurring in Sub-Saharan Africa, East Asia, China and South America. They are the cause of disease burden in school-age children in developing nations often resulting in impairment of physical growth, anaemia, malnutrition, stunting, wasting and poor intellectual development (Gufom et.al, .2022, W.H.O 2023).

Some works been reported on the parasitic contamination of soil, sand, foods and water worldwide with *Ascaris,* hookworm and *Trichiuris* being the most common (W.H.O 2023). Holland et al., (2022) opined that *ascariasis* in human was reported in at least 150 countries with most in the developing world, particularly in Asia and sub-Saharan Africa, particularly in areas with poor sanitation, lack of health care facilities and water supplies.

In Nigeria, intestinal helminthes infection have continue to prevail and continue persistence of intestinal parasites especially in children because of poor living standard, poverty health facilities, poor environmental sanitation, poor housing facilities, absence of portable and safe water supplies and ignorance of simple health promoting behaviors. (Wuso & Onyeabor, 2015). Many studies in Nigeria revealed that most geo-helminthes or soil transmitted helminthes are acquired in areas designed as infection foci-these are usually the immediate environment around homes, schools, playgrounds and other public areas. (Chukwudike et al., 2024). Ugboju & Asogu (2013) reported the prevalence of *Ascaris* 237(79%), hookworm 245(75%) and *Trichuris trichiuria* 165 (55%) out 300 stool samples examined among pupils aged between 0 and 15 years in Unawana Afikpo Ebonyi State. Gimba & Dawam 2015 cited in Gufom et al., (2022) revealed that *Ascraris lumbricoides* was the most predominant with 18(42.99%), *Entameoba histolytica* 16(38.19%) and *Stronyloides Stercoralis* is the least predominant 8(19.0%) in Abuja Township clinic. Gufom et al., (2014) reported the prevalence of intestinal parasites infection among school-age children in four primary schools in Heipang Gwol, LGA Plateau State identified eleven (11) different species including *Ascaris lumbricoides* (28.19%), Hookworms (21.99%), *Trichuris trichiuria* (12.5%). Strongyloides stercoralis (3.1%), *Schistosoma mansoni* (4.7%), *Taenia species* (9.4%), *Enterobius vermicularis* (3.1*%), Hymonolepis nana* (4.7%) *Entameoba histolytica* (6.3%), *Giardia lamblia* (3.1%), and *Balantidium coli* (31.1%) in dump sites. The presence and prevalence of these solid deposits in Du, Jos South Local Government Area of Plateau State transmitted helminthes soil waste Rahwol Kanang, Du is a serious public health problem, which call for an urgent attention by the local authority. Most literature review on the studies of the prevalence on pathogenic intestinal parasite in Jos metropolis has been concentrated on vegetables, fruits and drinking water but only scatty literature is showed on the prevalence of intestinal parasites in Rahwol Kanang Du district. The study aims to fill the knowledge gap and provide insights into transmission dynamics of intestinal parasites in the study area.

The aim of this research is to survey the prevalence of pathogenic intestinal parasite in waste contaminated soil in Rahwol Kanang Du District, Jos South Local Government Area, Plateau State.

Materials and Methods

Study Area

The study was carried out in Rahwol Kanang Du District, Jos South Local Government Area, Plateau State, Nigeria about 15 kilometers South East of Jos, the State Capital covers a total of 512km^2, it lies between latitude (9°34'22' and 9°54'40') N of equator and longitude (8^0,39'55') and (8^0,59'13') E of the meridian, and with an average altitude of about 128om above sea level. The National Population Census projected fiqure of the area was 407,9500 as March 2016. The human population density of the area stand at 778 inhabitants 1km^2. It has a cool climatic condition known as mountain climatic due to its altitude November to February is normally the peak of cold period whereas March and April are warm period (Bala et al., 2021).

Sample Size

The sample size was determined using the cochan formula (Cochran, 1977) as follows:

$$n = \frac{Z^2 \times P \times (1-P)}{e^2}$$

Where:

n = initial sample size for large populations
Z = score for the desired confidence level e.g. 1.96 for 95% confidence
P = estimated proportion of the population (50% or 0.5)
e = desired margin of error 6.49 or 0.064

$$n = \frac{1.96^2 \times 0.5 \times (1-0.5)}{0.064^2}$$

$$n = \frac{3.8416 \times 0.5 \times (0.5)}{0.0040}$$

$$n = \frac{0.9604}{0.0040}$$

$$n = 240$$

Sample Collection

A pilot study was carried out before the main research out before the main research work. The dump sites in Rahwol Knanag Du District Jos South LGA were visited and marked as follows: POA – waste dump site along TCNN road to Yelwa Club dam, POB – waste dump site behind COCIN Rahwol Kanang, POC – waste dump site near Pearly Gates Academy fence, POD – waste dump site along Catholic Church Rahwol Kanang street, POE – waste dump site opposite TCNN round about junction and POF – waste dump site near Zokut gas plant along Du-Shen road for the collection of waste contaminated soil samples. The soil samples were collected for a period of four (4) months, an average of sixty (60) were collected each month. For soil samples collection, an estimate area were measured with a graduated rope 8 square meters to estimate the length and breadth of an area. A stick was used to peg every 8 meters at interval points. The points of soil sample collection were marked as points 1,2,3,4,5,6,7,8,9,10. A ruler was sued to measured 4 cm on the trowel from its tip, to aid in measuring depth for soil collection with the trowel, 100g of the soil samples was randomly collected both from the surface and 4 cm deep in to the soil an put into labeled bottles. The labeled bottles contaminated soil samples were transported to the micro biology laboratory department main campus of Plateau State Polytechnic Barkin Ladi for parasitological analysis.

Laboratory Processing and Analysis

The soil samples collected were dissolved separately with normal saline and then sieved in test tubes. The filtrates were then spun using electrical centrifuge at 3000 Revolutions Per Minute (RPM) for five (5) minutes (Arora & Arora 2008). The sediment containing the ova or cysts of parasites settled at the bottom of the centrifuge test tubes. The supernatant was suspended at the top and later discarded, leaving the sediments or deposit which was pipetted with Pasteur pipette and transferred to a clean grease free slide, a drop of iodine solution as applied and covered with cover slip, accordingly mounted on microscope and were examined using, accordingly mounted on microscope and were examined using 10x and 40x objectives for identification of eggs or ova and cysts of soil transmitted helminthes or protozoa.

Results

Results of the analysis of the 240 soil samples collected from the six (6) polluted areas with soil waste 108 (45.0%) were positive with five (5) different pathogenic intestinal parasite ova. Table 1 shows the number of samples examined in the study area. Table 2 shown the distribution of pathogenic intestinal parasites in waste contaminated soil as follows: POA 17(42.5%), POB 18(45.0%), POC 16(40.0%), POD 19(47.5%), POE 18(45.0%) and POF 20 (50.0%). The distribution of pathogenic intestinal parasites ova recovered from waste contamination soil in the study area according to dumpsites, Ascaris lumbricoide 56(51.86%) in POA – POF, Hookworms 22(20.37%), Trichuris trichiuria 16(14.81%), Strongyloides stercoralis 8(7.41%) and enteriobius vermicularis 6(5.56%) captured in table 3.

Table 1: Frequency of Waste Contaminated Soil with Parasites in the Study Area

Waste Contaminated Soil (Samples)	Frequency	Percentage (%)
Positive	108	45.0%
Negative	132	55.0%
Total	**240**	**(100.0%)**

Table 2: Distribution of Pathogenic Intestinal Parasites in Waste Contaminated Soil in the Study Area

Area (Point)	Number Examined	Number Infected	Infection Rate (%)
POA	40	17	42.5%
POB	40	18	45.0%
POC	40	16	40.0%
POD	40	19	47.5%
POE	40	18	45.0%
POF	40	20	50.0%
Total	**240**	**108**	**45**

KEYS

POA = Waste of dump site along TCNN road leading to Yelwa Club dam

POB = Waste dump site behind COCIN Rahwol Kanang

POC = Waste Dump site near pearly gates Academy fence
POD = Waste Dump site along Catholic church street
POE = Waste Dump site opposite TCNN round about junction
POF = Waste Dump site near Zokut gas Plant Du-Shen road

Table 3: Distribution of Pathogenic Intestinal Parasites Recovered from Waste Contaminated Soil in the Study Area

Soil Samples	*Ascaris lumbricoides*	*Hookworms*	*Trichuris trichiuria*	*Strongyloides stercoralis*	*Enteriobius vermicularis*
POA	12	4	3	0	1
POB	10	5	5	2	0
POC	13	3	2	1	2
POD	12	3	4	2	0
POE	11	4	0	1	1
POF	6	3	1	2	2
Total	**56(51.86%)**	**22(20.37%)**	**16(14.41%)**	**8(7.41%)**	**6(5.56%)**

KEYS
POA = Waste of dump site along TCNN road leading to Yelwa Club dam
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POF = Waste Dump site near Zokut gas plant Du- Shen road

Discussion

The result of the work has demonstrated the present of sic different soil transmitted of human pathogenic intestinal parasites in the six selected dumpsites in Rahwol Kanang Du district in Jos South Local Government Area, Plateau State. The selected dumpsites used for collection of waste contaminated soil during the research were marked as follows: POA – waste dump site along TCNN road to Yelwa Club dam, POB – waste dump site behind COCIN Rahwol Kanang, POC – waste dump site near Pearly Gates Academy fence, POD – waste dump site along Catholic Church Rahwol Kanang street, POE – waste dump site opposite TCNN round about junction and POF – waste dump site near Zokut gas plant along Du-Shen road captured in table 2.

The overall prevalence of pathogenic intestinal parasites ova recovered in the study area was 108(45.0%). This finding in in line with Kum *et al.; (2023)* who reported 80% contamination in Gwol Market, Barkin Ladi LGA, Plateau State. A study by Oyewole & Simon-Oke (2022) in Ifedore district in South West Nigeria showed that 79.2% of the soil samples examined were positive for the presence of helminth larva and ova higher. Although the prevalence rate obtained in Rahwol Kanang is 45.0% contamination with pathogenic intestinal parasites, the risk of infection in individual or community may further increase, as such, desperate measures must be taken to reduce this. From table 2, shows that all the soil samples collected across the designated points were transmitted helminthes, POA 17(42.5%), POC 18(45.0%), POC 16(40.0%), POD 19(47.50), POE 18(45.0%) and POF 20(50.0%). Considering the six (6) sites which the soil samples were taken the highest contamination (50%) occurred in around the refuse

dumpsite near Zokut gas plant along Du-Shen road. This is obvious because refuse of different types from Bukuru and Kugiya are dumped there by Plateau State Environmental Sanitation Agency. This finding is similar to what was reported by Imale at al., (2021) in Calabar where intensity of soil transmitted helminthes in soil was significantly higher in dumpsiter compared to playground areas.

The five helminthes were recovered from the waste contaminated soil collected in the study area namely; *Ascaris lumbricoide, Hookworms Spp, Trichuris trichiuria, Strongyloides stercoralis and Enterobius vermicularis*. The highest occurrence pathogenic intestinal parasites was *Ascaris lumbricoides* 56 (51.86%), *Hookworms Spp,* 22 (20.37%), *Trichuris trichiuria* 16 (14.81%), *Strongyloides stercoralis* 8(7.41%) *while Enterobius vermicularis* 6(5.56%) was the least. This is the agreement with some researchers findings in Plateau State and Nigeria. Kum et al, (2023) recorded the occurrence of *Ascaris lumbricoides* 16(38.1%), *Hookworms Spp* 14 (33.33%), the least was *Trichuris trichiuria* 12 (28.57%), Naadok et al., (2023) also reported the prevalence of gastro intestinal parasites in Plateau State as follows; *Ascaris lumbricoides* 74(5.9%), *Hookworms Spp* 41(3.3%), and *Trichuris trichiuria* 2(0.2%). A study in Aba Municapal, Abia State found that residents near dumpsites had a higher prevalence of intestinal parasitic infections with parasites such as *Hookworms Spp* (12.1%), *Entamoeba histolytica* (10.6%) and *Ascaris lumbricoides* (9%) detected in faecal samples (Amadi et al., 2020). Another study in Edo State, Nigeria Akinnumbi et al., (2026) found that waste dumpsites served as reservoirs for soil transmitted helminthes (STH), posing health risks to nearby communities. The study identified four STH species *Hookworms Spp (37.8%), Ascaris lumbricoides* (24.4%), *Trichuris trichiuria* (7.6%), and *Strongyloides stercoralis* (31.6%).

The five species of pathogenic intestinal parasite recovered in the waste contaminated soil in the study area shown that *Ascaris lumbricoides* was the predominance helminthes, this agrees with previous reports (Kum et al., 2023, Imalele et al., 2023), who also indicated that *Ascaris lumbricoide* was the most frequently encountered soil helminthes.

Conclusion

Soil pollution is thus a major factor in the epidemiology of human *ascariasis* and *trichuriasis* and other soil transmitted helminthes. The prevalence of soil transmitted helminthes is worldwide but more common in the developing countries as a result of the following factors, poor standard of living, absence of safe and potable water supply, poor housing and toilet facilities, ignorance, poverty, lower standard of food preparation or personal hygiene and lack of proper environmental sanitation The presence and prevalence of these soils transmitted helminthes and protozoa in Rahwol Kanang community are a serious health problem which calls for an urgent attention by the local Government authority.

Recommendations

1. The Government should adopt proper waste disposal methods and open dump site located away from residential areas.
2. Implement community based waste management system
3. Promote waste reduction, reuse and recycling practices
4. Enforce waste disposal regulations

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