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Investigation of gastrointestinal parasites of solid waste from dumpsites in Bosso Local Government Area, Minna, Niger State, Nigeria

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ABSTRACT

The study was carried out to evaluate prevalence of intestinal parasite collected from dumpsite in Minna Metropolis. This was achieved via series of coordinated research across five (5) different dumpsites designated as site A, B, C, D and E. The five dump sites were spread within three locations (Mypa, bosso Market and Bosso New York) of Minna metropolis. Soil and household waste samples were collected at different intervals following standard procedures and processed using zinc floatation method. The result from the 25 soil samples investigated showed that almost all the dumpsites had at least one gastrointestinal parasite. The seven (7) species of gastrointestinal parasites isolated include: *Ascaris lumbricoides* 23 (22.77%), *Taenia* species 11 (10.89%), *Entamoeba histolytica* 25 (24.75%), *Entanmoeba coli* 14 (13.86), *Giardia lamblia* 11 (10.89%), Hookworm 8 (7.92%), and *Strongyloides stercoralis* 9 (8.91%). The highest number of parasites were isolated from dumpsite D, 24 (23.76%) while the least parasite abundance was recorded in dumpsite C 14 (13.86%). Overall prevalence of gastrointestinal parasites in the dumpsites (Market and Household waste) revealed that 101 (59.76%) and 68 (40.24%) of the total isolated parasites were found in market and household waste respectively. The parasites that were most prevalent in the dumpsites was *A. lumbricoide* 38 (22.49%), while *Strongyloides stercoralis* 16 (9.47%) was the least abundant. Statistically, there was no significant ($p>0.05$) difference in the abundance of parasites in relation to market and household dumpsites investigated This study revealed a significant abundance of gastrointestinal parasites in the dumpsites.

Keywords: Prevalence; Gastrointestinal parasites; Dumpsites; Abundance; Solid waste

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INTRODUCTION

Solid waste has been identified as a sign of societal lifestyles and production technology, including household garbage, non-hazardous solid waste from industrial and commercial institutions, market waste, yard waste, and street sweepings (Schubeler *et al.*, 1996). It has been shown that refuse dumps are significant source of transmission for intestinal parasitic infection in Kampala, Uganda and Jos, Nigeria (Adepetu *et al.*, 1995.)

The growing urban environmental risks that endanger people's health and future prospects, particularly those of poor city dwellers, are therefore receiving more attention. These difficulties are best exemplified by Minna, particularly the health risks associated with solid waste management (SWM), which frequently compound one another. The official dump

site in Minna, the capital of Niger State, is at the Maikunkele axis and is poorly planned. Agents that spread disease thrive in this environment. The evidence that is currently available demonstrates that poorly managed and designed landfills attract a wide variety of insects and rodents that spread disease to people, particularly to those who are exposed to the waste up close. Workers who handle solid waste that contains chemicals and metallic elements run the risk of being exposed to toxic substances. Almost 10% of the world populace is being affected with one or more geo- parasite (Esch and Petersen, 2013). *Entamoeba histolytica* account for the highest geo- parasite infection in cities of tropics and sub-tropics, leaving no country free of the scourge, not only that, *Giardiasis* occurs worldwide (Nwoke *et al.*, 2013)

MATERIALS AND METHODS

Description of the Study Area

The research was carried out in Minna, Nigeria's Niger State. Niger State is bordered on the north by Kebbi, Sokoto, and Kaduna; on the east by the Federal Capital Territory (FCT); on the west by the Benin Republic; and on the south by Kwara and Kogi. Bosso and Chanchaga are the two local government areas that make up the city. Minna has a mean annual rainfall of 1334mm, with the largest monthly rainfall of roughly 300mm occurring in August and September. The month with the highest average daily temperature of 30°C was March, and the month with the lowest average daily temperature was August, at around 22°C. The climate of Minna presents two distinct seasons: a rainy season (May- October) and dry season (November – April). The vegetation in the area is typically grass dominated savannah with scattered trees (Niger State Agricultural Developmental Project (NSADP), 2020).

Sampling Sites

Samples were collected from five (5) different dumpsites. The categorization is as follows:

Mypa (majorly household) - Site A; Mypa (Household and Market) - Site B; Bosso Market (Inside the market) - Site C; Bosso Market (Outside the market) - Site D; Bosso Newyork - Site E

Sample collection

A total of 50 samples (25 soil samples and 25 household waste sample) were collected from the five randomly selected dumpsites within Minna metropolis. At each location, samples were collected from different parts, giving a specific interval of 25-30cm from the initial point of collection. Each point of collection is being marked as the same dumpsite is revisited for another collection of samples. For each location, samples were collected at surface of the earth using the method of Cletus, (2015). Soil sample (80g) was collected from each sampling sites in the morning hours between 7:30am and 10:30am in a clean polythene bag. All samples were taken to the research laboratory of the Department of Animal Biology, Federal University of Technology, Minna, Niger State.

Sample processing

Eighty grams (80g) of soil collected from the six refuse dumpsites were passed through a coarse sieve of 4mm pore size to remove stones, grass and other undesirable materials. The preparation was transferred into a conical flask, to each flask, 50ml distilled water was added, stirred and allowed to settle for 30

minutes. After the mixture, the coarse particles were strained out by passing through a coarse mesh cloth into a centrifuge tube and centrifuged at 3000 revolutions per minute for 2 minutes. The supernatant was discarded while the sediments in each tube were stirred with sterile applicator stick. Ten milimetre (10ml) of Zinc sulphate floatation fluid of specific gravity of 1.3 was prepared as 400g to 1000ml of distilled water was added to each test tube until a slightly bulging meniscus was obtained on top of the tube (Adeyeba and Akinbo, 2002). A clean coverslip was placed on top of the tube to slightly touch the meniscus to prevent the content from spilling over. The cover slip was left in place for an average of 2 minutes.

Parasitological examination and Identification

The cover slip was removed carefully with the adhering floatation solution that may contain ova of parasites. The cover slip was then place faced down on a clean microscope slide (preventing bubbles). The cover slips were examined microscopically under ×10 and ×40 objectives, respectively for the presence of parasites ova (model: Olympus CH Trinocular light microscope). The cysts, and ova of encountered parasites were identified with the aid of parasitological atlases (Cheesbrough, 2006). Physical counts of encountered parasites' stages were done on microscope films and recorded appropriately.

Data Analysis

Chi square (x2) test was used to determine the significant difference of parasite infestation between the various dumpsites and market areas. P-values $p<0.05$ were considered statistically significant. Geometric mean intensity of a parasite was calculated as antilog (E $\log(x+1)/n$) with x being the number of parasites collected, and n the number of samples collected.

RESULTS

Prevalence and Abundance of Gastrointestinal Parasites Isolated from Market Dumpsites

The results of the study showed that almost all the dumpsites had at least one gastrointestinal parasite. A total of seven (7) species of gastrointestinal parasites were isolated from the soil or waste samples collected from market dumpsite. A total of one hundred and one (101) gastrointestinal parasites were isolated from market dumpsite. The parasites isolated include: *Ascaris lumbricoides* 23 (22.77%), *Taenia* species 11 (10.89%), *Entamoeba histolytica* 25 (24.75%), *Entanmoeba coli* 14 (13.86), *Giardia lamblia* 11 (10.89%), Hookworm 8 (7.92%), and *Strongyloides stercoralis* 9 (8.91%). The highest number of parasites were isolated from dumpsite D 24 (23.76%) followed by dumpsite E 23 (22.77%) while the least parasite abundance was recorded in dumpsite C 14 (13.86%). Statistically, there was a significant ($p<0.05$) difference in the abundance of parasites in relation to the different dumpsites investigated (Table 1). The most abundant parasite species isolated in the soil samples from market was *Entamoeba histolytica* 25 (24.75%) followed by *Ascaris lumbricoides* 23 (22.77%) while Hookworm 8 (7.92%) was the least abundant.

Prevalence and Abundance of Gastrointestinal Parasites in Household Waste Samples

Table 2 showed the relative parasite abundance in household waste collected

from five (5) dumpsites. A total of sixty-eight (68) gastrointestinal parasites were isolated from market dumpsite. The parasites isolated include: *Ascaris lumbricoides* 15 (22.06%), *Taenia* species 6 (8.82%), *Entamoeba histolytica* 12 (17.65%), *Entanmoeba coli* 9 (13.24%), *Giardia lamblia* 9 (13.24%), Hookworm 10 (14.71%), and *Strongyloides stercoralis* 7 (10.29%). The highest number of parasites were isolated from dumpsite A and D 18 (26. 47%) respectively followed by dumpsite B 13 (19.18%) while the least parasite abundance was recorded in dumpsite C 8 (11.76%). Statistically, there was a significant ($p<0.05$) difference in the abundance of parasites in relation to the different dumpsites investigated (Table 2). The most abundant parasite species isolated in the soil samples from market was *Ascaris lumbricoides* 15 (22.06%), followed by *Entamoeba histolytica* 12 (17.65%) while *Strongyloides stercoralis* 7 (10.29%) was the least abundant.

Overall abundance of gastrointestinal parasites in the dumpsites (Market and Household waste) in relation to species of parasite

Out of the 169 (100%) parasites isolated from materials collected from the dumpsite, 101 (59.76%) and 68 (40.24%) of the total isolated parasites were found in Market and Household waste respectively (Table 3). The parasites that were most prevalent in the dumpsites include: *A. lumbricoide* 38 (22.49%), followed by *E. histolytica* 37(21.89%), while *Strongyloides stercoralis* 16 (9.47%) was the least abundant. Statistically, there was no significant ($p>0.05$) difference in the abundance of parasites in relation to market and household dumpsites investigated (Table 3)

Table 1: Relative abundance of parasites isolated in samples obtained from household waste (n= 25)

Parasites Isolated	Dumpsites (%)					Total (%)
	A	B	C	D	E	
Ascaris lumbricoides	4 (17.39)	6 (26.09)	2 (8.70)	7 (30.43)	4 (17.39)	23 (22.77)
Taenia species	2 (18.18)	0 (0.00)	1 (9.09)	5 (45.45)	3 (27.27)	11 (10.89)
Entamoeba histolytica	7 (28.0)	8 (32.0)	5 (20.0)	2 (8.0)	3 (12.0)	25 (24.75)
Entamoeba coli	1 (7.14)	3 (21.43)	0 (0.00)	4 (28.57)	6 (42.86)	14 (13.86)
Giardia lamblia	0 (0.00)	3 (27.27)	5 (45.45)	2 (18.18)	1 (9.09)	11 (10.89)
Hookworm	3 (37.5)	2 (25.0)	0 (0.00)	1 (12.5)	2 (25.0)	8 (7.92)
Strongyloides stercoralis	1 (11.11)	0 (0.00)	1 (11.11)	3 (33.33)	4 (44.44)	9 (8.91)
Total	18 (17.82)	22 (21.78)	14 (13.86)	24 (23.76)	23 (22.77)	101 (100)

χ^2 Cal = 37.74; χ^2 tab = 36.42; df = 24

Table 2: Relative abundance of parasites isolated in samples obtained from household waste (n= 25)

Parasites Isolated	Dumpsites (%)					Total (%)
	A	B	C	D	E	
Ascaris lumbricoides	4 (26.67)	3 (20.0)	2 (13.33)	5 (33.33)	1 (6.67)	15 (22.06)
Taenia species	2 (33.33)	0 (0.00)	1 (16.67)	3 (50.0)	0 (0.00)	6 (8.82)
Entamoeba histolytica	3 (25.0)	4 (33.33)	2 (16.67)	0 (0.00)	3 (25.0)	12 (17.65)
Entamoeba coli	1 (11.11)	3 (33.33)	0 (0.00)	2 (22.22)	3 (33.33)	9 (13.24)
Giardia lamblia	3 (33.33)	1 (11.11)	2 (22.22)	2 (22.22)	1 (11.11)	9 (13.24)
Hookworm	4 (40.0)	2 (20.0)	0 (0.00)	3 (30.0)	1 (10.0)	10 (14.71)
Strongyloides stercoralis	1 (14.29)	0 (0.00)	1 (14.29)	3 (42.86)	2 (28.57)	7 (10.29)
	18 (26.47)	13 (19.18)	8 (11.76)	18 (26.47)	11 (16.18)	68 (100)

χ^2 Cal = 194.72; χ^2 tab = 36.42; df =

Table 3: Overall prevalence of parasites in soil and household waste collected from dumpsites in relation to species of parasites

Samples	Species of Parasites Isolated (%)							Total (%)
	Ascaris lumbricoides	*Taenia species*	*E. histolytica*	*E. coli*	*Giardia lamblia*	*Hookworm*	*Strongyloides stercoralis*	
Soil	23 (22.77)	11 (10.89)	25 (24.75)	14(13.86)	11 (10.89)	8 (7.92)	9 (8.91)	101(59.76)
Household waste	15 (22.06)	6 (8.82)	12 (17.65)	9 (13.24)	9 (13.24)	10 (14.71)	7 (10.29)	68 (40.24)
Total	38 (22.49)	17(10.06)	37 (21.89)	23(13.61)	20 (11.83)	18 (10.65)	16 (9.47)	169 (100)

χ^2 Cal = 3.16; χ^2 tab = 12.59; df =

DISCUSSION

Parasites of public health importance especially gastrointestinal parasites are often associated with poor sanitary habit, poor personal hygiene, lack of portable water and poverty (WHO, 2010). This study reveals the influence of poor waste management on the relative abundance of gastrointestinal parasites in the study area. Although the agency (Niger State Waste Management Agency) responsible for waste management in Niger State waste collection truck to collect waste at designated areas, its inadequacies has not impacted positively on the sanitary condition of the state. This development may be partly responsible for the high abundance of gastrointestinal parasites in dumpsites investigated in the study area. The results from this study is in consonance with similar studies in other parts of Nigeria by Ikpeama *et al.* (2016), in Owerri metropolis; Dada and Egbini (2016) in Ondo State; and Adesewa and Morenikeji, (2017) in Ibadan.

The overall parasites recovered from the soil (59.76%) is significantly higher than parasites encountered in the household waste (40.24%), similar trend was observed by previous researcher (Gboeloh, 2021). Dumpsite D (23.76%) and C (13.86%) has the highest and lowest prevalence of the different parasites encountered from the refuse waste. The low prevalence recorded in site C (inside Bosso Market) might be attributed to the routine sweeping and cleaning of the respective portion by shop owners compared to site D (outside Bosso Market) where anyone can drop waste including passers-by. Conversely, site A and D simultaneously shared the same highest sites with parasites prevalence from house hold waste while site C maintained its place as site with the lowest abundance of parasite from the refuse dump and household waste.

A. lumbricoides has the highest abundance in both the soil (22.7%) and house hold waste (22.06%). The high overall relative abundance of *Ascaris lumbricoides* (22.49%) observed in our study is higher than that reported in Ibadan (19.3%) but significantly lower than that reported in Jos, Plateau State (73%), and Ile-Ife in Osun State (39.1%) (Udoh *et al.*, 2019). The high abundance of the parasite could also be attributed to the climatic condition in the study area. In Niger State, the dumpsites are always wet, providing a moist soil and temperature necessary for the striving of parasitic eggs prior to contact with the ideal host (Dada and Egbunu, 2016; Gboeloh and Ike-Ihunwo, 2019).

Strongyloides stercoralis had lowest overall relative abundance of (9.4%) as observed in our study, this corroborate a similar 8% reported in Ibadan by (WHO, 2010) but in disparity with the high relative abundance of 38.5% reported by (Gloeloh, 2021). The differences in results could be attributed to the waste management practices employed by waste agencies in the different study areas and the age of the dump before treatment. *Entamoeba histolytica* was also observed to have a high relative abundance of 24.75% and 17.65% in the Market and household refuse respectively. However, this result is lower than the report of Ikpeama *et al.* (2016), who recorded 66.7% and 46.7% of *E. histolytica* in soil and refuse samples respectively. The researchers also reported 56.7% and 40% prevalence rate of hookworm in soil and refuse samples respectively, as against the 26.8% in soil and 0% in household refuse recorded in our study. The overall relative

abundance of 24.6% and 19.3% recorded for *A. lumbricoides* and hookworm in our study is higher than the 13.3% and 7.2% recorded for *A. lumbricoides* and hookworm reported by (Brooker *et al.*, 2006) respectively. The high prevalence of these parasites (*A. lumbricoides* and Hookworm) recorded in our study may be attributed to fact that feacal samples also disposed alongside with household waste, open defecation.

Conclusion: The study revealed a significant abundance of gastrointestinal parasites in the dumpsites and high health risk behavior by scavengers in the study area. The highest number of parasites were isolated from dumpsite D 24 (23.76%) followed by dumpsite B, while the least parasite abundance was recorded in dumpsite C. From the house hold waste, site A and D had the highest number of parasites isolated from dumpsite while the least parasite abundance was recorded in dumpsite C. The markets dumpsites have relative abundance of parasites than the household waste. *A. lumbricoide* is the most prevalent parasite from the dumpsites while *Strongyloides stercoralis* was the least abundant

Recommendations

Government policy aimed at proper and modern waste management strategies and public health enlightenment will certainly reduce the abundance and transmission of these parasites. Formulation of scientific waste management policies by the Niger State Waste Management Agency and education of waste scavengers will cub the impact of these parasites on public health.

REFERENCES

Adepetu A. A. Farmers and their farms on four Fadama plants on the Jos, Plateau, Jos Plateau Environmental Resources Development Programme, Report no 2.\

Adesewa, A., & Morenikeji O. (2017). Helminths and heavy metals in soils from a dumpsite in Ibadan city, Nigeria. *Journal of preventive medicine and hygiene.* 58 (4), 328 – 333.

Adeyeba, O. A., & Akinbo, J.A. (2002). Pathogenic intestinal parasites and bacterial agents in solid wastes. *East African Medical Journal,* 79 (11): 600-603.

Brooker, S., Clements, A., & Bundy, D. A. P. (2006). Global epidemiology, ecology and control of soil-transmitted helminth infections. *Advanced Parasitology,* 62, 223-265.

Cheesbrough, M. (2006) *Parasitological Atlases*

Cletus, I. I. (2015). Parasitological Evaluation of un-disposed refuse dump in Calabar. *Journal of pure & applied Zoology,* 3 (3):232 -239.

Dada, E.O., & Egbinu, A.A (2016). Dispersion of human intestinal Geohelminth ova in selected refuse dumpsites in Igbara-Oke, Ifedore, Local Government Area, Ondo state, Nigeria. *International Journal of Current Microbiology and Applied Science,* 5(4), 924-928.

Esch, K. J., & Petersen, C. A. (2013). "Transmission and epidemiology of Zoonotic protozoal disease of companion animals" *Clinical Microbiology Review,* 26 (1), 58 – 85.

Gboeloh, L. B. (2021). Evaluation of Gastrointestinal Parasites in Major Dumpsites and Health Risk Behaviour of Scavengers in Port Harcourt Metropolis.

Gboeloh, L. B., & Ike-Ihunwo, C. I. (2019). Prevalence of Soil Transmitted Helminth among pupils of community primary schools in Nkpor and Mgbodohia communities in Rivers state, Nigeria. *South Asian Journal of Parasitology,* 2(2), 1-10.

Ikpeama, C., Obianjuru, I. O. C. & Igomaka, A. I. (2016). The impact of refuse disposal dumpsites on the spread of intestinal helminthiasis in Owerri Metropolis, Imo state, south eastern Nigeria. *International Journal of Clinical and Laboratory Medicine,* 2(2), 13-18.

Nwoke, E. U., Ibam, G. A., Odikamonoro, O. O., & Umah, O. V., (2013). Examination of soil samples for the incidence of geohelminths parasites in Ebonyi north – central Area of Ebonyi State, South East of Nigeria. *Archives of Applied Science Research* (5) 41- 48.

Odu, N. N., Elechi, V. I., & Okonkwo, I. O., (2013). Prevalence of intestinal helminths infection among School Children in Urban and semi-urban areas in Port Harcourt, Rivers state. Nigeria. *World rural observations*, 5(1), 52-61.

Schubeler, P., Gujer, W., & Ludwig, C. (1996). Solid waste management in developing countries. *Annual Reviews in Energy and the Environment,* 21(1), 121-155.

Udoh, S. J., Olaniran, O., Adedire, B. A., Hassan-Olajokun, R. E., Olaniran, O. O., & Oyetokeo, O. (2019). Investigation on the Pattern of Intestinal Parasites Present in Refuse Dumps and Abattoir Wastes in Ile-Ife. Nigeria. Biol Med (Aligarh). 11:460. doi: 10.4172/0974-8369.1000460

World Health Organization. (2010). Global water supply and sanitation. Geneva. . Available via https://www.who.int/water_sanitation_health/publications/jmp2000/en/