



## Implication of *Rattus Rattus* as Vectors of Gastrointestinal helminthes Parasites in Parts of Osogbo, Southwestern Nigeria.

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### ABSTRACT:

Rats are one of the ubiquitous rodents around human residential areas and market places and their filthy habits make them to be potential carriers of pathogens. The current survey was aimed to determine gastro-intestinal helminths infection in 75 trapped rodents of domestic and market areas of Osogbo, Southwestern Nigeria to document the potential health risks associated with rats as mechanical vectors of medically important gastro-intestinal parasites Osogbo, Southwestern Nigeria. 37 rats were collected from the residential areas while 38 were collected from the market places. 16 (43%) of the 37 rats collected in residential area harboured gastro-intestinal parasites while 22 (57%) of the 38 rats from market places harbored parasites. Rats were trapped using metal snares and glue board traps, between October and December 2016 from residential and market areas and euthanized. The body surfaces and the faecal samples of rats collected from both residential area and market places were examined for parasites while the gastrointestinal and respiratory tracts were removed and examined to identify parasitic helminthes. The results indicated that 38(50.67 %) of examined rodents were infected with nine helminths species with market area having higher prevalence rates in all the species of parasites recovered: *Entamoeba hystolitica* (19.50%), *Balantidium coli* (13.76%), *Ascaris lumbricoides* (79.00%), *Thricuris muris* (22.30%), *Enterobius vermicularis* (13.76%), Hookworms (13.76%), *Nippostrongylus brasiliences* (3.65%), *Syphacia muris* (16.35%) and *Hymenolepis diminuta* (11.49%) while the prevalence of infection among the rats sampled in the domestic area are *Entamoeba hystolitica* (16.49%), *Balantidium coli* (11.34%), *Ascaris lumbricoides* (62.32%), *Thricuris muris* (13.76%), *Enterobius vermicularis* (11.14%), Hookworms (8.32%), *Nippostrongylus brasiliences* (2.25%), *Syphacia muris* (11.35%) and *Hymenolepis diminuta* (15.12%). Of the 75 sampled rats, 35(48.0 %) were males and 40 (52 %) were females. 21 (52.5%) of the males were infected compared to female rats 17 (48.6%). There was no significant difference in prevalence of gastrointestinal helminths among different age groups and sexes ( $P>0.05$ ). Market places harbored higher gastro-intestinal parasites than residential area. We concluded that examined rodents carry gastrointestinal parasites that are zoonotic and that both domestic and market areas are exposed to these infections. The control of these animals therefore has an important role in safeguarding public health. The promotion of hygienic conditions and periodical fumigation of the environment become imperative so as to control the population of rats and reduce the health risks associated with their presence in the study area.

**Keyword:** Rats, residential area, market places, helminths parasites, health risks, Risk factors, Nigeria.

### INTRODUCTION

Rodents are one of the most successful, abundant, and destructive group of animals causing direct and indirect damage to agricultural products both at pre and post-harvest stages. The domestic rats feed on faeces, human detritus and food stuffs, and they are therefore mostly found in the toilets, cupboards and kitchens. These filthy habits make them potential carriers of various pathogens including gastro-intestinal parasites [42, 10].

Gastro-intestinal parasites are transmitted through water, food and hand contamination with the infective ova, or cysts of the parasites [26, 30]. The diseases caused by the parasites constitute serious public health problems mostly in developing countries which lack necessary arsenals to combat the infections [5]. Most of the diseases (Such as Hookworm infections, Ameobiasis, Giardiasis, Ascariasis among many others) have been reported to be responsible for chronic diarrhea, liver failure, intestinal disturbances and stunted growth in the affected individuals [44,28,30,41]. Infection in human generally occurs directly through contact with rodent excrement, ingesting food contaminated with their fur, feet, urine or fecal dropping, rodent's

bites and indirectly through bites from ectoparasitic vectors such as flea and ticks [42]. Wild rodents serve as reservoir host and have greater ability to harbor a number of endoparasitic agents that play important role in human and livestock health [42, 14,12,35]. Helminths such as *Trichinella*, *Angiostrongylus*, *Capillaria*, *Hymenolepis*, *Railletina*, *Echinococcus*, *Schistosoma*, *Paragonimus*, and *Echinostoma* that were reported from rodents are importance in public health [23,22]. In addition, some of rodents' endoparasites such as *Capillaria hepatica* and *Angiostrongylus cantonensis* cause severe syndromes in humans and other animals [36]. Thus, investigation on rodents' parasites in different geographical areas has medical and veterinary importance to prevent transmission of diseases to humans and animals. Several studies have been conducted on parasites of wild rodents from different part of the world that reveal the occurrence of a rich parasite diversity including the endoparasitic helminths fauna [42, 14, 12, 35]. In Nigeria, there are some reports on the occurrence of gastrointestinal parasitic infection in different species of rodents in some areas [3, 17, 27, 33]. In addition, it is demonstrated that some rodents' species are reservoir of cutaneous

leishmaniasis [15, 45] and visceral leishmaniasis [29]. However, to the best of my knowledge, no study has been done on helminths' infection of rats in Osogbo. As efforts are being geared towards reducing the public health burden of the gastro-intestinal parasites in the developing countries, proper understanding of the routes of contacting the parasites would be of immense relieve in planning effective control strategies. The present study was carried out to investigate the roles of rats in disseminating gastro-intestinal parasites in residential areas and market places in Osogbo, Southwestern Nigeria.

## 2 MATERIALS AND METHODS

### Study area and sampling of rats

**Study area:** Rodents for this survey were obtained from residential area and market places of Osogbo, Southwest Nigeria (Osogbo metropolis is the State Capital of Osun State and lies between longitude 4° 34'E and latitude 7° 46'N.), and then examined for parasitic helminthic infection. Osogbo is situated between two cold and warm regions and enjoys a moderate and mountainous climate. It rains most in winter and is moderately warm in summer. The annual rainfall is 500 mm. The average temperature in the hottest months is above 22 °C (Osun state website.) as cited by Rufai & Ajayi, (2016).

### Study population

The rats used for this study were rats of both sexes in residential areas and market places within Osogbo.

### Study design

A total number of 75 live rats were collected from selected locations in residential areas and market places within Osogbo, Southwestern Nigeria from November 2016 and January 2017. Rats were trapped using metal snares and glue board traps. Live traps were baited with pieces of smoked fish and/or fresh-water fish, and were active for five consecutive days per three residential areas and three market places. Trapped rats were transferred to Tetfund Zoological Laboratory, Osun state University, Osogbo, and procedures for examination were carried out in adherence to the Ethical Committee on Biological Research, Osun state. After 24-48 hours the rats were euthanized by barbiturate anesthesia overdose. Each rodent sex was recorded, and identification of the species was confirmed on the basis of morphological characteristics with reference to identification keys as described by Kataranovski *et al.*, 1994 [20]. Rats were classified into young and adults according to body weight (borderline value 200 g). Samples were collected in batches, and immediately examined after euthanized. Complete external and internal autopsies for ectoparasites and endoparasites were carried out as described by

Research Animal Diagnosis Services, Research Model And Services, Charles River. Slides were prepared by crushing or scraping tissues rather than by taking surface smear. A scraping of the entire organ was made in the case of the gills, gall and urinary bladders. To each sample, 2ml of normal saline was added and then spun at 2000rpm for 5minutes. The deposit was then transferred into a glass slide and stained with 1% Lugol's iodine. The stained slide was subsequently observed under microscope for the ova and cysts of the parasites in accordance with [4] and an arbitrary scale was decided for measuring intensity of infestation of protozoan species. In metazoan infestations, total numbers of parasites were counted.

**Statistical Analysis:** Data on age, sex and those obtained during laboratory examinations of rats were summarized in Microsoft Excel Spread Sheet. 2007 version and presented in tables using descriptive statistics. The parasite burden in the body and faeces of the rats in the two environmental settings were subjected to statistical analysis using t-test.

## 3 RESULTS

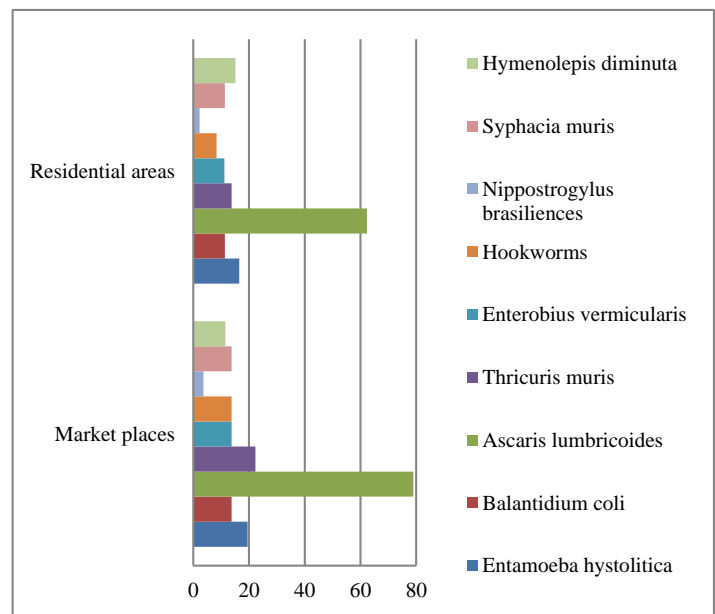


Figure 1. The prevalence of the parasites in rats positive for gastrointestinal helminth parasites in residential and market areas in Osogbo, Nigeria.

Table 1: Overall prevalence of gastrointestinal helminth parasites of rats in the sampled residential areas and market places in Osogbo

Variable	No of rats examined	No (%) infected	No of parasites identified		
			F	Bs	Io
<b>Location</b>					
Market places	38	22 (57%)	3	7	2
Residential areas	37	16 (43%)	3	7	2
<b>Sex</b>					
Male	35	17 (48.6%)	3	7	2
Female	40	21 (52.5%)	3	7	2
<b>Age</b>					
Young	30	9 (30%)	2	7	2
Adult	45	29 (64%)	3	7	2
Overall	75	38 (50.7%)			

F = faecal; Bs = Body surface; Io = Internal organs

Table 2. Mean of the parasite ova/ cysts on the body of rats collected in residential and market areas in Osogbo, Nigeria.

Parasites	Mean of the ova/ cysts of the parasite per rat	
	Residential	Market places
<i>Entamoeba histolytica</i>	4.0	3.5
<i>Entamoeba coli</i>	5.5	7.5
<i>Hymenolepis diminuta</i>	3.4	5.5
<i>Ascaris lumbricoides</i>	7.0	7.5
<i>Thricuris muris</i>	7.4	7.5
Hookworm	0	9.0
<i>Enterobius vermicularis</i>	1.5	6.5
<i>Nippostrongylus brasiliences</i>	2.3	3.1
<i>Syphacia muris</i>	3.7	5.3
<i>Hymenolepis diminuta</i>	0	1

The overall prevalence of gastrointestinal helminths of rats in the sampled residential areas and market places in Osogbo is presented in Table 1. Of the 75 sampled rats, 35(48.0 %) were males and 40 (52 %) were females. All rats were separated in two age groups, young 30(40.0 %) and adult 45(60.0%). Intestinal helminths were found in 37(49.3%) of the rats. A higher prevalence of infection was noted in male 21 (52.5%) compared to female rats 17 (48.6%). Of all rat samples collected, 37 were collected from the residential areas while 38 were collected from the market places. 16 (43%) of the 37 rats collected in residential area harboured gastro-intestinal parasites while 22 (57%) of the 38 rats from market places harboured parasites (Table 1). Cysts, ova and larvae of seven gastro-intestinal parasites namely cyst of *Entamoeba histolytica*, cysts of *Balantidium coli*, ova of *Ascaris lumbricoides*, larvae of *Strongylus* sp., ova of *Enterobius vermicularis* ova of Hookworms and ova of *Hymenolepis diminuta* were encountered on the body surface, while cysts of *Thricuris muris*, *Entamoeba muris* and larvae of *Ascaris lumbricoides*, *Nippostrongylus brasiliences* were found in the faecal samples while *Syphacia muris* and *Hymenolepis diminuta* were recovered from the intestines as the species of nematodes and cestodes recovered in this study respectively (Table 3). The same parasites were found in both rats sampled in residential areas and market places. The rats from market places had more parasite occurrence (four out of six) and burden than the residential areas (three out of six) but the differences in parasite occurrence and burden were not significant ( $p>0.05$ ) (Figure 1 and Table 2). The ova of *A. lumbricoides* had the highest occurrence and parasite burden in the body surface of the rats' positive for gastrointestinal helminthes in both market places and residential areas. The mean parasite load ranged between 3.5 and 9.0 oval/cyst per rats in market places while the mean parasite load was 1.5 - 7.5 per rats in the residential areas.

#### 4 DISCUSSION

The present study gives the first overview on the gastrointestinal parasitic infection of trapped rodents in Osogbo, of which nine species of helminths were reported. Data from previous studies on helminths parasites in rodents of other parts of Nigeria were partially comparable with the helminths fauna in the present study. The results from this study have demonstrated that rats constitute serious public health threats in Osogbo metropolis apart from their destructive habits. All the parasites recovered from their body are of medical importance and have been implicated in many gastro-intestinal disorders. *Entamoeba* species, *B. coli*, Hookworm and *A. lumbricoides* have been reported to cause chronic diarrhea, liver complications and stunted growth in the affected people [44, 39,28, 30, 41, 5]. The higher percentage of the rats harboring gastro-intestinal parasites encountered in market places is not a

departure from the expected results as similar observations have also been reported elsewhere (Salehzadeh *et al.*, 2007). Market place has poor sanitation and waste disposal habits of indiscriminate dumping of refuse, and these rats would have been contaminated during their movements on the dirty environment including toilets, waste dumps and indiscriminate movement of people from different environmental areas who might have brought parasites' eggs or oocysts through their shoes or baggage from contaminated areas. This emphasizes the significant role of rats in the transmission of zoonotic infections. The remarkable aspect of the results is however, the recovery of the major gastro-intestinal parasites (*Entamoeba muris*, *Hymenolepis diminuta*, *Balantidium coli*, *Ascaris lumbricoides*, *Enterobius vermicularis*, Hookworms, *Strongylus* sp.) in rats from both residential areas and market places. This observation arguably signifies the high burden of gastro-intestinal diseases and poor sanitary conditions of residential areas and market places in Osogbo metropolis despite monthly environmental sanitation in the city as these rats would have been contaminated through these dirty areas. The occurrence of *A. lumbricoides* in the faeces of rats in this study might have resulted from rats getting in contact with infected human faeces, Stewart, 1919 discovered as established by Davaine, 1863 that newly hatched larvae of *Ascaris lumbricoides* could be found in the faeces of rats (Ransom & Forest, 1919). The high occurrence of *A. lumbricoides* over other gastrointestinal parasites as recorded in this study may be associated with poor sanitary conditions. If our hypothesis of high disease burden of gastrointestinal infections in Osogbo metropolis is latter accepted through further investigations, the contamination of the rats as observed in this study would undoubtedly worsen the epidemiological situation. These parasites can be easily spread by body contacts, urine and faecal materials of the rats with food items, eating and drinking utensils in the homes and markets. The marginal disparity in the number of the parasites encountered in the body surface in comparison with those found in the faecal samples and intestinal organs could possibly be explained in two ways; it could be that the rodents only have body contact with the parasites without ingesting them or host specificity came into play where the parasites were unable to survive in the intestines of the rodents. Both reasons are valid when considering the fact that some of the ova/ cysts of the parasites encountered are sensitive to changes in environmental factors [40].

The current study identified *Hymenolepis diminuta* as the only species of tapeworm recovered from domestic rats in Osogbo. This finding is in agreement with Stojcevic *et al.*, (2004)[43] who also reported that *H. diminuta* as the only species of tapeworm recovered in rats in Maiduguri. The zoonotic potential of *Hymenolepis diminuta* was also previously reported in the United States, where it was associated with gastrointestinal disorders,



mainly in children [27] as cited by [35].

All parasite species showed a higher prevalence in male rats than in females. This was attributed by [ (Davis *et al.*, 1948; Pisano and Storer, 1948; Calhoun, 1962) as cited by [35] to the fact that infected males have larger territories than uninfected males, and that the home range of males tends to overlap which could increase their exposure to infection while reproductive females show a stronger site-specific organization. Also, the male hormone testosterone has a negative effect on the immune function (Grossman, 1989; Folstad *et al.*, 1992). Another hypothesis assumes that among mammals the larger bodies of males are easier targets for parasites [6]. In this study, Infection rate in male animals 21 (52.5%) was higher than female 17 (48.6%), this is in agreement with finding of [1] who also found higher prevalence of helminths in male rodents.

Therefore, the recovery of helminths from domestic rats sampled in this study is not an unusual finding, because rodents are ubiquitous animals and have a fundamental role in the epidemiology of several diseases, including parasitic zoonoses.

## 5 CONCLUSION

In conclusion, we have reported the public health risks of rats as carriers of medically important gastro-intestinal parasites in Osogbo metropolis. We therefore recommend wholesome hygienic conditions of the residents of Osogbo metropolis since rats only thrive in filthy environment. We also recommend better packaging before food stuffs meant for sale are display in the market, to prevent contamination of food stuffs that may be sold across border. The periodic fumigation of the residential areas and market places is also imperative so as to reduce the incidence and risks of gastrointestinal parasitic infections through rodents' disseminators such as domestic rats as observed in this study.

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