

HUMAN INFECTING PARASITIC WORMS, IN COCKROACHES FROM ODAU IN THE NIGER DELTA REGION OF NIGERIA

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ABSTRACT

Parasitic worms of different species were obtained from cockroaches examined in Odau, a community in the Niger Delta region of Nigeria. One thousand (1000) cockroaches were caught from households (one hundred), randomly selected within the community. The helminths were identified as *Trichuris trichuria* (N=313; 20.6%); *Ancylostoma duodenale* (N=368; 24.4%); *Ascaris lumbricoides* (N=571; 36.6%); *Strongyloides stecoralis* (N=173; 11.4%); and *Trichostrongylus sp.* (N=93; 6.1%). Seven hundred and ninety one (79.1%) out of the cockroaches, had parasitic helminths. The total number of parasites isolated was one thousand, five hundred and eighteen (1,518). The rate of occurrence of *Ascaris sp.* in the cockroaches was significantly higher ($p < 0.05$) compared to the other parasites. The abundance of helminth parasitic species in the cockroaches examined in the present study indicate that the environment may not be in good sanitary condition. If this level of association between cockroaches and helminth parasites is maintained, the transmission of parasitic agents/diseases especially to humans in the area will increase.

Keywords: Cockroaches, Parasitic helminths, Increased transmission, Human infection, Dirty environment.

Contribution/ Originality

This study is one of the very few studies which have investigated cockroaches (*Periplaneta americana*), in line with its association with helminths, found to be parasitic to the humans especially, in the Niger Delta, Nigeria. The parasites extracted from the cockroaches can cause diseases which are easily transmitted to people within the community, especially, where the sanitary condition is low.

1. INTRODUCTION

The prevalence and morbidity of human helminth infections in Nigeria, especially, in rural areas are continuously high. Some habits and communal associations of humans are believed to encourage the spread and sustenance of helminth infections [1, 2]. The public health importance of helminthic infection is largely related to its high morbidity, especially in children (1-15 years), in endemic areas.

It was reported that intestinal helminthiasis affects an estimated 500 million to 1 billion people yearly, with at least 400 million children of school age, chronically infected with *A. lumbricoides*, *T. trichuria* and hookworms [3]. An estimated 280 million children, were infected yearly with hookworm (out of these, 41 million cases occurs in sub Saharan Africa), 478 million were infected with *Ascaris lumbricoides* and 347 million were infected with *Trichuris trichuria* in the world [4].

Humans acquire these worms either by ingestion of the eggs, (*Ascaris lumbricoides*, *Enterobius vermicularis* etc., and *Trichuris trichura*) or by larval penetration of skin (*Strongyloides stecoralis* and *Ancylostoma spp.*), and transmission is closely related to environmental hygiene [1, 2, 5]. Man appeared to be the principle source of the infection, since he carries the helminth parasites and spreads them to others, through infected faeces. On the other hand, studies have shown that arthropods can also transmit helminth parasites to humans [6-9].

Cases of human infecting parasitic organisms in association with cockroaches had been observed and reported in some parts of the world [6, 7, 10]. Data on the association of cockroaches with parasitic helminthes in Nigeria, especially, in the study area, are scarce. The present study aims at examining the occurrence of helminth parasites of humans in the digestive system of cockroaches.

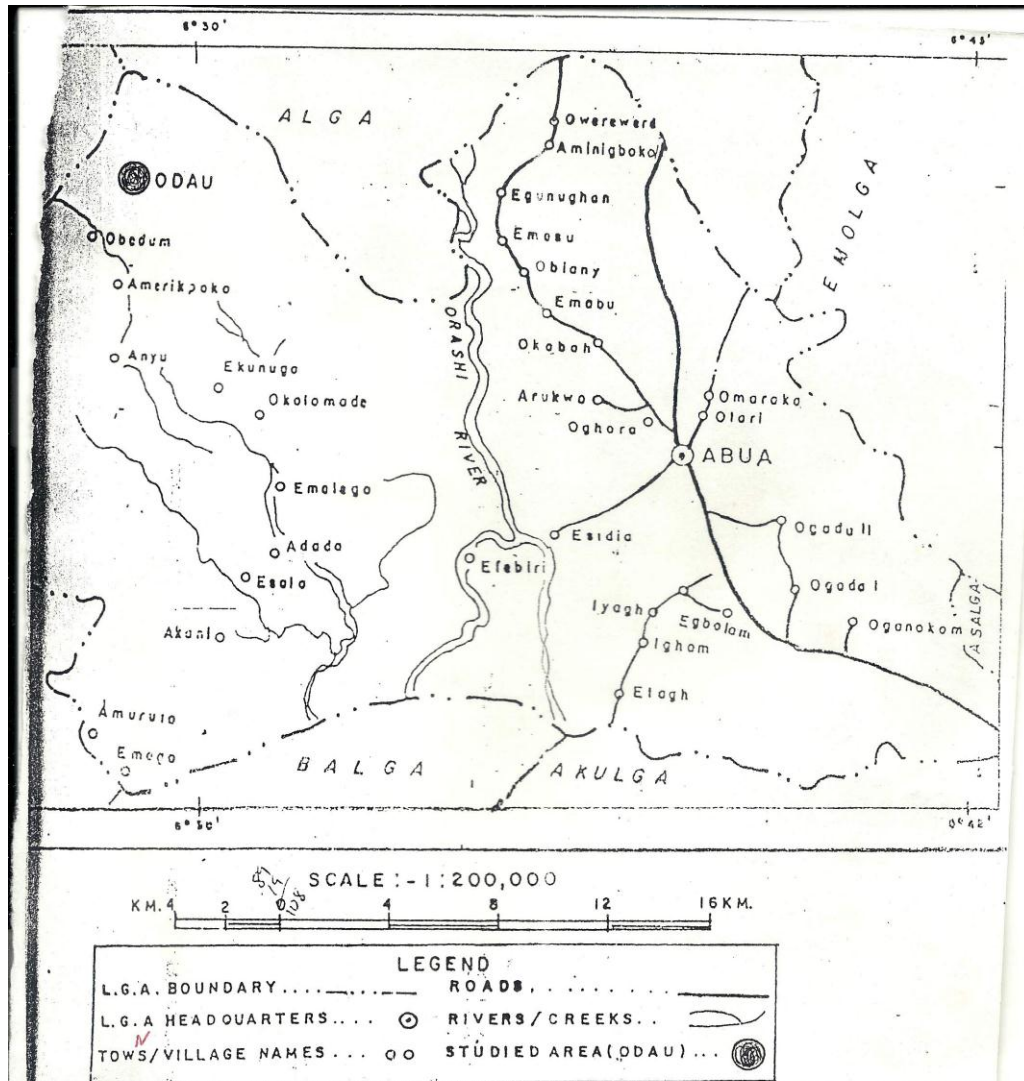
2. MATERIALS AND METHODS

2.1. Study Area

This study was conducted in a rural community in Rivers state, in the Niger Delta area of Nigeria fig.1. Odau is located on latitude 4°56'N and longitude 6°27'E'. The temperature ranges from 29°C during the rainy season, to 32°C during the drier months. Dry season occurs from late December to February while the period of rainfall lasts from March to the middle of December. The average rainfall is 2,200mm annually [11]. Odau is among the lowest areas of the flood plains of the Niger Delta with average altitude of 2.3m above sea level and vegetation which is fresh water swamp forests.

The people of Odau are predominately peasant farmers and fisher-folks, and palm wine tappers. They depend sufficiently on ponds and rain water for most of their occupational and domestic activities. The inhabitants live in clustered homesteads of mainly mud houses, reinforced with bamboo sticks. Due to lack of adequate toilet facilities, and other essential amenities, most of them defaecate in the bush.

Fig-1. Map of AbuaOdual L.G.A. showing Odu, the study area.



2.2. Sample Collection

One thousand (1000) cockroaches were caught from 100 households in Odu, Abua Odual Local Government Area Rivers State, Nigeria.

The cockroaches were caught alive with sterile broom, (between 8.00pm and 11.00pm and in the morning, between 7.00am and 9.00am) and kept in labeled specimen containers, containing cotton wool soaked in chloroform. Thereafter, they were taken to the Laboratory and left overnight in the refrigerator at 4°C.

2.3. Dissection of the Cockroaches to Expose the Digestive System

Each cockroach was pinned down in a dissecting tray, with the ventral side facing up. The head and legs were severed out using a small sharp pair of scissors and fine pointed forceps. The body was carefully opened from the rear to the thorax. Using a small sewing needle, fats surrounding the abdominal organs were removed and the alimentary canal was exposed. It was

completely cut out and put in a 50ml specimen container and 5ml of physiological saline was added. Three cuts were made on the intestine and rectum to release the contents of the digestive system into the container, containing physiological saline.

2.4. Microscopic Examination of the Preparation

Some drops of Lugol's iodine were added to the mixture of the gut content and physiological saline. The intestinal contents were viewed under 10x magnification of a binocular microscope, for the presence of helminths. Eggs and larvae of helminth parasites present were identified, and the numbers were counted and recorded. Adult worms were viewed using magnifying glass or hand lens.

3. RESULTS

There is high occurrence of different species of parasitic helminthes in the digestive system of cockroaches examined in Odau community. Out of 1000 cockroaches examined, seven hundred and ninety-one (79.1%) of them had parasites. The five species of human helminth parasites extracted were, *Trichuris trichuria*, *Ancylostoma duodenale*, *Ascaris lumbricoides*, *Strongyloides stecoralis* and *Trichostrongyloid* sp. The highest occurring helminth parasite was *Ascaris* sp., with a total number of 571 (37.6%). The rate of occurrence was significantly higher ($p < 0.05$) than that of the other helminths isolated. The number and percentage occurrence for each helminth species were shown in table 1.

In cockroaches collected for examination during the day, 72.0% of them with parasites were collected outside the house, and 79.6% were collected from inside the house. On the other hand, 84.0% of those collected outside the house at night, had parasites, while 80.0% of them with parasites were collected inside the house table 2.

The total number of parasites obtained from the study, were one thousand, five hundred and eighteen. The cockroaches which were caught at night had more parasites than those caught during the day. The peak occurrence rate (N= 496; 32.7%) of the parasites was found in cockroaches got outside the houses at night. Conversely, in cockroaches collected outside the house during the day, the parasites, had the lowest occurrence rate (18.9%) table 3.

The distribution of the parasites according to different sites and periods was shown in table 4. The number of *Trichuris* sp. obtained was higher (N= 105; 33.5%) in cockroaches caught outside the households at night. Similarly, *Ascaris* sp., *Strongyloides* sp., and *Trichostrongyloids* sp. were highest in cockroaches collected outside the house at night. On the other hand, the number and percentage occurrence of Hookworm (*Ancylostoma* sp. N= 173; 40.0%) in the cockroaches were highest in those caught from inside of the households at night.

Generally, it was observed that the cockroaches collected outside human dwellings at night, had the highest number of helminth parasites compared to the ones collected from inside of the houses. Moreover, the number of helminthes obtained from cockroaches which were collected during the day time was significantly lower ($p < 0.05$) than those collected at night.

4. DISCUSSION

Parasitic helminths known to infect man were extracted from the digestive system of the cockroaches examined. This indicates an increase in the mode of transmission of helminth parasites in the community. Some arthropods have been implicated in the transmission of human infective helminth parasites. A study conducted in Mexico [10] reported the presence of many parasitic helminths and protozoa in the gut of cockroaches.

In Malaysia, three types of nematodes (eggs of round worms *Ascaris lumbricoides* L., Pinworm- *Trichuris trichuria* L., and Hookworm- *Ancylostoma* spp.) were found on the external body surface and in gut contents of some Diptera- *Chrysomya rufifacies*, (Macquat), *Chrysomya amegacephala* (Fabricius) and *Sarcophaga* spp [6]. Also, in Addis Ababa, Ethiopia, it was noted that the flies *Musca domestica* L. and *Chrysomya megacephala* F. were mechanical vectors of helminthic parasites in a typical slum area [7].

All the parasites isolated were of great health risks.

The public health importance of helminthiasis is reportedly due to the high morbidity experienced in the infection, especially, in children in endemic areas [1]. Poor health status of the affected individuals may result in loss of ability to perform their daily activities effectively. The effects of feeding on humans by different helminth parasites manifest in different forms. *Ascaris lumbricoides* for instance, sucks blood, nutrients and liquid contents of the hosts intestinal lumen, causing mal-nourishment, under development and cognitive impairment in small children [8]. Chronic ascariasis in the adult humans, could result in allergic reactions, sensitization phenomenon and fatal intestinal obstruction often leading to death [9]. Others including *Trichuris* sp. *Strongyloides* sp. etc., cause different pathological disorders in the human body, which are not restricted to the gastro intestinal tracts [10-13].

The high rate of occurrence (79.1%) of helminths parasites in the cockroaches examined was associated with the poor rural condition of the community, and their habit of defaecating in the bush, due to lack of adequate toilet facilities and other essential amenities. It has been noted that eggs of helminth parasites contaminate the soil through the faeces of infected humans and could adhere to food materials or organisms, in contact with the soil or faeces [14]. These were possible ways in which cockroaches could contact the infecting organisms, since they forage in different filthy habitats, including toilets, soil, dead and decaying materials, and even aquatic environment [2, 4].

Cockroaches live in dirty environments, feed on filthy materials including human faeces which may be colonized by parasites and other pathogenic organisms, and could be the primary source of the infection to people. The legs of many species of cockroaches are morphologically modified with comb like tubercles, spines or hairs, to aid the process of feedings, grooming and contamination of food and water in human dwellings [15, 16].

A number of studies had noted that environmental dirtiness, low levels of living standards, low income, etc. and ignorance contribute to the continued increase in prevalence and morbidity of parasitic infections in Africa [2, 5, 8].

Most Cockroaches have been observed to move daily from their harborage where they forage, to human habitations [15]. They are commonly seen in kitchens, stores, bathroom, toilets,

bedrooms and even cupboards, wardrobes and refrigerators [15]. Their nocturnal and filthy habits were noted to make them ideal carriers of serious pathogenic agents, which results in food poisoning, leading to serious diseases of humans [16-18]. Cockroaches are capable of biting human beings especially when they are sleeping. Some humans reportedly develop allergic reactions to cockroach antigens, often inhaled through particles of dust containing their crushed parts in air, or through their undesirable smell, or by mere seeing a cockroach, with resultant asthma related health problems [8].

This study also observed that infected cockroaches could be found anywhere in a dirty environment, including human dwellings. That explained why high numbers of parasitic helminthes occurred both in cockroaches inside the houses and those collected from the surroundings. That, therefore creates the impression that the environment may not be in good sanitary condition. Close contact with cockroaches especially in human dwellings should be discouraged. With clean environment, toilet facilities, and good drinking water, the people will maintain some level of healthy living.

5. CONCLUSION

There is high occurrence of different species of parasitic helminthes, in the digestive system of cockroaches examined in Odau community. This creates the impression that their environment may not be in good sanitary condition and the infections, could easily spread from the cockroaches to humans in the community. Close contact with cockroaches especially in human dwellings should be discouraged.

Due to the low standard of sanitation and developments in the community, there is the need to properly educate the population, on the dangers associated with cockroaches and how to control them.

Further studies should be carried out in the community to ascertain the status of helminth infections in the humans. Environmental hygiene is very necessary and should be encouraged in every locality, to reduce the population and bad effects of arthropod pests, especially, cockroaches in human surroundings.

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Plate-1. Photograph of one of the cockroaches examined.



Table-1.Number and type of parasites obtained from the cockroaches

Parasite type	Total number of parasites	Percentage occurrence
<i>Trichuris trichuria</i>	313	20.6
<i>Ancylostoma duodenale</i>	368	24.4
<i>Ascaris lumbricoides</i>	571	37.6
<i>Strongyloides stecoralis</i>	173	11.4
<i>Trichostrongylous sp.</i>	93	6.1
Total	1518	

Table-2.The rate of infection of the cockroaches according to collection sites and periods of the day.

Sites/periods of collection	Number of cockroaches examined	Number of parasites	with parasites	Percentage with parasites
Day/ outside	250	180		72.0
Day/ inside	250	199		79.6
Night/ outside	250	210		84.0
Night/ inside	250	202		80.0
Total	1000	791		79.1

Table-3.Prevalence of the parasitic helminthes.

Site/period of collection	Number of parasites	Percentage infection
Day/outside	288	18.9
Day/inside	354	23.3
Night/outside	496	32.7
Night/inside	380	25.0
Total	1518	

Table-4. Rate of occurrence of parasites helminthes according to time of the day and site of collection.

	Trichuris - trichuria	Ancylostom a duodenale	Ascaris lumbricoide s	Strongyloide s stecoralis	Trichostrongylou s sp.
Day/ outside	57(18.2)	49(13.3)	130(22.8)	28(16.2)	24(25.8)
Day/insid e	71(22.6)	53(14.4)	170(29.8)	45(26.0)	15(16.1)
Night/ Outside	105(33.5)	93(25.3)	200(35.0)	66(38.2)	32(34.4)
Night/ Inside	80(25.6)	173(47.0)	71(12.4)	34(19.7)	22(23.7)

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