

Full Length Research Paper

# Prevalence of cockroaches (*Periplanata americana*) in households in Calabar: Public health implications

Etim, S. E.<sup>1\*</sup>, Okon, O. E.<sup>2</sup>, Akpan, P. A.<sup>1</sup>, Ukpong G. I.<sup>1</sup> and Oku, E. E.<sup>1</sup>

<sup>1</sup>Department of Biological Sciences, Cross River University of Technology, Calabar, Cross River State, Nigeria.

<sup>2</sup>Department of Zoology and Environmental Biology, University of Calabar, Calabar, Cross River State, Nigeria.

Accepted 14 January, 2013

The study was carried out in Anantigha area of Calabar, Nigeria and involved the trapping and examination of cockroaches from toilets, kitchens, living rooms and bedrooms of houses to determine the parasites in and on the cockroaches and also to assess the possible role of the cockroaches in the dissemination of medically important parasites. A total of 322 cockroaches were trapped from the different sites within the households and all identified as *Periplananta americana* species. Out of the 322 cockroaches examined, 58.6% were infected with one or several species of gastrointestinal parasites. Parasites isolated and identified include *Balantidium coli* (8.8%), Hookworms (9.6%), *Entameba coli* (10.4%), *Enterobius vermicularis* (12.9%), *Entameba histolytica* (13.7%), *Trichuris trichuira* (16.9%) and *Ascaris lumbricoides* (24.4%). Cockroaches collected from the toilets had the highest parasite load of 4 to 54 parasites/ml followed by those from the kitchen with 1 to 24 parasites/ml, and those from the living room 1 to 12 parasites/ml while 1 to 10 parasites/ml was observed from cockroaches from the bedroom. No cestodes were encountered in this study. More parasites were recovered from the external than in the gastro-intestinal tract with prevalence rates of 65.3 and 34.6%, respectively. The presence of gastro-intestinal parasites was significant since these parasites can easily be transferred by the cockroaches to humans. This study has shown that cockroaches represent an important reservoir of important parasites which can cause disease in man. It also highlights the potential of cockroaches as mechanical transmitters of parasite ova and cysts which they pick up from faeces and transfer to food by crawling. There is need to control cockroaches indoors and outside.

**Key words:** Cockroaches, parasites, mechanical transmission, Calabar, Nigeria.

## INTRODUCTION

Cockroaches are found all over the world with about 3500 known species. They are among the notorious pests that are found in households, supermarkets, public places, and refuse dumps. In addition to their repulsive and annoying characteristics, they eat and contaminate food and leave a persistent offensive odour in infested places (Revault et al., 1993; Pai et al., 2004) and Lemons et al. (2006). Cockroaches are nocturnal and omnivorous and

these characteristics make them ideal carriers of pathogens. According to Taffeng et al. (2005), cockroaches are known to carry bacteria, protozoa, helminthes fungi and viruses, however, their role or direct transmission of these infectious agents has not been really established. According to Pai et al. (2004) and Salehzadeh et al. (2007), parasites have been found on the external parts of cockroaches. Also, Kim and Zong (1974) Thyseen et al. (2004) and Chan et al. (2004) have also shown that cockroaches are carriers of medically important organisms.

Cockroaches are something that many people are worried about when they see them in their homes. This is

\*Corresponding author. E-mail: [susaneetim@yahoo.com](mailto:susaneetim@yahoo.com), [drsusaneetim@yahoo.com](mailto:drsusaneetim@yahoo.com).

because the presence of cockroaches indicates unsanitary conditions. According to Graczyk et al. (2005) cockroaches are known to carry organisms that cause diseases like dysentery, typhoid and polio as well as gastroenteritis because they live on anything from fermenting products, rotting food, faeces, fresh food and then move from one location to another with ease. Their filthy breeding habits, feeding mechanisms and indiscriminate travel between filth and food make them efficient vectors of human enteric parasites. Cockroaches can cause potentially serious health problems, provoke allergic reactions and as have been suggested possible vectors by Thyseen et al. (2004), Getachew et al. (2007), Tاتفeng et al. (2005) and Fakoorziba et al. (2010). Cockroaches not only contaminate food with their droppings but can also cause food poisoning (Pai et al., 2004). According to Tاتفeng et al. (2005), some people are allergic to antigens and faeces of cockroaches which may result in asthmatic – related health problems. Even though no one exposes himself to their faces on purpose, it can be inhaled through particles of dust in the air. Food can also be contaminated with the faeces of the cockroaches, dead cockroaches and salivary gland excretions. So, the presence of even a cockroach is not to be overlooked as they can multiply and spread very fast. This is because they secrete a pheromone in their faces which attracts other cockroaches, with a quick buildup in unsanitary conditions. Cockroaches live in groups and are attracted to humidity, warmth and darkness and are common in toilets, bathrooms, kitchens and dining and bedrooms. The mere sight of cockroaches cause considerable emotional distress due to the strong repulsive odour they emit. Their presence in households is of epidemiological significance due to their nocturnal and filthy habits (Cruden and Markovetz, 1987). Their nocturnal and filthy habits make them ideal carriers of parasites.

This study assessed the prevalence of parasites of cockroaches and the potential of the cockroaches in diseases transmission in Calabar. Parasites were isolated from the external and gastro-intestinal tract of the gastro-intestinal tract of cockroaches.

## MATERIALS AND METHODS

### Study area

The study was carried out between January and June, 2011 in Anantigha area of Calabar. Anantigha is a peri-urban community where sanitary conditions are below standard. There is no pipe-borne water supply and the people rely on wells and commercial bore holes for their water needs. The area was chosen because of the low sanitary conditions and presence of refuse heaps which attracted flies and cockroaches. Some households still used pit latrines for defecation since there was no adequate water supply for water closet toilets. Some houses with water closets lacked water for proper use and the toilets were usually in a poor sanitary condition. Temperature in Calabar ranges between 28 and 32°C and mean annual rainfall is 1830 mm. There are two distinct seasons; the rainy season (April-September) and the dry season (October-

March).

### Sample collection

Three hundred and twenty two (322) adult cockroaches were trapped from different parts of the 65 households selected randomly from the community for the period of the survey. Fifteen houses were separate bungalows having single family units while 50 houses were buildings with many families who shared facilities, kitchens, bathrooms and toilets. Only whole and live cockroaches were used for the study. The cockroaches were caught at night on sticky traps placed against vertical surfaces corners and floors of the kitchen, toilets, bathrooms, bedrooms and living rooms from households in different parts of the community. Each cockroach after collection was put in a sterile universal container and transported within an hour to the Biology Laboratory of Cross River University of Technology, Calabar, for further examination. The cockroaches were killed individually by using chloroform-soaked cotton wool and examined under the dissecting microscope for identification using standard taxonomical keys.

### Isolation of parasites from the external surface of the cockroaches

After identification, 2 ml of normal saline was added to the universal container with the cockroach and shaken for 2 min to detach the parasites on the surface of the cockroach. 1 ml of the washing fluid was then transferred to a centrifuge tube and centrifuged at 2000 rpm for 5 min. The supernatant was discarded and the deposits stained with 1% Lugol's iodine and examined using light microscope x40 objective lens as described by Salehzadehah et al. (2007). Parasites were identified using taxonomical keys and counted.

### Isolation of parasites from the gastro-intestinal tract of the cockroaches

After the external examination, the cockroaches were separately placed in 70% ethanol for five minutes (to remove parasites from the external surfaces) and then washed in sterile saline to remove the alcohol from the body of the cockroaches. They were allowed to dry at room temperature. The cockroach was then fixed on a dissecting Petri-dish, the head severed first, followed by the legs, then the abdomen was opened using fine pointed forceps and discarded. The gut and other abdominal organs were removed using fine needles. The intestine was then examined over a black background for detection of parasites. 2 ml normal saline was added and the intestine macerated. 1 ml of the macerate was centrifuged at 2000 rpm for 5 min and the deposits stained with 1% Lugol's iodine before examination. Ova and cysts of parasites present were identified using taxonomical keys and counted using x40 objective lens of the light microscope.

## RESULTS

A total of 322 cockroaches were collected during the period of survey from the 65 households examined and all were identified as *Periplaneta americana*. The study revealed that these cockroaches trapped from different places in the houses (toilets, kitchen, living rooms and bedrooms) harboured various microorganisms with an

**Table 1.** Number of infected cockroaches trapped in various sites in the 65 households in Calabar.

Location	No. of cockroaches examined	No. of cockroaches with parasites infected	Percentage infection rate	Parasites/ml mean range
Toilets and latrines	160	102	63.7	4 – 65
Kitchens	112	64	57.1	1 – 24
Living rooms	28	13	46.4	1 – 12
Bedrooms	22	10	45.4	1 – 8
Total	322	189	58.6	

**Table 2.** Types of parasites and percentage infection rate presence of parasites on cockroaches examined.

Type of infection	No. of cockroaches infected	No. of parasites isolated	Percentage infection rate
Helminthes	151	166	79.8
Protozoa	38	82	20.1
Total	189	248	

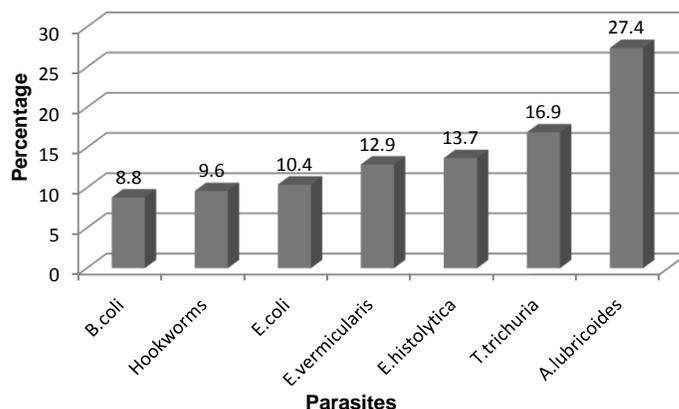
**Table 3.** Parasites infection present on external and gastro-intestinal tract of cockroaches in Calabar.

Site examined	No. of cockroaches infected	No. of parasites isolated	Percentage infection rate
External surface	189	162	65.3
Internal surface gastro-intestinal tract	189	86	34.6%
Total	189	248	

infection rate of 58.6%. A total of 248 organisms of medical importance were identified and comprised, cysts of *Balantidium coli* (8.8%) Hookworms (9.6%), *Entameba coli* cysts (10.4%), *Enterobius vermicularis* (12.9%), *Entameba histolytica* cyst (13.7%), *Trichuris trichiura* (16.9%), *Ascaris lumbricoides* (27.4%), collected from the external and internal surfaces gastro-intestinal tract of the cockroaches collected. There were mixed infections in some cockroaches as 30.6% of the cockroaches examined harboured all the parasites identified, 16.9% had four parasites each, 14.8%, two parasites each while 14.2% had five parasites each and 11.6% had one parasite while 1.5% had three parasites each. No cockroach had five parasites. Cockroaches collected from the toilets and latrine had the highest infection rate of 63.7% followed by cockroaches collected from the kitchen with 57.1%, those from the living room 46.4% while those from the bedroom had 45.4% as shown in Table 1. shows percentage of cockroaches that had parasites. Those with the highest percentage of infection rate were cockroaches collected from the toilets.

Table 2 shows that more helminthes and protozoa (79.8% and 20.1%) were isolated from the cockroaches More parasites, 65.3% of total parasites obtained were isolated from the external surface than the gastro-intestinal tract that had 34.6% (Table 3).

Figure 1 shows that *A. lumbricoides* was the largest in number most common parasite while the least common



**Figure 1.** Percentage of the various parasites isolated from the cockroaches.

was *B. coli*

**DISCUSSION**

Speculations have always been made on the involvement of cockroaches as possible vectors of diseases in our communities. However, very few studies are available on this issue. Findings from this study indicated that cockroaches may play an important role in the trans-mission of some parasites especially those isolated and identified.

Parasite infection rate of 58.6% observed on the cockroaches observed in this study is quite significant. This is comparable with results by Chamavit *et al.* (2011) but lower than Al-Mayali and Al-yaqoobi (2010) who reported infection rates of 54.1 and 83.33% respectively. This high prevalence recorded in Anantigha area of Calabar may be due to unsanitary conditions coupled with low socio economic status of the people. Organisms identified in this study are all known parasites which produce disease in humans and is similar to Tachbele *et al.* (2006). All the collected cockroaches were identified as *P. americana*. Results in this study are similar to results by Pai *et al.* (2003) and Chan *et al.* (2004) who stated that significant since cockroaches are known as carriers of infectious agents and significantly contribute to the spread of parasitic infections, this is similar to the report by Chan *et al.* (2004). Poor faecal and garbage disposal systems observed in this area, contribute to the proliferation of cockroaches and parasitic contamination of the cockroaches with resultant possible transmission of these parasites to human food when by the cockroaches crawl about. It is important to note that the cockroaches collected from the toilets had more parasites because they were easily exposed to and contaminated by faecal matter. As a result of their high mobility of the cockroaches, they easily deposit parasites carried on their bodies or within them on food and other parts of the house when they move about. Cockroaches from houses with pit latrines had higher mean parasite count when compared to those trapped from houses with water system toilets (with 65 and 52 parasites/ml) respectively. This variation could be explained by the fact that pit latrines are more accessible to the cockroaches and these also provide more favourable hide-outs during the day while the cockroaches move during the day into the house at night in search of food.

Our findings show that there are many parasites of public health significance carried and harboured by cockroaches in Calabar. Unfortunately, the people did not consider presence of cockroaches and parasitic infections as a serious problem, even though they did not like the sight of cockroaches.

The isolation of these parasites from the cockroaches indicated that these pests could pose health problems to humans who may overlook their potential role in the spread of these parasites.

Although it is difficult to prove the direct involvement of cockroaches in the direct transmission of pathogenic agents, it is important to note that since they carry pathogenic organisms that are of public health and medical importance inside and on their bodies, they can be incriminated in the mechanical transmission; these organisms then they move about from faeces to food and vice versa.

## Conclusion

Cockroaches constitute an important reservoir for

pathogens; therefore the control of cockroaches is important since this will reduce the spread of parasitic diseases transmitted by cockroaches in the community. Cockroaches represent a risk for humans even though their involvement in biological transmission of diseases is still difficult to demonstrate and be determined. Control and management of cockroach infestations in Calabar and elsewhere should be conducted to reduce their spread. This should involve daily emptying of garbage and proper disposal along with and elimination of the cockroach habitats and the cockroaches within the home using insecticides.

## REFERENCES

- Al-Mayali HH, Al-yaqoobi MSM (2010) Parasites of cockroach. *P. americana* (L) in Al-Diwaniya Province, Iraq. *J. Thi-Qar Sci.* 2(3).
- Chan OT, Lee TK, Hardman JM, Navin JJ (2004). The cockroach as a host for *Trichinella* and *Enterobius vermicularis*: implications for public health. *Hawaii Med. J.* 63:74-77.
- Chamavit P, Sahaisooh P, Niamnuay N (2011). The majority of cockroaches from the Samutprakarn Province of Thailand are carriers of parasitic organisms. *EXCL I J.* 10:218-222.
- Cruden DL, Markovetz AJ (1987). Microbial ecology of the cockroach gut. *Ann. Rev. Microbiol.* 41:617-643
- Fakoorziba MR, Eghbal F, Hassanzadel J, Moemenbella-Ford MD (2010). Cockroaches (*P. americana* and *B. germanica*) as potential vectors of the pathogenic bacteria found in nosocomial infections. *Ann. Trop. Med. Parasitol.* 104(6):521-528.
- Getachew S, Gebre-Michael T, Erko B, Balkaw M, Medhin G (2007) Non biting cyclorophan flies (Diptera) as carriers of intestinal parasites in slum areas of Addis Ababa, Ethiopia. *Acta Trop.* 103:186-194.
- Graczyk TK, Knight R, Tamang L (2005). Mechanical transmission of human protozoa and parasites by insects. *Clin. Microbiol. Rev.* 18(1):126-132.
- Kim HU, Zong MS (1974) Microbiological study of the cockroaches from houses. *Korean J. Pub. Health.* 11:122-125.
- Lemons AA, Lemons JA, Prado MA, Pimenta FC, Gir E, Silva HM (2006). Cockroaches as carriers of fungi of medical importance. *Mycoses* 49:23-25.
- Pai HH, Ko JE, Chen ER (2003). Cockroach (*P. americana* and *B. germanica*) as potential mechanical disseminator of *E. histolytica*. *Acta Trop.* 87:355-359.
- Pai HH, Chen, Wei-chen C, Peng C-F (2004). Cockroaches as potential vectors of nosocomial infectious. *Infect. Control Hosp. Epidemiol.* 25(11):979-981.
- Revault C, Cloare A, Le Gruyader A (1993). A bacterial load of cockroaches in relation to urban environment. *Epidemiol. Infect.* 110:317-325.
- Salehzadeh A, Tavacol, P, Mahjub H (2007) Bacteria, fungal and parasitic contamination of cockroaches in public hospitals of Hamadan, Iran. *J. Vector-borne Dis.* 44: 105-110.
- Tachbele E, Erku W, Gebre-Michael T, Ashenafi M (2006) Cockroach associated food-borne bacterial pathogens from some hospitals and restaurants in Addis Ababa, Ethiopia: Distribution and antibiograms. *J. Rural Trop. Pub. Health.* 5:34 - 41.
- Tattfeng YM, Usuancele MU, Orukpe A, Digban AK, Okodua M, Oviasogie F, Turay AA (2005). Mechanical transmission of pathogenic organisms: The role of cockroaches. *J. Vector-borne Dis.* 42:129 - 134.
- Thyseen PJ, Moretti T, Dic Ueta MT, Ribeiro OB (2004). The role of insects (Blattodea, Diptera and Hymoptera) as possible mechanical vectors of helminthes in the domiciliary and pre-domiciliary environment. *Cad. Saude Publica* 20:10 96-1102.