



# Food-borne human parasitic pathogens associated with household cockroaches and houseflies in Nigeria



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## ABSTRACT

Cockroaches and houseflies pose significant public health threat owing to their ability to mechanically transmit human intestinal parasites and other disease-causing microorganisms. This study aims at assessing the vectoral capacity of cockroaches and houseflies in the transmission of human intestinal parasites. Intestinal parasite external surface contamination of 130 cockroaches and 150 houseflies caught within dwelling places in Ilishan-Remo town, Ogun State, Nigeria was determined. Cockroaches (six parasite species) were more contaminated than houseflies (four parasite species). The most prevalent parasites were *Trichuris trichiura* (74.0%) and hookworm (63.0%) in houseflies and cockroaches respectively. There were significant differences in the prevalence of hookworm, *T. trichiura* and *Taenia* spp. isolated from cockroaches and houseflies ( $P < 0.05$ ). There is high contamination of human intestinal parasites in cockroaches and houseflies in human dwelling places in the study area, thus they have the ability to transmit these parasites to unkempt food materials.

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## 1. Introduction

Soil transmitted parasites are important pathogens of public health concerns in most rural areas of many endemic countries (Hoorfar, 2011). Poverty, poor environmental hygiene, and impoverished health services have been noted as the predisposing factors (El-Sherbini and Gneidy, 2012). The most notable source of transmission of these parasites is through the indiscriminate disposal of human faecal waste. While these pathogens are often transmitted through consumption of contaminated water, convalescent carrier, and unhygienic food handlers, the importance of mechanical carriers like cockroaches and flies cannot be over-emphasised (Breitschwerdt et al., 2010).

Approximately 99% of the 4000 species of cockroaches described are wild and do not represent a risk to human health while the remaining 1% which are domestic have become a considerable nuisance and pose public health threat (Ramirez, 1989). Cockroaches are indiscriminate feeders and often times subsist on human faeces thus can serve as potential carrier of parasites, fungi and bacteria (Fotedar and Banerjee, 1992; Rivault et al., 1993a; Doiz et al., 2000; Pai et al., 2003). The role of cockroaches in the transmission of parasites such as *Entamoeba histolytica*, *Toxoplasma gondii*, *Sarcocystis*, *Giardia lamblia* and other protozoan parasites had been emphasised (Graczyk et al., 2005).

Associated with unsanitary conditions and human pathogens transmission are over 50 species of synanthropic flies (Getachew et al., 2007; Shoukry and Morsy, 2011). Flies are often attracted to unsanitary communities with garbage, carcasses and faeces and when scattered around dwelling places, they could facilitate the flies' migration indoors. Although our study area has factors that

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could potentiate easy contamination of cockroaches and flies with human intestinal parasites, little is known about the role of these insects in parasite transmission. So, the study assessed the public health impact of cockroaches and flies in relation to parasite contamination in a peri-urban community of Nigeria.

## 1.1. Materials and methods

### 1.1.1. Study area

Cockroaches (*Periplaneta americana* and *Blatta orientalis*) and houseflies (*Musca domestica*) were sampled from dwelling places within Ilishan-Remo community, Ogun State. The community is peri-urban with inadequate infrastructural facilities. Due to a lack of good toilet facilities in some dwelling places and organised community waste disposal systems, the people often resort to making use of nearby bushes for these purposes. There are small and large public waste and refuse dump sites around the community of which most are close to dwelling places, thus serving as suitable breeding sites for flies and cockroaches and their eventual migration into nearby houses.

### 1.1.2. Insects' collection and parasite isolation

A total of 130 cockroaches and 150 houseflies were caught through sweeping combined with trapping from different locations indoor including toilets, kitchens, parlours and bedrooms in the study area, January–February 2014. Cockroaches trapped in crevices, boxes, cooking utensils, cupboards and other household materials were used while houseflies' collection was through sweeping using clean brooms designated for the purpose in the different locations. Each intact insect caught was placed in a sterilised sample bottle and then transported to the Microbiology Laboratory, Department Biosciences and Biotechnology, Babcock University, Ilishan-Remo, Ogun State, Nigeria. The cockroaches and houseflies were identified using standard taxonomic keys. After identification, each insect was placed in a centrifuge tube containing 5 mL of normal saline (Tatfeng et al., 2005). The tube was shaken vigorously in order to detach any insect's external body surface adhering parasites. After removal of insects, the fluid was centrifuged at 3000 rpm for 3 min. The supernatant was decanted while the sediment was placed on a clean glass slide, and stained with Lugol's iodine and viewed under the  $\times 40$  microscope objective lens for parasite identification eggs and cysts (Cheesbrough, 1998).

### 1.1.3. Statistical analysis

Analysis of data was performed by GraphPad Prism 5 (GraphPad Software, Inc., La Jolla, CA 92037, USA). Descriptive statistics was used to analyze the proportion of insects infested by parasites while Chi square analysis was used to determine significant differences in proportion of cockroaches and houseflies infested with parasites. P value less than 0.05 was significantly different.

## 1.2. Results

Cockroaches which were more contaminated were infested with six parasite species (*Ascaris lumbricoides*, *Enterobius vermicularis*, hookworm, *Trichuris trichiura*, *E. histolytica* and *Taenia* spp.). Houseflies however, were infested with four parasite species (*A. lumbricoides*, hookworm, *T. trichiura*, and *Taenia* spp.). *E. vermicularis* (15.3%) and *E. histolytica* (0.8%) in cockroaches were absent in houseflies. The most prevalent parasites were *T. trichiura* (74.0%) and hookworm (63.0%) in houseflies and cockroaches respectively. There were significant differences in the prevalence of hookworm, *T. trichiura* and *Taenia* spp. isolated from cockroaches and houseflies ( $P < 0.05$ ) (Table 1). The female cockroaches were more contaminated 78/83 (94.0%) than their male counterparts 38/47 (80.9%) (Fig. 1).

## 1.3. Discussion

Although no study on epidemiology of human parasitic diseases has been carried out in the study area, the present study suggests cockroaches and houseflies as important agents of pathogen transmission to man. The most convenient route of transmission could be through contamination of food since the insects were collected within human dwelling places. While the two insects are waste scavengers, the larger size of cockroach could have enabled it to trap more parasites than the housefly, thus increasing its vectoral capacity. Cockroaches especially inhabit dark places of which latrines are examples of those places, thus also increasing their parasite carrying capacity. Houseflies and other non-blood sucking insects are common indoors and outdoors

**Table 1**  
Human intestinal parasites isolated from cockroaches and houseflies.

Parasite spp.	Cockroach (n = 130)			Housefly (n = 150)			P-value
	No. positive	No. negative	Prevalence (%)	No. positive	No. negative	Prevalence (%)	
<i>A. lumbricoides</i>	68	62	52.3	71	79	47.3	0.41
<i>E. vermicularis</i>	20	110	15.4	0	0	0.0	–
Hookworm	82	48	63.1	44	106	29.3	<0.0001
<i>T. trichiura</i>	27	103	20.8	111	39	74.0	<0.0001
<i>E. histolytica</i>	1	129	0.8	0	0	0.0	–
<i>Taenia</i> spp.	53	77	40.8	41	109	27.3	0.02

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