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Determination of Parasitic Agents Associated with Cockroaches in Dutsin-Ma Town, Northwestern Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Authors TA and HSY designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors TA and AE managed the analyses of the study. Author TA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background: Cockroaches are known to be mechanical vectors of disease-causing agents such as parasites, bacteria, fungi and viruses. This study determined parasitic agents associated with cockroaches in Dutsin-Ma Town, Northwest Nigeria. A total of 600 cockroaches were collected from toilets, dumpsites, suck-away and sewages of Female and Male Hostels of Federal University Dutsin-Ma, residential houses in Darawa, Hayin-Gada and Kadangaru in Dutsin-Ma Town.
Aims: To provide the public with this knowledge, this study was put forward to determine parasitic agents associated with cockroaches in Dutsin-Ma Town, Northwestern Nigeria.
Study Design: The study was carried out in Dutsin-Ma Local Government Area, Nigeria. Cockroaches collected from the toilets had the highest parasite load, followed by those from the suck-away, and those from the dump site and then cockroaches from the sewages.
Results and Discussion: A total of 600 cockroaches (identified as *Periplanata americana* species)

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were examined, 95.33% were infected with several species of gastrointestinal parasites. Parasites isolated and identified include *Strongyloides stercolaris* (25.26%), fluke (17.89%), *Nyctotherus ovalis* (2.98%), *Enterobius vermicularis* (13.68%), *Entamoeba histolytica* (12.28%), *Toxascaris leonina* (24.46%). More parasites were recovered from the gastro-intestinal than on the external parts with prevalence rates of 97.33% and 92.67%, respectively.

Conclusion: This study has shown that *Periplanata americana* represent an important reservoir of parasites which can cause disease in man. Hence public awareness is required to educate people on the potential of *Periplanata americana* in transmitting intestinal parasites thus, there is a need to control cockroaches indoors and outside.

Keywords: Protozoa; nematode; parasite; Dutsin-Ma; Nigeria.

1. INTRODUCTION

Cockroaches are the most abundant and obnoxious non-biting insect pests in residential buildings, hospitals, hostels, hotels and restaurants [1]. They feed indiscriminately on human food and sewage. Over three thousand five hundred species of cockroaches have been identified and thirty of these species are more adapted to human habitation. Of these, *Periplanata americana, Blattela germanica* and *Blattela orientalis* are considered the most common pests of humans [2]. When cockroaches run over food, they contaminate the food by leaving an oily liquid that has offensive odour or bacteria that can cause food poisoning [3]. Some parasites have been found in the external and internal body parts of cockroaches [4]. Findings have also shown that exposure to cockroach antigens may play an important role in Asthma related health problems [5].

In Nigeria, the risk to human health arising from cockroach infestations have been reported [6]. Cockroaches are abundant in most homes in Nigeria, where they are fondly referred to as “landlords” in homes. They are among the most notorious pests of premises, which frequently feed on human faeces and can disseminate cysts of enteric protozoans in the environment if such faeces are contaminated. Besides contaminating food by leaving droppings and bacteria that can cause food poisoning [7], they also transmit bacteria, fungi, and other pathogenic microorganisms in infested areas [8,9]. They feed on garbage and sewage and so have high chances of disseminating human pathogens [10,11]. In addition, their nocturnal and filthy habits made them ideal carriers of various pathogenic microorganisms [6]. In 2016, Morenikeji et al. [12] reported a very high prevalence (87.1%) of parasites in cockroaches recovered from residential houses around Awotan dumpsite in Ido Local Government Area of Oyo State in Nigeria.

Despite the abundance of cockroaches in residential areas in Dutsin-Ma town and the relatively high prevalence of parasitic infections in the area, there is no reported study on the roles of cockroaches as carriers of bacteria, parasites and other pathogens in Dutsin-Ma Town. To provide the public with this knowledge, this study was put forward to determine parasitic agents associated with cockroaches in Dutsin-Ma Town, Northwestern Nigeria.

2. METHODOLOGY

2.1 Study Area

The study was carried out in Dutsin-Ma Local Government Area on latitude 12.455' and longitude 7.4914, area of 527 km^2 (Fig. 1) with elevation of 605 m and average temperature of 26°C, wind NW 2 km/h 25% humidity and a population of 169,671 as at 2006 census [13].

Aborigines of Dutsin-Ma are predominantly farmers, cattle rarers and traders. There has been a tremendous increase in human population, a number of houses and activities in Dutsin-Ma in the last 6 years, which is not unconnected with the siting of the new Federal University in the Town. Dutsin-Ma is a community where sanitary conditions are below standard, residential areas are under developed with inadequate pipe-borne water supply, residents relying on wells, Dutsin-Ma Dam, commercial water vendors and a few private boreholes for their water needs. Most households lack good water cistern toilet, relying majorly on pit latrines or dumping their faecal matter in the nearby dumpsites. The high numbers of almajiri schools, which mostly lack sanitary facilities, with almajiris practicing open defecation also contribute to the poor sanitary condition of the area.

2.2 Sample Collection, and Parasites Isolation and Identification

A total of six hundred (600) cockroaches were caught using Sticky traps of cardboard paper and adhesive, three hundred sixty (360) cockroaches were from houses with open toilets and two hundred forty (240) from houses with broken sewage systems. They were examined for external and internal together with the mouth part pathogens. Selected houses around Dutsin-Ma Town were stratified into 5 cardinal points: Darawa, Hayingada, Kadangaru, Female hostel and Male hostel of the Federal University Dutsin-Ma. Cockroaches were collected from randomly selection houses from each cardinal points area of studies.

The prepared trap was pinned to flat wooden surfaces found in kitchens, toilets, bathrooms, bedrooms and living rooms. The traps were set at 7:00 pm and inspected at 7:00 am daily for four weeks, as described by Mogbo et al. [14]. Cockroaches trapped were transferred into universal containers and then transported to the Laboratory for further examination. The cockroaches were put to sleep by using chloroform soaked cotton wool and examined under the dissecting microscope for identification using standard taxonomical keys by Department of Biological Sciences Federal University, Dutsin-Ma.

Sedimentation technique as described by Brook and Sloss [15] was used to extract parasites in each sample collected. Parasites collected were examined using light microscope ×40 objective lens as described by Salehzadeh et al. [16]. Parasites were identified using taxonomical keys by Cheesbrough [17,18].

2.3 Statistical Analysis

Data collected are presented in tables and prevalence expressed in percentage.

3. RESULTS

A total of Six hundred cockroaches were Collected from five sampling areas (Female Hostel, Male Hostel, Hayin-gada, Kadangaru and Darawa toilets and dumpsite) were examined. The examination was done both externally and internally 300 samples each. A total of 300 cockroaches each for external and internal examination were found as 278(92.67%) and 292(97.33%) prevalence respectively. Highest prevalence [78(28.06%)] and the lowest [26(9.35)] was recorded in Hayin-Gada and Darawa respectively (Table 1).

Table 2 shows the prevalence of identified parasites species on external body parts of cockroaches with highest prevalence *Toxascaris leonine* 68(24.46%) and least prevalence of *Strongyloides stercoralis* 108(36.98%) and none recorded as globular substrate.

Table 3 shows overall (external and gut) prevalence of parasites according to sample area.

Table 4 shows the overall (external and gut) prevalence of identified species was: *Strongyloides stercoralis* 144(25.26%), flukes 102(17.89%) *Nyctotherus ovalis* 17(2.98%), globular substrates 49(8.60%), egg of *Enterobius vermicularis* 78(13.68%), *Entamoeba histolitica* 70(12.2%), with the highest and lowest prevalence recorded in *Strongyloides starcoralis* and *Nyctotherus ovalis* respectively.

4. DISCUSSION

In this study, the intestinal parasites of medical importance were isolated from the body surface and guts contents of the cockroaches. 95.33% of cockroach specimens examined had been found to harbour at least one species of human intestinal parasites. This is similar to high parasites carriage rate (77.52%) had been reported from Nigeria [19]. In contrast, no parasites species were collected from a residential area in Iran but relatively low percentage of parasites were isolated from cockroaches gotten from public hospital in the same study area [16]. Therefore, the variation in the incidence of parasites load associated with cockroach varies with the hygiene condition of the environment and also the population of people living within the environment. This may account for the variation in parasites carriage rate among the different sampling areas.

Although no study on epidemiology of pathogens in cockroaches has been carried out in the study areas, the present study suggests cockroaches as important agents of pathogens transmission to man. In this study show that cockroaches may be agents of parasitic infection which were more contaminated were infested with six parasite *Strongyloides stercolaris*, fluke, *Nyctotherus ovalis*, *Enterobius vermicularis*, *Toxascaris leonina* and *Entamoeba histolytica* species,

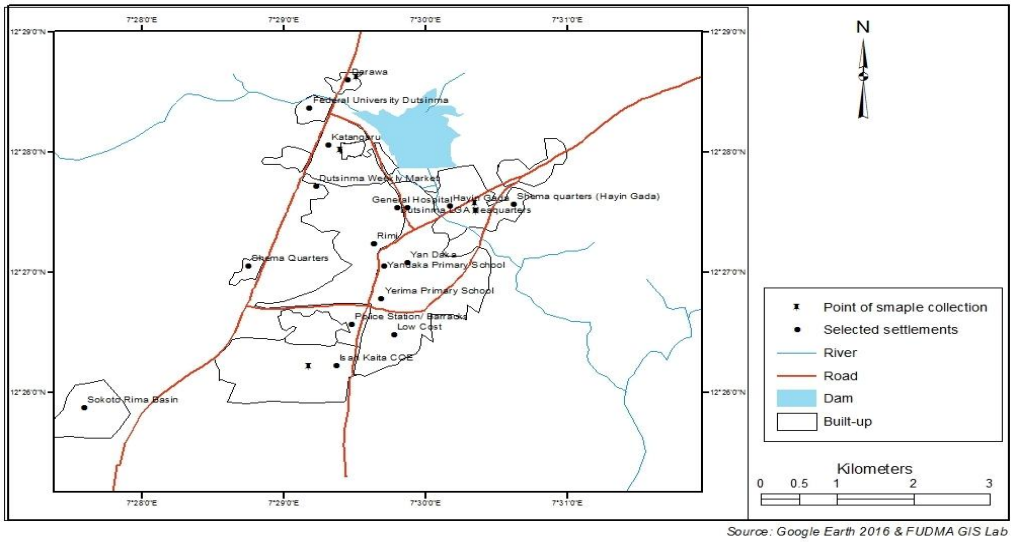

Fig. 1. Map showing study area

Table 1. Prevalence of parasites infestation according to cockroach body parts in Dutsin-Ma town

Sampling site	External body part		Internal body part	
	Number examined	Number infested (%)	Number examined	Number infested (%)
Female Hostel	78	74 (94.9)	72	70 (97.2)
Male Hostel	74	64 (86.5)	80	78 (97.5)
Hayin-Gada	81	78 (96.3)	76	76 (100)
Kadangaru	41	36 (87.8)	36	36 (100)
Darawa	26	26 (100)	36	32 (88.9)
Total	**300**	**278 (92.7)**	**300**	**292 (97.3)**

Table 2. Prevalence of parasites recovered from body parts (external and gut) of cockroach

Type of parasite	External body part		Internal body part	
	Number examined	Number present (%)	Number examined	Number present (%)
Strongyloides stercolaris	300	36 (12)	300	108 (36)
Flukes	300	60 (20)	300	42 (14)
Nyctotheru sovalis	300	1 (0.3)	300	16 (5.3)
Toxascaris leonine	300	68 (22.7)	300	42 (14)
Enterobius vermicularis	300	26 (8.7)	300	52 (17.3)
Entamoeba histolytica	300	38 (12.7)	300	32 (10.7)
Glubular Substrates	300	49 (16.3)	300	42 (14)

Table 3. Prevalence of parasites infested cockroaches according to sampled sites

Sampled site	Number examined	Number infested	Prevalence (%)
Female Hostel	150	144	96
Male Hostel	154	142	92.2
Hayin-Gada	157	154	98.1
Kadangaru	77	72	93.5
Darawa	62	58	93.5
Total	**600**	**572**	**95.3**

Table 4. Prevalence of parasites according to types of parasite isolated from cockroaches in Dutsin-Ma town

Type of Parasite	Number of samples examined	Number of parasites present	Prevalence (%)
Strongyloides stercoralis	600	144	24.0
Flukes	600	102	17.0
Nyctotherus ovalis	600	17	2.8
Toxascaris leonine	600	110	18.3
Enterobius vermicularis	600	78	13.0
Entamoeba histolytica	600	70	11.7
Globular substrates	600	49	8.2

which is similar to reports of Salehzadeh et al. [16]. All the parasites recovered from the body are of medical importance and have been implicated in many gastrointestinal disorders. *Enterobius vermicularis*, hook worm and *Ascaris lumbricoides* have been reported to cause chronic diarrhea. The higher percentage of the cockroaches harbouring gastrointestinal parasites encountered in the residential environment is not a departure from the expected results as similar observation has also been reported elsewhere [20]. Hospital host patients suffering from different ailments and these cockroaches would have been contaminated during their nocturnal movements from one ward to other areas including toilets [21].

5. CONCLUSION AND RECOMMENDATION

This study reveals that most cockroaches in Dutsin-Ma are carriers of different types of nematode and protozoan parasites. This high prevalence of parasites in the cockroaches places them as potential transmitters/carriers that could contaminate food and other items in human residents in Dutsin-Ma. It also shed light on the potential mechanical transmission of human nematode and protozoan parasites that may be threats to public health if not properly managed.

Therefore, adequate awareness needs to be created among inhabitants of the residents and students hostels on the need to avoid contact or contamination of food and water with cockroaches. Proper covering and washing of any food and cooking utensils should be promoted. Controlling of the cockroaches population through the use of insecticides and screening of houses is highly recommended. Building of modern houses devoid of crevices that support cockroaches' life cycle should be adopted. Proper waste management practices should also be put in place.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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