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SURVEY OF MEDICALLY IMPORTANT PROTOZOANS INFESTED ON COCKROACHES COLLECTED FROM STUDENT HOSTEL IN SA'ADU ZUNGUR UNIVERSITY, BAUCHI STATE

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ABSTRACT

This study was carried out to evaluate the prevalence of parasitic protozoans contamination of cockroaches collected from student hostels in Sa'adu Zungur University, Gadau main campus, Bauchi State. A total of one hundred and fifty (150) adult *Periplaneta americana* (cockroaches) obtained from the three students hostels which includes; Hall II, Hall III and Cafeteria were examined for this study. The study was conducted between July and August, 2024. Cockroaches were caught alive using a hand-picking method. Normal saline sedimentation techniques was used to detached parasites from the external body of the cockroaches, and the precipitate was observed under light microscope (10x and 40x) for the detection of parasites. The overall prevalence of parasitic protozoans associated with cockroaches in this study was 42 (16%), with the cockroach species infestation in Hall II as 20 (40%) followed by Cafeteria 17 (34%) and with the least of positive samples at Hall III 5 (10%). There was a significance difference in terms of frequency of positive samples across the selected hostels (χ^2=80.24, *P-value*= $3.69x10^{-18}$). The parasitic protozoans recorded were; *Toxoplasma gondii, Entamoeba histolytica, and Balantidium coli*. The result shows that *Balantidium coli* had the highest frequency and percentage of occurrence 20 (47.62%) across the three selected hostels, followed by *Entamoeba histolytica* 16 (38.09%) with the least in *Toxoplasma gondii* 6 (14.29%) respectively. This study revealed the presence of parasitic protozoans associated with the cockroaches in Sa'adu Zungur University, Bauchi State. From the outcome of this study, it is recommended that appropriate measures should be taken by the university authorities to ensure the reduction of the impact of cockroaches on spreading diseases, particularly in the student hostel areas where cockroaches' contamination is pronounced as they pose a public health risk.

Keywords: Survey, Cockroaches, Parasitic protozoans, Infested

INTRODUCTION

Cockroaches are arthropods with jointed appendages, exoskeleton, segmented body, central nervous system, digestive and sensory receptors (Technical Learning College, 2018; Okpara and Amos, 2019). It has been reported previously that there are more than 4,400 known species of cockroaches worldwide, out of which 30 species were highly associated to human domicile, thriving to survive in different kinds of environment and consuming precisely on organic matter (Beccaloni, 2014; Adenusi *et al.,* 2018; Dokmaikaw and Pisit, 2019; Shaibu *et al.*, 2019; Debash *et al.*, 2020; Ikeh *et al.*, 2023). More so, the cockroaches are mostly found in abundance at different kinds of habitat in which other living organism particularly human beings survive. These includes; residential houses, hospitals, working places, eateries and hostels (Piper and Antonelli, 2012; Abdu and Almu, 2023). Their population into a particular environment is highly connected to other factors like; poor sanitation, poor pest control practices, old and unmaintained building conditions, socio-economic status, food handler behavior and other environmental conditions such as temperature, humidity and lighting (Abudin *et al.*, 2023; Akeju *et al.,* 2024). With regards to cockroaches, there are basically two (2) most prevalent and well-known species in Nigeria and worldwide, and these species are American species (*Periplaneta americana*) and German species (*Blattela germanica*) (Anikwe *et al.*, 2014; Hamu *et al.*, 2014; Adenusi *et al.*, 2018; Dokmaikaw and Pisit, 2019; Debash *et al.*, 2020; Abdu and Almu, 2023; Akeju *et al.*, 2024).

American species (*Periplaneta americana*) and German species (*Blattela germanica*) are described as pest to most people at different regions globally (Adenusi *et al.*, 2018; Shaibu *et al.*, 2019; Debash *et al.*, 2020). In other opinion, the majority of these species live in tropical and subtropical regions and they are not considered as pest. These species mostly feed on human faeces as well as human food as such capable of causing significant health problems to humans. They are commonly described as the greatest potential mechanical vectors of various pathogenic microorganism that includes; bacteria, virus, fungi and parasites (Dokmaikaw *et al.*, 2019; Shaibu *et al.*, 2019; Debash *et al.*, 2020; Ikeh *et al.*, 2023; Akeju *et al.,* 2024). Consequently, most of these pathogenic microorganism are known to cause life-threatening illness in both humans and domestic animals (Galecki and Sokol, 2019; Dokmaikaw *et al.*, 2019; Debash *et al.*, 2020; Akeju *et al.*, 2024).

Cockroaches are sensitive to acquire disease pathogens and mechanically depositing disease-causing organism into human consumables hence contaminates it. This is evidently due to their unclean habit, indiscriminate diet and other feeding processes (Akeju *et al.*, 2024). Conversely, there is an increase in cockroaches' population in public places all over the world, posing a serious risk to human health. In Nigeria, several researchers such as Bala and Sule, 2012; Etim *et al.*, 2013; Yaro, 2015; Adenusi *et al.*, 2018; Shaibu *et al.*, 2019; Wahedi *et al.*, 2020; Abdu and Almu, 2023; Ikeh *et al.*, 2023 and Akeju *et al.*, 2024 had studied the role of cockroaches as carrier of medically important parasites in Sokoto, Calabar, Zaria, Lagos, Zaria, Adamawa, Kano, Anambra and Ondo State respectively. They all revealed pathogenic microorganisms including helminthes and protozoans associated with cockroaches.

Hostel life can be a unique and enriching experience, but it can also be challenging, especially when it comes to maintaining proper environmental sanitation. Lack of proper cooperation is common among students. This has observed in several instances. In shared responsibilities, as in cleaning and maintaining of common areas such as rooms are sometimes shared among students. However, some individuals may not take their responsibilities seriously, leading to a lack of cooperation. Furthermore, different habits and standards could also leads to lack of cooperation as students come from diverse background may have different habits and standards especially to cleanliness. Lack of proper supervision or accountability, some students may not feel motivated to contribute to maintaining a clean environment for their safety. The existence of poor cooperation among the students could seriously leads to unhygienic condition, pest infestation, disease outbreak, unpleasant living environment as well as poor reputation to that particular environment. The present study was therefore designed to carry out a survey of medically important protozoans infested on cockroaches collected from student Hostels in Sa'adu Zungur University, Bauchi State.

MATERIALS AND METHODS

Study Area

This study was carried out in Sa'adu Zungur University, Gadau Main Campus Bauchi State. Sa'adu Zungur University (formerly Bauchi State University Gadau) is a state-owned institution in Bauchi State, Nigeria. The University's main campus is in Gadau, Gadau town. It is located geographically at 11.3000^0 N and 9.8833^0 E respectively.

The two common seasons occur at varying periods. Dry season (November to April), this period experiences higher temperature, with April being the hottest month, averaging around 40^0C. Temperatures are relatively lower during these months (May to October) with January and February being the coolest, averaging around 11^0C. The region receives an average annual rainfall ranging from 700mm in the north parts to 1,250mm in the southern areas. The majority of the rainfall occurs between May and October, with the peak typically in August. The humidity levels are generally lower during dry season while increases during the rainy season. The main campus hosts the School of Basic and Remedial Studies, Faculties of Art, Education, Agriculture, Basic Medical Sciences, Pharmaceutical Sciences and Sciences (OpenAI, 2025). The University had constructed hostels where students are occupying as their accommodations.

Sample Collection

A total of one fifty (150) adult cockroaches were collected from three (3) main student's hostels at Sa'adu Zungur University, Gadau main campus for parasitological studies. The three (3) of the main hostels used in this study includes; Hall II, Hall III and Cafeteria. A total of fifty (50) adult cockroaches were trapped and collected from each hostel. The cockroaches were caught alive using a hand-picking method with the aid of sterilized hand gloves and a clean container between (7:00pm to 10:00pm) in the night hours as described by Abdul and Almu, (2023). Each container was carefully labeled based on it is location and the collected cockroaches were transported to the Biological Sciences Department Laboratory for further analysis.

Identification of Cockroach species

To determine the species and sexes of the cockroaches, morphological identification was performed using a morphological keys described by Brenner and Gefeller, (1997), and dichotomous key as described by Ikeh *et al.* (2023).

Isolation of the parasites from cockroaches' external body

After the identification of the cockroach species, each cockroach was placed individually in a centrifuge tube containing 5ml of normal saline and agitated vigorously for 3minutes to detach parasites from the external body of the cockroaches. The wash off from the individual body of each cockroach was centrifuged for 5 minutes at 2500 revolution per minutes (rpm), and the precipitate was placed on a clean glass slide and stained with 1% lugol's iodine and examined under light microscope (10x and 40x) for the detection of parasites as described by Abdul and Almu, (2023).

Identification of Parasites

The cysts, ova and larvae of the parasites were identified using the identification keys by WHO, (1994) and in Cheesbrough, (2009).

Data Analysis

Data was analyzed using Microsoft Excel version (2019). Descriptive statistics were used to analyze the frequencies of occurrence and percentage of parasites isolated from the external body surface of the cockroaches. Chi-Square analysis was used to compare the prevalence of the parasites across the selected locations.

RESULTS AND DISCUSSION

Prevalence of positive cockroach samples across the selected hostels at Sa'adu Zungur University, Gadau Main Campus, Bauchi State

Prevalence of positive cockroaches from selected student's hostels at Sa'adu Zungur University, Gadau Main campus is presented in Table 1. The results revealed a higher positive cockroach species in Hall II 20 (40%) followed by Cafeteria 17 (54%) and with the least of positive samples in Hall III 5 (10%) among the three hostels sampled. The overall prevalence of parasitic protozoans associated with cockroaches in this study was small, 42 (16%). There is a significance different in terms of frequency of positive samples across the selected hostels (χ^2=80.24, *P-value*= $<3.69x10^{-18}$).

Table 1: Prevalence of positive cockroach samples across the selected hostels at Sa'adu Zungur University, Bauchi State

Hostels	*Periplaneta americana* Samples examined	Infested samples	% of Infested samples
Hall II	50	20	40
Hall III	50	5	10
Cafeteria	50	17	34
Total	150	42	16

χ^2=80.24, *P-value*= $3.69x10^{-18}$

Composition of parasitic protozoans associated with cockroach samples collected at different hostels at Sa'adu Zungur University, Bauchi State

The study revealed that there are three parasitic protozoan species associated with cockroach samples collected and examined across the selected hostels at Sa'adu Zungur University, Gadau Main Campus Bauchi State. The parasitic protozoans recorded were; *Toxoplasma gondii, Entamoeba histolytica, and Balantidium coli.* The result shows that *Balantidium coli* had the highest frequency and percentage of occurrence 20 (47.62%) across the three selected hostels, followed by *Entamoeba histolytica* 16 (38.09%) with the least was *Toxoplasma gondii* 6 (14.29%) respectively (Table 2).

Table 2: Species of parasitic protozoans associated with cockroach samples collected at different hostels at Sa'adu Zungur University, Bauchi State

Parasites	Frequency	% of occurrence
Toxoplasma gondii	6	14.29
Entamoeba histolytica	16	38.09
Balantidium coli	20	47.62
Total	42	100

Parasites distribution on cockroach samples with respect to selected hostels at Sa'adu Zungur University, Bauchi State

In this study, parasite distribution on cockroach samples varied with respect to selected hostels at Sa'adu Zungur University, Gadau Main Campus, Bauchi State. The results revealed that at Hall II, *Balantidium coli* had the highest distribution 9 (45.00%), followed by *Entamoeba histolytica* 6 (37.5%) with the least in distribution by *Toxoplasma gondii* 5 (83.33%). At Hall III, *Entamoeba histolytica* had the highest distribution 3 (18.75%), followed by *Toxoplasma gondii* and *Balantidium coli* shared same frequency of distribution as 1 (16.67%) and 1 (5.00) (The reason why we had same frequency but different percentage here is that we accounted each parasite across the selected hostels. E.g for *Toxoplasma gondii*, total frequency across the hostels is 6, making Hall II with 5 had 83.33%, Hall III with 16.67% and Cafeteria with 0%) respectively. At Cafeteria, *Balantidium coli* had the highest distribution 10 (50.00%), followed by *Entamoeba histolytica* 7 (43.75%) while *Toxoplasma gondii* had zero distribution (Table 3).

Table 3: Parasites distribution on cockroach samples with respect to selected hostels at Sa'adu Zungur University, Bauchi State

Hostels	Parasites		
	Toxoplasma gondii	***Entamoeba histolytica***	***Balantidium coli***
Hall II	5(83.33%)	6(37.5%)	9(45.00)
Hall III	1(16.67%)	3(18.75%)	1(5.00)
Cafeteria	0(0.00%)	7(43.75%)	10(50.00)
Total	6	16	20

Discussion

The health status of academic institution remain important been as the space where students and other academia inhabit for their educational pursuit. Cockroaches are described as offensive pest, and hence a greater concern to students as well as general public due to their ability to serve as mechanical vectors of pathogens including parasitic protozoans (Atiokeng *et al.,* 2017; Debash *et al.,* 2020; Ikeh *et al.,* 2023). The species of cockroaches obtained from different student hostels in this study were all identified as American species (*Periplaneta americana*) which agrees with similar studies carried out by Adenusi *et al.* (2018); Ikeh *et al.* (2023) and Akeju *et al.* (2024). The parasitic protozoans recorded in this study have been confirmed to be responsible for various disease conditions in humans, some of which could be life-threatening. The parasitic protozoans recorded in this study were; *Toxoplasma gondii, Entamoeba histolytica* and *Balantidium coli*. High prevalence of *Entamoeba histolytica* was reported by several researchers including Debash *et al.* (2020) and Akeju *et al.* (2024). *Entamoeba histolytica* is a causative agent of amoebiasis, a potentially severe and life threatening disease and as well the second most common cause of death from parasitic disease, after malaria (Adenusi *et al.*, 2018; Debash *et al.*, 2020; Akeju *et al.*, 2024). The high prevalent of *Entamoeba histolytica* might be connected with the ability of the cyst to survive days to weeks in the external environment, hence easily accessible by the cockroaches. *Toxoplasma gondii* is responsible for a disease condition known as toxoplasmosis. This disease is more common among woman and it affect the infected individual by reducing the white blood cell counts in the body (Hassen *et al.,* 2019). Hence serious attention needs to be given to student hostel in arresting the mobility of cockroaches around. Balantidiosis is a disease caused by *Balantidium coli*, it affect the infected individual by reducing the haemoglobin quantity as well as red blood cell counts (Aninagyei *et al.,* 2021). It also causes bloody stool in patients suffering from balantidiosis (Yazar *et al.,* 2004). Therefore, hygienic arrangements need to be improving across student's hostel in order to prevent them from becoming infected. Results show that cockroaches were found to be infected with parasitic protozoans, similar to this as reported by several authors (Adenusi *et al.,* 2018; Atiokeng *et al.,* 2017; Hamu *et al.,* 2014; Oyeyemi *et al.,* 2016; Dokmaikaw and Pisit, 2019; Ikeh *et al.,* 2023; Akeju *et al.,* 2024). Our findings revealed low prevalence of parasitic protozoans 42 (16%). The result of the present study is higher than the work of Atiokeng *et al.* (2017) in Cameroon who reported overall prevalence of 9.00%. This result corroborate with the findings of previous studies in Nigeria with 17.54% (Abdu and Almu, 2023). Other studies reported higher prevalence such as 36.00% (Debash *et al.,* 2020), 96.4% and other countries such as Ethiopia with 75.1-75.6% (Haile *et al.,* 2018; Hamu *et al.,* 2014), and Thailand with 46.4% (Dokmaikaw and Pisit, 2019).

Low prevalence of parasitic protozoan in this study as compared with other studies might be attributed to the

difference in environmental conditions as well as level of environmental sanitation practices. In this study, different factors were found to be significant predictors of parasites carriage by the cockroaches. Student attitude towards environmental hygiene such as indiscriminate waste disposal, improper cleaning habits as well as improper utilization of rest rooms by the students have contributed to the carriage of important pathogenic species by the cockroaches around the hostels (Debash *et al.*, 2020). Previous studies from different parts of Nigeria (Isaac *et al.*, 2014; Bala and Sule, 2012; Etim *et al.*, 2013; Adenusi *et al.*, 2018) and elsewhere (Hamu *et al.*, 2014; Kinfu and Erko, 2008; Chimavit *et al.*, 2011) have reported that cockroaches captured from hostels and other related environments harbored parasites. The parasites carried by cockroaches are usually acquired from the environment they find themselves (Menasria *et al.*, 2015; Wahedi *et al.*, 2020) and proliferation of such parasites to our living space is highly associated with level of poor sanitation. Report from several studies in Nigeria and other countries have confirmed that cockroaches harbored more parasites in their external body part than any other part of the their body (Adenusi *et al.*, 2018; Dokmaikaw and Pisit, 2019; Shaibu *et al.*, 2019; Wahedi *et al.*, 2020; Debash *et al.*, 2020; Abdu and Almu, 2023; Ikeh *et al.*, 2023). Life pattern of students in most tertiary institution's hostels in Nigeria look similar. Evaluation form previous studies have revealed that parasite load on the cockroaches in a particular environment is highly connected with the cockroach populations. Similarly, Onyido *et al.*, (2009) had earlier revealed that Nigerian Universities were known to be overcrowded with high number of students in small hostels, and this contributed to increase in cockroach population in the hostel environment. Sulaimon *et al.*, (2015) also revealed that longer student's occupancy and other activities in the University campus in association with unsanitary condition of the hostel have contributed to a larger extent on cockroach population which in turn attributed to the high prevalence of pathogenic species carriage by cockroaches within campus.

CONCLUSION

This study revealed the presence of parasitic protozoans associated with the cockroaches in Sa'adu Zungur University, Gadau Main Campus, Bauchi State. Improper environmental hygienic practices around the student's hostels such as absence of waste containers for refuse collection at different corners, indiscriminate littering of waste materials like empty sachet of water, biscuits, noodles and used black nylons in addition with improper cleaning of surroundings, rooms and rest rooms have greatly attributed to the increase in population of cockroaches around hostel areas. Out of the three (3) parasitic protozoans isolated, *Balantidium coli* was the most prevalent, followed by *Entamoeba histolytica* was recorded to have high occurrence while *Taxoplasma gondii* had the least prevalence The presence of these pathogenic species on the studied cockroaches highlights their roles as potential mechanical vectors of parasite disease agents.

RECOMMENDATIONS

From the outcome of this study, it is recommended that appropriate measures should be taken by the university authorities to ensure the reduction of the impact of cockroaches on spreading diseases, particularly in the student hostel areas where cockroaches' contamination is pronounced as they pose a public health risk. Use of recommended chemicals that will assist in controlling their abundance around should be on regular basis, awareness to students on the health risk pose by these vectors should be considered.

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