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ENTOMOLOGICAL AND PARASITOLOGICAL INDICES OF MALARIA PARASITE TRANSMISSION IN IMO STATE POLYTECHNIC OMUMA, ORU EAST, NIGERIA

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ABSTRACT

The study conducted between May and September of 2023 examined entomological and parasitological indicators of malaria parasite transmission in order to identify the predominant mosquito species and establish the malaria endemicity in the vicinity of Imo State Polytechnic Omuma. The Pyrethrum Spray Catch (PSC) was utilized to collect adult mosquitoes. Various mosquito species were gathered, categorized, and recognized. To detect the presence of a malaria parasite in the blood film stained with Giemsa stain, blood samples were taken from the same students whose rooms were utilized for the entomological survey during the parasitological study. Both the T-test and the Chi-square were used to assess the data. In all, 297 mosquitoes were detected in the research region (table 1), of which 230 Culex quinquefasciatus represented (77.4%) and 67 Anopheles gambiae (22.6%). The study was conducted at eight (8) sites. Comparing the results with the Anopheles gambiae recorded from the same site, Table 2b demonstrates that Culex quinquefasciatus had the highest prevalence and was substantially different at $p<0.05$. According to the results of the parasitological investigation, when 21 (42.0%) of the students residing in the hostel had their malaria parasite infection checked, 18 (85.7%) tested positive and 3 (14.3%) tested negative. When 29 students (58.0%) who were staying in the lodges had their malaria parasite infection checked, 23 (79.3%) of them tested positive, and 6 (20.7%) tested negative. Among the 50 learners randomly selected for parasitological analysis from the study's school hostels and lodges, there was no significant difference ($p>0.05$) in the number of students who tested positive. The percentage of mosquito abundance and falciparum malaria presence found in this study are

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significant for public health. In order to develop strategies for the control of mosquito-borne diseases in Imo State Polytechnic Omuma and its surroundings, this study offers helpful baseline data.

Keywords: Entomological, parasitological, malaria, *Plasmodium falciparum*.

1.0 INTRODUCTION

Millions of people in tropical nations continue to be at risk of malaria despite decades of progress in prevention and treatment. Over time, growing usage of control techniques such as insecticide-treated nets, indoor residual spraying, and early treatment with Artemisinin-based Combination Therapies (ACTs) has resulted in a reduction in malaria morbidity and death in several African nations. The ability of the parasite to become resistant to anti-malarial medications and the growing pesticide resistance of the mosquito vector are obstacles to this development. Female Anopheles mosquitoes are the primary vectors of malaria transmission because they facilitate the sporogonic growth, or mosquito-borne parasite multiplication, of human malaria parasites. Out of the approximately 2,500 Anopheles mosquito species, fewer than 50 have the ability to spread malaria. The World Health Organization (WHO) states that malaria is the most significant parasite illness in the world, with an estimated 247 million cases and 881,000 fatalities—the majority of which occur in children under the age of five. For more than 2.4 billion individuals, or around 4% of the global population, it represents a serious concern. Malaria is, in fact, a serious global public health issue (WHO, 2008). In Africa more than $12 billion is lost to malaria annually thus reducing the Gross Domestic Product (GDP) and contributes to a great extent to the poverty situation in Africa as it exerts a negative influence on the productivity of households in Africa. Furthermore, due to their poor degree of resistance to the disease and the millions of people who die from it each year, it is a recurrent illness throughout tropical Africa (WHO, 2007).

Certain African communities are more susceptible to malaria transmission due to climatic factors including high humidity and

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warmth, which hasten mosquito development. Malaria transmission is further aided by substandard housing since populations living in it are constantly bitten by mosquitoes. Although attacks from mosquitoes outside the house are still possible, treated nets provide protection against them (Awolola et al., 204).

The majority of malaria-related deaths globally are caused by Plasmodium falciparum, which is also the most common species in Sub-Saharan Africa. The population at risk and the intensity of transmission differ significantly between and within nations (Abeku et al, 2004). Seventy percent of the 2.4 billion people who could contract falciparum malaria reside in low-endemic-risk settings. In sub-Saharan Africa, where falciparum malaria is a major cause of illness, mortality, and disability, the majority of populations at medium and high risk reside (Ahmed, 2007).

In order to effectively construct area-specific control interventions that will result in the disease's control, a thorough understanding of the local malaria determinants is crucial.

2.0 MATERIALS AND METHODS

2.1 AREA OF STUDY

Between May 2023 and September 2023, the study was conducted at Imo State Polytechnic Omuma, Oru East LGA, Imo State, Nigeria. The Oru East Local Government Area's headquarters are at Omuma town, which is located in Imo State in southeast Nigeria. In Imo State, it is among the oldest towns. The city receives 963.3 mm of rainfall annually and is situated in the rainforest belt at roughly latitude 5.560° N and longitude 6.972° E. Mgbidi borders it on the west, Akatta and Attah on the east, Eleh and Nempi on the north, and Amiri and Otulu on the south**.** There are four communities in it: Umuhu-Omuma, Etiti-Omuma, Ozuh-Omuma, and Abia-Omuma.

Religion

In Omuma, Christianity is the most common religion.

Culture

Immersed in Igbo music and art, Omuma culture is representative of all Igbo civilizations. Many of the festivals and cultural practices that were once connected to prehistoric tribal gods and customs are no longer observed as a result of the spread of Christianity.

Figure 1: Map of Imo State indicating Omuma's location in Oru East Local Government Area.

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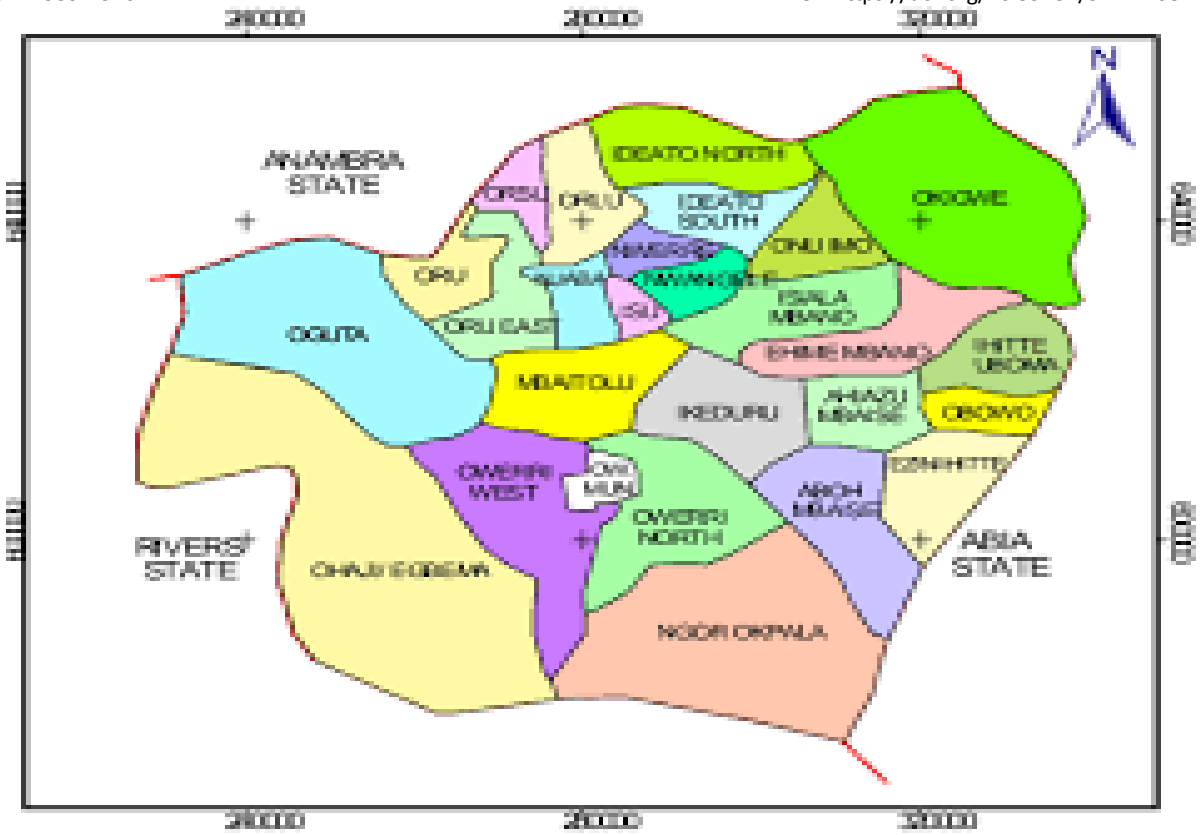

2.2 Mosquito Collection, Preservation and Identification

Pyrethrum Spray Catches (PSC) were utilized in the mosquito collection process. Using a white sheet that measured five meters by five meters and was secured to the wall with masking tape, a sample of the population of mosquitoes that were resting indoors was taken. After applying a pyrethroid pesticide, the room was sealed up and left for ten minutes. Following this time, the mosquitoes discovered on the sheet were collected, manually selected using a forceps onto petri dishes, and transported to the laboratory where they were identified using the Gullies and De Mellon [1968] keys.

Weekly mosquito collections were conducted between 6:00 and 7:00 p.m. utilizing the pyrethrum spray method. After being gathered, the specimens were placed in a petri dish and brought to the lab for analysis.

2.3 Parasitological Analysis

Students' blood samples were taken with a 2 cm syringe, and the blood was then transferred into an EDTA bottle without being vigorously shaken to prevent cell distortion. A drop of blood was then placed in the centre of a grease-free slide using a

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dropper to create a thick film smear, and the slide was labelled. The sample was then emulsified and was allowed to air dry for 10 minutes, the thick blood smear preparation was then stained with Giemsa stain and was washed with water and then allowed to dry. With the help of oil emersion and x100 emersion objective lens, the slide containing the sample was viewed under the microscope to check for the presence of the ring form stages of the parasites in the blood of the individuals used for the study in the laboratory.

2.4 Data Analysis

The data collected were analyzed using Chi-square and T-test. The Chi-square was used to compare if there is a significant difference between the students living in the hostel and lodges while T-test was used to compare whether there is a significant difference among the mosquito species encountered in the study area.

3.0 RESULTS

3.1 RESULTS

A total of 297 mosquitoes (table 1) consisting of 230 *Culex quinquefasciatus* representing (77.4%), and Anopheles gambiae 67(22.6%), were recorded in the study area. Table 2a lists the various species found at the research region's various locations (lodges and hostels), and Table 2b compares whether the species with the highest prevalence in the area differ significantly at p value < 0.05. According to table 2a, a total of eight (8) sites were used for the study and different species were collected at different site within the time under review. Hostel A recorded a total of 83(27.9%) mosquitoes encountered at the site within the period under review representing 63(75.9%) of *Culexquinquefasciatus*, and 20(24.1%) of *Anopheles gambiae*. Hostel B recorded a total of 18(6.1%) mosquitoes with *Culexquinquefasciatus* being the only mosquito species encountered in the area as *Anopheles gambiae* were not recorded. Hostel C recorded a total of 41(13.8%) of all the species encountered at the site representing 34(82.9%) *Culexquinquefasciatus* and 7(17.1%) *Anopheles gambiae* mosquitoes respectively. According to table 2a, Lodge A. recorded a total of 11(3.7%) mosquitoes with the only success recorded for *Culexquinquefasciatus*. Lodge B recorded 56(18.9%) with *Culexquinquefasciatus* having 37(66.1%) and *Anopheles gambiae* 19(33.9%) respectively. Lodge C recorded four (4) mosquitoes with 1(25%) recorded for *Culexquinquefasciatus* and 3(75%) recorded for *Anopheles gambiae*. Lodge D had a total

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of 77(25.9%) mosquitoes with *Culexquinquefasciatus* recording 66(85.7%) and *Anopheles gambiae* 11(14.3%) of the species recorded at this site. Lodge E had a total of 7(2.4%) mosquitoes with *Anopheles gambiae* being the only species encountered with 7(100%) in the study area. (Table 2a).

Also, according to table 2b which compared whether there is a significant difference between species with the highest prevalence in the study area, from the result of this table, *Culexquinquefasciatus* recorded a total of 230(77.4%) and *Anopheles gambiae* 67(22.6%). The result shows that *Culexquinquefasciatus* had the highest prevalence and was significantly different at $p<0.05$. (Table 2b) when compared with the *Anopheles gambiae* also recorded from the same site used for the study. **Table 3a** highlights the prevalence of malaria parasite infection among the students used for the study in Imo State Polytechnic Omuma while **Table 3b** Compared if there is significant difference between students living in hostels and lodges that was examined for Falciparum malaria in the study area at p value $p>0.05$. Out of the total number of 50 students sampled randomly inhabiting both the school hostels and Lodges, a total of 21(42.0%) students living in the hostel were examined for malaria parasite infection, of the number examined,18 (85.7 %) tested positive and were infected with *Plasmodium falciparum* while 3 (14.3) tested negative without any presence of *Plasmodium falciparum*. Also, among the students living in Lodges built outside the school premises, a total of 29(58.0%) of the students were examined for malaria parasite infection, among the number examined, 23 (79.3%) of the students tested positive and were infected with *Plasmodium falciparum* while 6 (20.7%) tested negative for ***Plasmodium falciparum*.** Furthermore, comparing between students living in the hostels and lodges that was examined for Falciparum malaria, irrespective of the number that tested positive, it was not significantly different at $p>0.05$ among the hotel and lodges used in the study area.

TABLE 1: OVERALL SPECIES OF MOSQUITOES IDENTIFIED IN THE STUDY AREA

Species Identified	**No identified**	**Percentage of occurrence (%)**
Culex quinquefasciatus	**230**	**77.4**

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Anopheles gambiae	**67**	**22.6**
Total	**297**	**100**

TABLE 2a: DIFFERENT TYPES OF SPECIES IDENTIFIED AT DIFFERENT SITES IN THE STUDY AREA

	Culex quinquefasciatus	***Anopheles gambiae***	**Total (%)**
Site	**Types of species identified and percentage abundance**		
Hostel A	63(75.9)	20(24.1)	83(27.9)
Hostel B	18(100.0)	0(0.0)	18(6.1)
Hostel C	34(82.9)	7(17.1)	41(13.8)
Lodge (A)	11(100)	0(0.0)	11(3.7)
Lodge (B)	37(66.1)	19(33.9)	56(18.8)
Lodge (C)	1(25.0)	3(75.0)	4(1.3)
Lodge (D)	66(85.7)	11(14.3)	77(25.9)
Lodge (E)	0 (0.0)	7(100.0)	7(2.4)
Total	**230(77.4)**	**67(22.6)**	**297(99.9)**

Keys:
Site 1: Hostel A
Site 2: Hostel B
Site 3: Hostel C
Site 4: Lodge (A)
Site 5: Lodge (B)
Site 6: Lodge (C)
Site 7: Lodge (D)
Site 8: Lodge (E)

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Table 2b. Comparing if there is a significant difference between the species with the highest abundance in the study area at p value < 0.05

Site	***Culex quinquefasciatus***	***Anopheles gambiae***	**Total**
Hostel A	63 (75.9)	20 (24.1)	83 (27.9)
Hostel B	18 (100.0)	0 (0.00)	18 (6.1)
Hostel C	34 (82.9)	7 (17.1)	41 (13.8)
Lodge A	11 (100.0)	0 (0.0)	11 (3.7)
Lodge B	37 (66.1)	19 (33.9)	56 (18.9)
Lodge C	1 (25.0)	3 (75.0)	4 (1.3)
Lodge D	66 (85.7)	11 (14.3)	77 (25.9)
Lodge E	0 (0.0)	7 (100.0)	7 (2.4)
Total	**230 (77.4)**	**67 (22.6)**	**297 (100.0)**
t value	2.737		
df	7		
p Value	0.029*		

* - significant at p<0.05.

TABLE 3: PREVALENCE OF MALARIA PARASITE INFECTION AMONG THE STUDENTS USED FOR THE STUDY IN IMO STATE POLYTECHNIC OMUMA

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Site of collection	No Examined	No of +Ve (%)	No of –Ve
Students living in Hostel	**21**	**18(36%)**	**3(6%)**
Students living Lodges	**29**	**23(46%)**	**6(12%)**
Total	**50**	**41(82%)**	**9(18%)**

Table 3b. Comparing if there is significant difference between students living in hostels and lodges that was examined for Falciparum malaria in the study area at p value p>0.05

Site of Collection	Number Examined	Number Positive (%)	Number Negative (%)	Chi-square	df	p Value
Students living in Hostel	21(42.0)	18 (85.7)	3 (14.3)	0.338	1	0.561ns
Students living Lodges	29(58.0)	23 (79.3)	6 (20.7)			
Total	**50(100)**	**41 (82.0)**	**9 (18.0)**			

Ns – Not significant at p>0.05.

4.0 DISCUSSION

The study conducted in Imo State Polytechnic Omuma and its environs between May and September of 2023 examined the entomological and parasitological indicators of malaria parasite transmission. The study showed high abundance of mosquito species in the study area and the prevalence of malaria parasite among the students living in both hostel and Lodges within the study areas were used as indicators of malaria transmission.

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Culex mosquito's relative abundance was high while *Anopheles* mosquito percentage occurrence was relatively low (Table 1), though the use of some insecticides and usage of long-lasting insecticide treated nets (LLITN) can reduce vector infectivity as well as vectors survival rate and the length of the sporogonic cycle. Both school hostel and lodge had high abundance of mosquitoes taking into consideration the number of sites used for the study, probably because of some of the environmental practices within the study areas which includes; indiscriminate disposing of containers, receptacles, water storage jars, abandoned cans etc., also the *Anopheles species* found in this study areas were also reported by Coluzzi*et al (2002).* which is the primary malaria parasite vector throughout Africa, and particularly in Nigeria, appears to be influenced by the range and relative abundance of mosquito species in relation to certain climatic conditions, most notably the annual precipitation. Malaria parasite prevalence was high taking into consideration the number of students examined, this indicates a high rate of plasmodium parasite among the students. The results obtained from the parasitological examination of blood samples of the students is in line with the overall species of adult female anopheles' mosquitos as the principal vector of malaria transmission. The overall species of anopheles mosquitoes within the study areas also agrees with the findings of Bockarie*et al* (1994) who reported that anopheles species occur regularly throughout the wet and dry seasons in West Africa mostly with the peak of the rainy seasons which is in line with the period the study were carried out. Thus, the high rate of malaria infection within the study area could be attributed to the fact that the infection is already a looming endemic problem in Nigeria, including Imo State Polytechnic as the sample and surveying period coincided with the peak of raining season when mosquitoes are breeding due to the amount of rainfall from May to August and early September which falls within the time under review.

Furthermore, gutters and other drainages are frequently clogged with water due to an ineffective public waste disposal system, and Imo State and its surroundings, including the study area Imo State Polytechnic, Omuma, are relatively wet and poorly drained. All of these factors serve as good and suitable breeding grounds for mosquitoes, which aid in the stable and continuous transmission of malaria even after the months of November

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and December, during the height of the rainy season. Hence, there should be urgent attention to eliminate all the indices that support mosquito breeding and possible disease transmission. Students Union government, the management in collaboration with the ministry of health should make available insecticide treated bed nets (ITN'S) in other to prevent the students being beaten by mosquitoes and hence reducing the rate of transmission to the lowest minimum. Also, antimalarial drugs should be made available periodically to the students as an intervention in reduction and prevention of malaria parasite infection.

4.1 CONCLUSION

The results of this investigation show that the entomological and parasitological markers of malaria transmission—such as the various mosquito species detected at various locations within the study areas and the plasmodium parasite detected in the blood samples of students residing in the school's hostels and lodges—are both well-established within the study areas, which explains why malaria is endemic in Imo State Polytechnic and around it.

The mosquito species found in this study are uncommon, exist at Imo State Polytechnic in Omuma, and are all known to use the artificial breeding grounds found the study area. The disparity found in species distribution among sampling sites may be attributed to the dissimilarity in aquatic habitat diversity in each site.

4.2 RECOMMENDATION

It is recommended that insecticides and long-lasting insecticide treated nets should be constantly used by the students to reduce the vector infectivity as well as vectors survival rates and length of sporogonic cycle of mosquitoes. Also, good environmental practices within the study areas vis-à-vis; disposing of containers, receptacles, water storage jars etc. that contributed to high mosquitoes breeding should be disposed properly. The school authority and landlords should encourage and advocate for regular clean up exercise to constantly reduce possible breeding sites of these disease vectors.

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