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Malaria Vector Distribution Within The Premises Of A Busy, Referral Hospital In Port Harcourt, Nigeria.

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ABSTRACT

Malaria remains a global public health concern. Its transmission varies geographically, depending on how favourable the environment is to the vector's distribution. Hospital settings do not seem spared of malaria receptivity especially large, high-volume, referral health facilities where malaria ranks high on the list of hospital-acquired infections among patients, visitors, and staff. The study aimed to ascertain the distribution of malaria vectors within the premises of a busy, referral hospital in Port Harcourt, Nigeria. The study was a descriptive, cross-sectional design. Study sampling collection sites were twenty-nine (29) and were purposively selected based on whether they were enclosed spaces within the hospital premises that were used for work or sleeping or both and had presence of human traffic. Adult mosquitoes were collected indoor using the Pyrethrum Spray Catch in two cycles (September-October and November-December 2020). Two vector collectors spent a maximum of ten minutes per house for collection during the morning hours (06:00-09:00hrs). Morphological identification only was conducted on all mosquito samples. All data were entered and analysed for descriptive statistics with Microsoft Excel®, while Fisher's 95% Confidence Intervals were computed using WINPEPI®. A total of 47 and 73 adult mosquitoes were collected and identified in 29 locations in Cycles 1 and 2, respectively. Of these, *Anopheles* spp. accounted for 4.26% (95%CI=0.52- 14.54) and 1.37% (95%CI=0.03-7.40) in Cycles 1 and 2 respectively; the rest of the collected mosquitoes were *Culex* spp. representing 95.74% and 98.63% respectively. The study found a preponderance of *Culex spp.* rather than the malaria vector, *Anopheles spp.*, within the University of Port Harcourt Teaching Hospital premises. Nonetheless, the hospital management should pay attention to the reduction of culicine mosquitoes not only because of being a 'biting nuisance' but also their roles as vectors of lymphatic filariasis.

Keywords: malaria, mosquito, malaria vector distribution, hospital premises, Port Harcourt.

INTRODUCTION

Malaria remains a life-threatening parasitic disease of public health importance that is prevalent in tropical and subtropical regions around the world. In 2020, the malaria cases reported by the World Health Organization (WHO) was estimated as 219 million cases globally, and over 400,000 deaths, with most of the deaths occurring in children under the age of 5 years (WHO, 2020).

Plasmodium falciparum is the most common cause of malaria (70 percent) amongst the other causative protozoa responsible for this febrile illness (Gunathilaka *et al.*, 2019). The parasite is transmitted from person to person through the bites of an infected adult female *Anopheles* mosquito (Aju-Ameh *et al.*, 2016). The two major vectors of human malaria in sub-Saharan Africa are *Anopheles gambiae* and *Anopheles arabiensis*. They occur in considerable dominant numbers and have grown to become the most important vector species of malaria (Sinka *et al.*, 2010). Often the female *Anopheles* feed on warm-blooded animals, with the anthropophagic species preferring man, while the zoophilic ones are inclined to various living beings. The consumption of blood meals and gonotrophic cycles are unpredictable and are the channel of malaria parasite supply and transmission (Service & Townson, 2010).

Malaria vector distribution is ecological, varying from one geographical location or physical environment to another, contingent upon the suitability of the climate, available breeding sites, biting behaviour, host preference, and life span. Taken together, malaria vectors display distinguishable behaviour and capacity to transmit parasites.

Nigeria is a huge and ecologically diverse country, and malaria transmission elements differ as indicated by climatic, geographic, and socio-economics conditions. There is limited data on the vectorial capacity of mosquito species, such as sporozoite rate or entomological inoculation rate in southern Nigeria. The University of Port Harcourt Teaching Hospital (UPTH) was selected as a study site because of its receptivity for malaria transmission being one of the principal tertiary hospitals in the South South geopolitical zone of Nigeria that draws a high volume of clientele and had garnered an unenviable reputation of being said to have a huge 'mosquito problem' according to reports from patients, visitors, and staff. It has been said that the location of the hospital in close proximity to a swampy forest conservation area belonging to the adjacent University of Port Harcourt may be responsible. The study aimed to ascertain the distribution of malaria vectors within the premises of the University of Port Harcourt Teaching Hospital, Port Harcourt with a view to providing information to guide environmental health management actions.

METHODOLOGY

Study Area

This study was part of a larger descriptive, cross-sectional study to determine the perceptions of the staff and clients within the University of Port Harcourt Teaching Hospital, Port Harcourt (UPTH) on malaria vectors and mosquito abundance and distribution. The hospital is a high-volume, tertiary level, referral hospital located between latitudes 4°49′27″N and 7°2′1″E. The hospital lies in the freshwater swamp forest eco-vegetational zone. The swampy and undulating terrain of the environment of the hospital provides suitable mosquito-breeding sites. The hospital is in close proximity to the University of Port Harcourt botanical conservation site. Port Harcourt is the capital of Rivers State, the epicentre of the oil-rich Niger Delta region in southern Nigeria. It experiences an average of 2293.6 mm (90.3 in) of rainfall per year, or 191.1 mm (7.5 in) per month. The month of September appears to experience the wettest weather with an average of 367.1 mm (14.5 in) of rainfall, while December experiences the driest weather with an average of 20.2 mm (0.8 in) of rainfall (Climatemps.com).

Sampling Locations and Technique

Sampling locations were established to ensure maximum coverage of the study site. These were purposively selected based on whether they were enclosed spaces within the UPTH premises that were used for work or sleeping or both, and had presence of human traffic, thus they included hospital wards, laboratories, offices, and sleeping rooms. Adult mosquitoes were subsequently collected in twenty-nine (29) locations of the hospital: Internal medicine ward (3 rooms), Community medicine ward (2 rooms),

Haematology laboratory (2 rooms), Microbiology laboratory (2 rooms), Centre for health and development office (3 rooms), Doctor's quarters (16 rooms), and Gynaecology ward (1 room).

Standard mosquito nets and pyrethrum spray catch (PSC) technique was used to capture indoor resting mosquitoes from 06:00 to 09:00 at two periods (September-October and November-December 2020). The mosquitoes caught were examined at the Rivers State University mosquito laboratory. Each mosquito was placed in a clean petri dish and viewed under a microscope. The microscope was used to classify and state the sex of each mosquito compared to studies. Prior to labelling, individual samples were stored in Eppendorf tubes (1.5ml) with dry silica gel. Morphological identification only was conducted on all mosquito samples.

Data Analysis

Data were recorded on record sheets and entered in Microsoft Excel® spreadsheet for analysis of descriptive statistics. Results have been presented in counts, proportions, and simple frequency tables. Fisher's 95% Confidence Intervals for proportions were computed with WINPEPI® (Abramson, 2004)

Ethical Approval

Permission was sought and obtained from the University of Port Harcourt and the University of Port Harcourt Teaching Hospital (UPH/CEREMAD/REC/MM72/060). Participants' written consent was received. To ensure confidentiality, the University was assured the findings would be kept confidential after data collection.

RESULT

Table 1 is a display of the specific details for all the sample collection sites including the number of occupants and number of mosquitoes collected at each site in Cycle 1. The results show that, 3 sites in Internal Medicine ward were sampled, and 4 adult *Culex* mosquitoes were identified. In Haematology laboratory, 2 sites were sampled and a total number of 4 adult *Culex* mosquitoes were identified. In Micro-biology laboratory, 2 two rooms were sampled, and no mosquito was found (reason been that fumigation was done before the sampling). The results also showed that in Community Medicine ward, 2 rooms were sampled, and two adult *Culex* mosquitoes were identified. Centre for Health and Development (CHD) had 3 rooms and 4 adult *Culex* mosquitoes were identified. Gynaecology ward had 1 room sampled and no adult mosquitoes were found. In Doctors' quarter, 16 rooms were sampled, a total number of 1 female, 1 male *Anopheles* and 31 *Culex* mosquitoes were identified. The findings showed that a grand total of 29 rooms, and 47 adult mosquitoes including 2(4.3%) *Anopheles* and 45(95.7%) *Culex* were recorded.

Table 1: Mosquitoes sample collection sites and vector distribution (September -October)

Variables	**No of rooms**	**No. of mosquitoes**	**Anopheline spp**	**Culicine spp**
Locations			n (%)	n (%)
Internal medicine ward	3	4	0	4(8.51)
Hematology laboratory	2	4	0	4(8.51)
Micro-biology laboratory	2	0	0	0
Community medicine ward	2	2	0	2(4.26)
CHD office	3	4	0	4(8.51)
Gynecology ward	1	0	0	0
Doctors Quarter	16	33	2(4.3)	31(65.96)
Total	**29**	**47**	**2 (4.3)**	**45 (95.7)**

Table 2 explains the collection of mosquito from the month of November –December on malaria vector distribution. The result from the study collection sites showed that 3 rooms in Internal Medicine ward was sampled, and 3 adult *Culex* mosquitoes were identified. In Haematology laboratory, 2 rooms were sampled, a total number of 7 adult *Culex* mosquitoes were identified. In Micro-biology laboratory, 2 two rooms were sampled, 20 adult *Culex* mosquitoes were identified. The result also showed that in Community Medicine ward, 2 rooms were sampled, and 12 adult *Culex* mosquitoes were identified. Centre for Health and Development office (CHD) had 2 rooms and 1 female *Anopheline* and 5 adult *Culex* mosquitoes. Gynaecology ward had 2 room sampled, 10 adult *Culex* mosquitoes were identified. In Doctors' quarter, 8 rooms were sampled, a total number of 15 *Culex* mosquitoes were identified. The findings showed that a grand total of 21 rooms, and 73 adult mosquitoes 1(1.4%) *Anopheles* and 72(98.6%) *Culex* were recorded.

Table 2: Mosquitoes sample collection sites and vector distribution (November - December)

Variables	**No of rooms**	**No. of mosquitoes**	**Anopheline spp**	**Culicine spp**
Locations			n (%)	n (%)
Internal medicine ward	3	3	0	3(4.1)
Hematology laboratory	2	7	0	7(9.6)
Micro-biology laboratory	2	20	0	20(27.4)
Community medicine ward	2	12	0	12(16.4)
CHD office	2	6	1(1.4)	5(6.8)
Gynecology ward	2	10	0	10(13.7)
Doctors Quarter	8	15	0	15(20.5)
Total	**21**	**73**	**1(1.4)**	**72 (98.6)**

DISCUSSION

The finding of the study corroborates with the study of Okparaiba *et al* (2019) in the University of Port Harcourt Teaching Hospital who reported the abundance of *Culex* distribution in the hospital compared to the actual malaria vector (*Anopheles*). The finding of the study also corresponds to that of Mattah *et al* (2017) and Mbokazi *et al* (2018) whose study reported the distribution of more *Culex* than the *Anopheles* species. The similarities in these studies might be attributed to the fact that the distribution of malaria vector depend on the geographical location and positioning of the study area. This is also supported by the studies of Kara *et al* (2010), Akpan *et al* (2018) and Akpan *et al* (2019) whose studies discovered that the abundance of malaria vector is dependent on the location of the study area and temperature fluctuations. By implication, this shows that mosquito control can be improved on by studying the location and temperature fluctuations of a particular area.

However, the studies of Moreno *et al* (2009) and Gunathilaka *et al* (2019) is not in keeping with the finding of the present study as they reported the abundance of the distribution of the malaria vector *Anopheles*. The reason for the abundance of the female *Anopheles* mosquito in these studies might be since the geographical location is an area that is more favourable to the breeding of the *Anopheles* mosquito. However, a major fact to note in the present study was that the collection of samples was carried out in the dry season that may not favour the breeding of the malaria vector. Additionally, fumigation of the hospital against this malaria vector may also play an important role for their poor abundance compared to other species.

CONCLUSION

Findings in this study revealed malaria vector distribution including other mosquito species which in turn provided a better understanding of their patterns, efficient management, and intervention. Also, findings of this study, it was concluded that there is abundance of *Culex* rather than *Anopheles* the malaria vector within the University of Port Harcourt Teaching Hospital. By implication, occupants are likely to be infected with diseases transmitted by the *Culex* mosquito.

RECOMMENDATION

Based on the findings in this study, the following are recommended.

To Management/Institutions

The University of Port Harcourt Teaching Hospital (UPTH) should through its management provide adequate resources to control vector. This will in turn reduce the burden of diseases associated with mosquito bites.

The University of Port Harcourt Teaching Hospital (UPTH) should ensure they provide urgent intervention to reduce the case of vector/human by environmental control such as replacing torn nets on windows, provision of screens on doors and long-lasting insecticide net etc.

University of Port Harcourt Teaching Hospital (UPTH) should pay more attention to the reduction of *Culex* species because of its increase in number as found in the study and their roles as vectors of lymphatic filariasis.

The University of Port Harcourt Teaching Hospital (UPTH) should ensure they carry out fumigation practices from time to time especially on larva to reduce the rate at which mosquitoes breed around the premises including proper environmental sanitation.

To Communities

Communities who live within the University of Port Harcourt Teaching Hospital (UPTH) through its leaderships should organise educative programmes and sanitation exercises that will help in the reduction of mosquito breeding sites members.

To Individuals

Occupants of work and living spaces within University of Port Harcourt Teaching Hospital (UPTH) should ensure they protect themselves by using long lasting insecticide net while in the hospital.

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