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Mosquito Survey and the Difficulties of Long Lasting Insecticide Nets Usage in Ifite Awka, Awka South LGA, Anambra State Nigeria

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Abstract

Background: *The risk of mosquito-borne illnesses being transmitted from persons to persons via infected mosquito bites makes mosquito presence in educational settings a serious hazard to the health of students and other occupants.*

Objectives: *This study was carried out in Ifite Awka, Awka South L.G.A, Anambra State, Nigeria and mosquitoes surveillance was carried out between October and December 2021*

Methods: *Mosquitoes were collected through three major sampling methods namely; Pyrethrum Knockdown Collection (PKC) for the indoor mosquitoes, Human Landing Catch (HLC) and larval sampling for outdoor mosquitoes.*

Result: *A total of 440 mosquitoes were collected from the sample locations and results from the study showed that the predominant species was Culex quinquefasciatus 323/440 (73.4%) followed by Anopheles gambiae 99/440 (22.5%), Mansoni africana 16/440 (3.6%) while Aedes aegypti was the least 2/440 (0.5%). There was a significant difference in abundance between the four mosquito species ($p<0.000$). With regards to hostels, the abundance of mosquitoes in Godfelic hostel was not significantly different ($p=0.874$) and highest compared to other sample locations. hostels were sampled. In the larval habitats sampled, the three mosquito genera present were Anopheles gambiae, Culex quinquefasciatus and Mansoni africana. Result on the challenges of using LLINs in malaria control using a questionnaire revealed that out of the 99 respondents, 32.73% implicated adverse reactions of chemical in nets, 27.27% complained of itching while using the nets, 34.55% complained of increase in body temperature and 5.455% complained of sneezing.*

Conclusion: *The findings of this study will be useful in developing and implementing a larval management strategy as a means of vector management, and it is recommends that ongoing campaigns to promote the use of long-lasting insecticidal nets (LLINs) to prevent malaria should be supported.*

Keywords: Mosquitoes; Long Lasting Insecticide Nets; Malaria; Ifite; Anambra State

Introduction

Mosquitoes are tiny, thin insects that ingest blood meals from humans and other animals. They are widely dispersed around the globe, both in tropical and temperate areas. Mosquitoes are drawn to humans intensely and have evolved to reproduce in environments that humans have helped to build. Agricultural practices such as irrigation system, fish ponds and use of water storage containers in livestock houses provide suitable breeding ground for anthropophilic mosquitoes. Also, poor housing conditions may increase man vector contact. Bushes, garbage heaps, swamp and stagnant pools of water provide hospitable breeding ground for the mosquitoes [1]. The optimum rainfall, temperature, and humidity conditions are found in tropical regions, including Nigeria, where several mosquito species thrive and survive. When an uninfected individual is bitten by an infected female Anopheles mosquito, malaria is transmitted to humans. Malaria is highly endemic in sub- Saharan Africa including Nigeria [2]. The parasite of the genus Plasmodium is the causative agent malaria, which is a parasitic disease. Plasmodium falciparum, Plasmodium malariae, Plasmodium vivax, and Plasmodium ovale are the four primary species of Plasmodium known to cause malaria [3]. According to the WHO's 2018 global malaria report, there were an estimated 219 million cases and 435,000 deaths worldwide [2]. Nigeria has the biggest population in Africa and the whole globe at risk for malaria, with an estimated 198 million inhabitants [2]. Data from the WHO, which indicated that Nigeria had the greatest number of malaria cases and mortality (19%) in 2017, support this [2]. Due to climatic

factors that are favorable for mosquito breeding, malaria is an endemic disease that persists [4]. It has been demonstrated that using bed nets impregnated with insecticide is an efficient way to lower malaria outbreaks and the mortality rate of the disease [5]. It has been studied that the appropriate use of insecticide-treated bed nets (ITNs) is an effective, affordable, and efficient technique of preventing malaria [6]. There is, however, little information available on issues that arise in using ITNs. Additionally, a number of studies have looked at the efficiency of ITNs in preventing malaria, and some results indicate low compliance with their use [7]. Although insecticide-treated nets (ITNs) have been found as a practical and affordable way to reduce malaria-related morbidity and death, it is important to take into account the factors that affect ITN use compliance. So it's crucial to examine and understand why individuals do not use ITNs. This would greatly aid in the development of behavioral change initiatives and campaigns aimed at promoting and enhancing the use of ITNs in Nigeria by policy makers, non-governmental organizations, the government, and everyone else engaged in the fight against malaria [8].

Material and Methods

Study Area

This study was conducted in Ifite-awka Community Awka South L.G.A, Anambra state. The study took place between October and November, 2021. Ifite-awka in the region of Anambra State is a town located in Nigeria- some 317km south of Abuja, the country's capital. Ifite-awka is situated in Awka South, Anambra, Nigeria, its geographical co-ordinates are 60 151 011 North, 70 51 011 East and its Original name is Ifite-Awka. Typically, the temperature ranges between 27°C and 30°C from June to December but climbs to 32°C to 34°C from January to April, with the latter three months of the dry season having intense heat. The area is density populated by staff and students of Nnamidi Azikiwe University (NAU) as well as public servants who live in and around commissioner's quarter's axis due to its proximity to the Anambra State Government. The villages that made up of Ifite-Awka is Enu-Ifite, Ezinato-Ifite and Agbada-Ifite [9].

Figure 1: Map showing Ifite Awka: https//maps.app.goo.gl/zVMBoDoK3LQTbAKd9

Study Design

Sampling of mosquito species composition was carried out at the beginning of the dry season (October-December 2021). Sampling was performed using human bait catch, pyrethrum spray catch and larval sampling. Anopheles mosquitoes were identified to species level. A cross-sectional study among consenting people in the community using semi structured self-administered questionnaires was done. The questionnaires assessed the challenges faced by people when using LLINs. People included in the study were people that had access to LLINs in their household and therefore were likely to use them. The filled-out questionnaires were validated on-site for completeness.

Collection of Adult Mosquitoes

Pyrethrum Knockdown Collection (PKC)

Randomly selected rooms of similar size were sampled and all dwellings were rectangular. The PKC procedure involves taking out all the large furniture and covering the floor with white bed linens. The whole inside of the rooms was treated with pyrethroid insecticide. To ensure mosquito knockdown, all doors and windows remained closed for 10 to 15 minutes. After the insecticide collection, the white sheets were gently pulled at the edges to let the mosquitoes cluster in the middle for sample collection. The mosquitoes were removed off the sheets using forceps and put in a petri dish with filter paper. Due to effectiveness, safety, and accessibility pyrethroid insecticide was used in this study. The combined number of mosquitoes collected from PKC was calculated to provide a total catch for each dwelling.

Human Landing Catch (HLC)

A team of two catchers with a similar level of abilities and expertise conducted the HLC outside. The experiment was carried out at several places within the same research region. All mosquitoes that landed on the subjects' exposed hands and legs were trapped in a test tube that had been cotton wool-plugged in earlier. To guarantee that only mosquitoes were captured during collections, all catchers were outfitted with moderately intense torch lights. Normally, this was carried out between 6:00 and 8:30 p.m.

Mosquito Larval Sampling

The different types of habitat available for this research such as swamps, drainage ditches, and abandoned goldmines were identified at the beginning of the study. For each survey, the different types of breeding sites were sampled using a standard laddle. Ten dips were made at each habitat and the presence and absence of mosquito larvae was recorded.

Identification and Storage of Mosquitoes

Adult mosquitoes captured using the aforementioned techniques were instantly killed by being exposed to chloroform and were morphologically identified. Anopheline adults that had been killed were dried and kept in a cold, dark place in 1.5 ml micro-centrifuge tubes containing cotton wool and silica gel beads.

Ethical Consideration

The residents of the Ifite-Awka village granted permission for the research to be conducted in exchange for a letter of identification from the Department of Parasitology and Entomology. Before administering the questionnaire, informed consent was sought from the research population.

Administration of Questionnaire

Questionnaires were given to the people living in the community in order to get the data on the difficulties the community face in using LLINs.

Analysis of Data

Using EP1 info software version 7, the data collected were analyzed. While continuous variables were shown as mean +- SD, the results were shown as frequency and percentages. In Ifite Awka, a bar chart was utilized to assess how discomfort of using LLIN. A 0.05 p-value was considered as statistically significant.

Result

Abundance of Mosquito Species in Ifite Awka, Awka South L.G.A Anambra State

Out of the total 104 mosquitoes collected, 50 (48.1%) were found indoors and 54 (55.9%) were found outdoors. The most abundant species were Culex mosquitoes 94 (90.4%) followed by Mansoni 8 (7.7%), then Aedes 2 (1.9%). In indoor collections, Culex mosquitoes were most abundant 48 (96%) followed by Mansoni 2 (4%). There were no Anopheles or Aedes species found among indoor collected mosquitoes. Culex mosquitoes were also more abundant in outdoor collections 46 (85.2%) then Mansoni 6 (11.1%) and Aedes 2 (3.7%). There was significant difference in abundance of mosquitoes between indoor and outdoor mosquitoes collected at P =0.000.

Table 1: Abundance of Mosquito Species at Ifite Awka, Awka South L.G.A

Anopheles spp (%)	Culex spp (%)	Aedes spp (%)	Mansoni spp (%)	Total (%)
Indoor 0	48(96)	0	2(4)	50(48.1)
Outdoor 0	46(85.2)	2(3.7)	6(11.1)	54(55.9)
Total (%) 0	94(90.4)	2(1.9)	8(7.7)	104(100)
Outdoor 0	46(85.2)	2(3.7)	6(11.1)	54(55.9)
Total (%) 0	94(90.4)	2(1.9)	8(7.7)	104(100)

Mean, Standard deviation, Standard error; P= (0.05); 13.0000, 21.08486,7.45462.

Distribution of Mosquitoes at Ifite Awka, Awka South L.G.A, Anambra State.

Out of the 5 lodges sampled, Godfelic lodge had the highest number of mosquitoes 35(33.7%) while favour lodge had the lowest number of mosquitoes 4(3.8%). There were no Anopheles specie found in all the sampled lodges. There was no significant difference in distribution of mosquito species according to lodges at p=0.874.

Table 2: Distribution of mosquito species according to lodges in Ifite Awka, Awka South L.G.A, Anambra State.

Lodges Anopheles spp (%)	Culex spp (%)	Aedes spp (%)	Mansoni spp (%)	Total (%)
Favour Lodge 0	3 (75)	1 (25)	0	4 (3.8)
Godfelic Lodge 0	33 (94.3)	0	2 (5.7)	35 (33.7)
J.J Palace 0	18 (100)	0	0	18 (17.3)
Our ladies 3 0	17 (77.3)	1 (4.5)	4 (18.2)	22 (21.2)
Deluso Lodge 0	23 (92)	0	2(8)	25 (24)
Total (%) 0	94 (90.4)	2 (1.9)	8 (7.7)	104 (100)

Mean, Standard deviation, Standard error; p= (0.05) 5.2000, 9.52890, 2.13073.

Breeding Habitat of Mosquito Species at Ifite Awka, Awka South L.GA, Anambra State.

Out of the 336 mosquitoes collected during the larval collection, 103 (or 30.7%) larvae were detected in gutters, while 19 (5.7%) were detected in cans. The most prevalent species in all nesting locations studied was Culex specie 229 (68.2%), followed by Anopheles and Mansoni spp, respectively. None of the breeding locations contained any Aedes species. At p = 0.790, there was no significant difference between the larval breeding sites in the study region.

Table 3: Breeding Sites of Mosquito Species in Ifite Awka, Awka South L.G.A, Anambra State.

Breeding Sites	Anopheles spp (%)	Culex spp (%)	Aedes spp (%)	Mansoni spp (%)	Total (%)
Canned containers	18 (94.7)	0	0	1 (5.3%)	19 (5.7)
Disposed plastics	0	63 (100)	0	0	63 (18.6)
Gutters	30 (29.1)	70 (67.9)	0	3 (2.9%)	103 (30.7)
Stagnant water	11 (11.9)	81 (88)	0	0	92 (27.4)
Tyres	30 (88.2)	0	0	4 (11.8%)	34 (10.1)
Total (%)	99 (29.5)	229 (68.2)	0	8 (2.4)	336(100)

Mean, standard deviation, standard error, p= (0.05); 15.5500, 26.02120, 5.81852.

Difficulties of Long Lasting Insecticide Nets Usage at Ifite Awka, Awka South L.G.A, Anambra State.

Out of the 100 questionnaires that was distributed, 99 responses were recorded. The most challenges faced by people were Increase in body temperature (34.546%) followed by Adverse Skin reaction to chemical in Nets (32.727%) , Itching (27.273%) and Sneezing (5.455%) respectively.

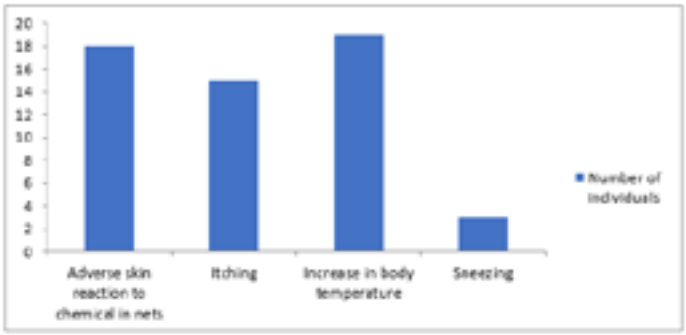

Figure 2: The difficulties of Long Lasting Insecticide Nets Usage at Ifite Awka.

Discussion

The findings from this study designed to survey the abundance and distribution of Mosquito Species in Ifite Awka yielded a total number of 440 mosquitoes made up of four species which includes; Anopheles gambia (22.5%), Culex quinquefasciatus (73.4%), Aedes aegypti (0.5%) and Mansoni africana (3.6%). It was shown that Culex quinquefasciatus is the most predominant with 323 mosquitoes and an abundance of 73.4%. This came as no surprise given the close proximity of the lodges in Ifite and the abundance of suitable filthy breeding sites, which made it very simple for Culex quinquefasciatus to to breed and fly throughout the surrounding area. According to Ombugadu et al. and Adeoye et al., Culex quinquefasciatus was the most prevalent mosquitoes in the dorms at the Federal University of Lafia, Nassarawa State, and University of Lagos, respectively [10,11]. Additionally, Mistica et al. found solely Culicine mosquitoes in the setting of public schools [12]. In the Ojo district of Lagos, more Culex than Anopheles were found, according to studies by Okwa and Sulaimon [13]. Studies by Ondiba et al., Malina et al., and Ombugadu et al., on the other hand, revealed that Anopheles gambiae was the dominating mosquito species in schools as well as other environments [14,15,10]. The Culex species are potential carriers of disease including encephalitis, filariasis, and others. This survey will serve to draw the attention of people livng in Ifite Awka to the imminent and possible outbreak of filariasis as, According to Egbuche et al., of all mosquito species found in the research area, Culex quinquefasciatus, Anopheles gambiae, and Mansoni africana are responsible for transmitting the filarial worm Wuchereria bancrofti, which causes lymphatic filariasis [16].

With a percentage abundance of 0.5%, Anopheles gambiae is the second most prevalent species in this research, which may indicate that continuous anthropogenic activities in Ifite Awka have created more transient breeding habitats for Anopheles gambiae, such as tire tracks, hoof prints, and rice paddy. This is similar with studies by Williams and Pinto, Patricia et al., and Adeleke et al. who demonstrated that Anopheles mosquito breeding efficiency was influenced by temporary environments [17-19]. Additionally, Anopheles gambiae was listed by Adeoye et al. as the second most prevalent mosquito in a research on endophilic mosquitoes in Ifite Awka student residences [11]. Other species identified includes; Mansoni Africana which has an abundance of 3.6% and the least abundant being Aedes aegypti with an abundance of 0.5%. Variations were seen in the mosquito population dispersion in accordance to the yearly months and seasons. Although it didn't seem to follow a specific pattern, it was found to be typically low in the sampling locations during the dry season (December to January), when the majority of temporary habitats are dried, which is consistent with findings of Bugoro et al [20]. In all the lodges sampled, Godfelic lodge had the highest number of mosquitoes 35(33.7%) while Favour lodge had the lowest number of mosquitoes 4(3.8%). Also given the length of the study, lack of ceilings, window nets, or door nets in the study area, which allow blood-fed mosquitoes to flee before or during indoor collection, and the ineffectiveness of the Human Landing Catch as a collection method may be held responsible for the low mosquito population. According to this study, Culex quinquefasciatus predominate the mosquito population at Godfelic Lodge, which is consistent with the findings of Ezihe et al [21]. In contrast, Oguoma et al. 's findings from North Central Nigeria showed that Anopheles species were the most prevalent species of collected mosquito [22]. During larval sampling, most mosquito larva were found in Gutters (30.7%), stagnant waters (27.4%), disposed plastics (18.6%), and tyres (10.1%) while the least mosquitoes were in canned containers (5.7%). The most prominent breeding grounds for mosquitoes during this study period were gutters. The majority of these habitats had different kinds of plants, which offered mosquitoes the perfect microhabitats. In comparison to other breeding areas that were studied, it was shown that gutters and stagnant waterways were habitat to more mosquitoes. Because Culex quinquefasciatus larvae were shown to be quite common in polluted locations, this study also

demonstrates that Culex spp. were the most widely distributed mosquito larvae. Hidayati et al. also noted that Culex quinquefasciatus typically breeds in polluted, stagnant water with a high organic content [23]. But several studies revealed that Culex quinquefasciatus also accepted environments with turbid water where organic matter were present [24]. This is a definite indicator that Culex spp. larvae are more habitat-adaptable than other mosquito species. Also, the abundance of Culex quinquefasciatus in drains (polluted water) in this study is in agreement with the findings of Service [25]. Also, it was recorded that Aedes mosquito larvae was absent in all the breeding sites sampled.

Through the distribution of questionnaires, the study also evaluated the difficulties associated with the use of long-lasting insecticidal nets in the fight against malaria. The public health department has employed long-lasting insecticidal nets to combat malaria, which is spread by Anopheles mosquitoes. Ninety-nine out of one hundred questions were correctly completed. Of the 99 individuals who had used LLINs at least once, 18 reported chemical toxicity that resulted in unpleasant consequences such swelling of the face, peppering of the eyes, and peeling of the hands, while 15 reported itching, 19 reported a rise in body temperature, and 3 reported sneezing. Numerous complaints of unpleasant reactions, including facial swelling, eye irritation, and hand peeling, indicate that some respondents may not be aware of crucial concerns like drying the nets for 24 hours prior to the first usage and how to properly tuck them beneath the bed or mat. Studies by Aribodor et al., Israel et al., Allah et al., and others also mentioned concerns about chemical toxicity and injury from LLINs [26-28]. The adverse reactions have significant consequences, particularly in terms of lowering the adoption of LLIN as a vector control tool in this area. The identification of increase in body temperature as one of the major challenges of using LLINs is similar to reports from others researchers; [28,29,7,]. The Nigerian Meteorological Agency reports that Nigeria experiences tropical weather with temperatures ranging from 22 to 37 degrees Celsius (NIMET, 2018). According to Asuquo et al., 2017, Israel et al., 2018, and Onyemaechi et al., 2017, the non-use of LLINs has been attributed to the lack of power/electricity, especially at night, throughout the majority of nation. In addition, a study of communities in Mestizo, Peru, discovered that LLINs users appreciated how it kept them warm at night. This finding may be related to the region's chilly temperature (Harvey et al., 2008). Residents of this community should be informed about the cause of such reactions in order to alleviate their concerns and address any existing misconceptions.

Conclusion

This study clearly showed that mosquitoes are present in Ifite Awka. The number of mosquito specimens collected during the study period was relatively low due to the dry season which decreased the amount of temporal habitats in the study area. The Culex quinquefasciatus was the most dominant due to the availability of polluted stagnant waters in the study area. Most of the mosquitoes were collected in gutters and stagnant waters. Also Pyrethrum Knockdown Catch (PKC) and Human Landing Catch (HLC) was used in the collection of indoor and outdoor resting mosquitoes respectively. A typical necessary control approach required in the study area is the covering of all currently open drainage systems across Ifite Awka since the major site of collection of mosquitoes within Ifite Awka is the open drainage systems. The drainage systems have the capacity to accommodate about 1260 Larvae. This may be seen to be a small contribution to prevention but at the peak of raining seasons, they can harbor more than this number of mosquitoes, if estimates are made from the number of larval collections in this study, covering the drainages could thus reduce the exposure of people to mosquitoes alongside LLINs to reduce vector density in their residential accommodation. The difficulties in using LLINs revealed by this study's survey highlight the necessity of maintaining the commitment and confidence of LLIN users in this region through frequent monitoring and surveillance visits aimed at educating the populace on the proper use and maintenance of their nets for maximum malaria vector control benefits. The doors and windows of the student residences should be covered with mosquito-net screens because it is possible that the students would not always have enough money to buy insecticide sprays. LLINs should also be made available to the residents of the Ifite.

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