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Malaria Prevalence and Indoor-Biting Mosquito Vector Abundance in Ogbunike, Oyi Local Government Area, Anambra State, Nigeria *(Pp. 1-13)*

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Abstract

This paper studies malaria prevalence and the abundance of indoor-biting mosquito vectors in Ogbunike community, Oyi Local Government Area of Anambra State, Nigeria between May and September 2010. Blood samples were collected from 208 healthy participants (94 males and 114 females)

selected from the six villages of the town. Thick and thin blood films were made, stained with Field's stains A and B and examined microscopically. Indoor-biting mosquito vectors were collected using Pyrethrum Knockdown Collection method (PKC). Of the 208 participants, 121 (58.2%) were malaria positives. Considering the intensity of malaria among the participants, 86 (71.1%) had mild infection (+), 32 (26.4%) had moderate infection (++) and 3 (2.5%) had heavy infection (+++). Only Plasmodium falciparum was seen. Osile village had the highest prevalence (64.5%) while Umueri had the least prevalence (51.7%). Malaria prevalence among different villages of the community was statistically significant (8.88, df = 5; p<0.05) while malaria intensity was not significant (0.82, df=5; p>0.05). The age group ≥61 has the highest malaria prevalence (64.7%), followed by age group of 0-10 (63.2%) while 41-50 had the least (42.9%). The malaria prevalence in relation to age was significant (5.56, df=5; p<0.05). Malaria prevalence according to occupation was not significant (p>0.05). Females 73(35.1%) were affected more than the males 48(23.1%) though there was no significant difference (p>0.05). 110 Anopheles gambiae was collected from the six villages of the community with Osile having the highest indoor-biting Anopheles mosquito 24 (21.8%) while Ifite had the least collection 13 (11.8%). There was a positive strong relationship between malaria prevalence and Anopheles abundance in the villages in Ogbunike (r=0.1221684; p<0.05).

Key words: Malaria, Prevalence, Vector abundance, Rainforest, Rural, Community.

Introduction

Malaria remains an important public health parasitic disease in both tropical and subtropical countries in Africa where it is mostly seasonal with its major incidence occurring in the rainy season (Eneanya, 1998; Oesterholt *et al*, 2006). Despite decades of control efforts, malaria continues to be a major public health concern throughout the world. It is estimated that there are 300-500 million new cases every year, with 1.5 to 2.7 million deaths worldwide particularly in Africa (WHO, 1992) where about 90% of the global cases are recorded (WHO, 1992; Breman *et al*, 2004,). Children under five years and pregnant women are affected most (WHO, 2008).

In Nigeria, the risk of malaria infection exists throughout the country. Malaria is endemic and stable, being a major cause of morbidity and mortality, resulting in 25% infant and 30% childhood mortality (FMH,

2005a). More than 90% of the total population is at risk of malaria and at least 50% of the population suffers from at least one episode of malaria each year. Beyond the impact on children and pregnant women, it affects the general population (RBM, 2005; FHM, 2005b). The disease is the commonest cause of outpatient attendance across all age groups with about 66% of clinic attendance due to malaria (FMH, 2000) and thus constituting a great burden on the already depressed economy. The enormous loss of life, days of labour, absenteeism in schools and cost of treatment of patients brought on by malaria make it a major social and economic burden in Nigeria.

Malaria parasites, *Plasmodium* species, are generally transmitted by female *Anopheles* mosquitoes. The prevalence, intensity and regularity of malaria differ from location to location depending on factors such as rainfall patterns and proximity of human dwelling places to vector breeding sites among others (Onyido *et al*, 2009a). *Anopheles gambiae*, the principal transmitter of malaria in Nigeria is closely associated with sunlit water collections close to human dwellings while *Anopheles funestus* another important malaria vector tends to breed more in cool, clear, shaded, permanent water bodies in rural areas relatively undisturbed by man (Onyido *et al*, 2009b).

Several studies on the pattern of malaria in Nigeria have been carried out but these were mostly concentrated in urban and sub-urban communities than in rural communities (Aribodor *et al,* 2003). This study is intended to extend and intensify research on malaria among rural dwellers who are mostly at risk. Specifically the study is carried out in the rural community of Ogbunike in Oyi Local Government Area of Anambra State. The objective of this study is to determine malaria prevalence and vector abundance in the community as well as the extent of the relationship between malaria prevalence and malaria vector abundance.

Materials and Methods

This study was carried out in Ogbunike in Oyi Local Government Area of Anambra State, South-east Nigeria. The community is located on Latitude 6^0 11'20" North and Longitude 6^0 51'30" East of the equator (Microsoft Encarta, 2008). The vegetation is of the rain forest variety supporting several species of trees, shrubs and grasses. Drinking and domestic water supplies are from rivers running across the community and many small streams and springs. The biggest river is the Kisa River flowing down from Ifite-dunu, running through Umudioka, Ogbunike and Oze and emptying into the River Niger at

Nkisi River, Onitsha. The town's major attraction is the famous Ogbunike Cave and St. Monica Women Training College.

The town is made of up of six villages; Ifite, Amawa, Azu, Osile, Ukalor, Umueri and has a population of 15,000 (NPC, 1991). The inhabitants are mainly of Igbo origin living peacefully with people from other ethnic communities as Hausas, Fulanis, Yorubas and Efiks. The majority of the inhabitants are farmers with a few civil servants, students and other professionals. As a rural community, pipe born water, health centre and other government establishments are lacking. Most houses in the community are built of concrete walls with corrugated iron roofing although there are still a few mud and thatched houses around.

Ethical Consideration

A formal letter of introduction and intent obtained from the Head of Department of Parasitology and Entomology, Nnamdi Azikiwe University Awka was presented to the community leader with whose permission the community was sensitized about the study. Verbal consent was obtained from each adult tested before blood samples were taken and the consent for screening of children was obtained from their parents or guardians. Verbal consent was also obtained from the heads of homes where PKC collections were carried out.

Selection of Participants

The participants were healthy individuals who did not show any sign and symptoms of malaria like fever. Also their temperatures were measured with clinical thermometer to ascertain that they were not running temperature.

Collection of Blood Samples

Capillary blood of the participants were collected and used to make thick and thin blood films. The blood films were stained using Field's stain A and B and examined microscopically according to Cheesbrough (2006). Their biodata such as names, ages, sex and occupations were collected through oral interview and were recorded in a field note book. A total of 208 participants were tested for malaria parasite. The intensity of malaria was recorded using the plus sign thus: mild infection (+): 1-10 parasites per 100 high power fields; Moderate infection (++): 11-100 parasites per 100 high power fields; heavy infection (+++): 1-10 parasites per high power field (Cheesbrough, 2006).

Collection of Indoor-biting Mosquito Vectors

Three houses were randomly selected from each village for this survey. Adult mosquitoes that bite and rest indoors were sampled using PKC method between the hours of 6.00am and 9.00am in the morning. Large white sheets were laid wall to wall on floors of the rooms and all doors and windows were shut. A pyrethriod-based insecticide aerosol (Mortein) was sprayed inside the rooms only for houses with ceilings but both inside and outside on the house eaves and every possible escape route of the mosquitoes for houses without ceilings. After 20 minutes, the spread sheets were systematically folded and taken outside where the mosquitoes were collected using forceps, into a Petri dish lined with filter paper placed over dampened cotton wool. The collections were sent to the National Arbovirus Research Centre Laboratory Enugu for proper identification. The mosquitoes were identified using the gross morphology of the species, mouthparts, antennae, proboscis, patches of pale and black scales on the wings and legs and the terminal abdominal segments (Gillet, 1972).

Data Analysis

Data from the prevalence study were analyzed statistically for significant differences using the One Way Analysis of Variance (ANOVA). Correlation analysis $\{r = SPxy/\sqrt{(SSx.SSy)}\}$ was used to test for the extent of the relationship between malaria prevalence and malaria vector abundance.

Results

Out of the 208 people tested for malaria, 121 (58.2%) were positive with malaria parasites. Of the 121 positive cases of malaria, 86 (71.1%) had mild infection; 32 (26.4%) had moderate infection and 3 (2.5%) had heavy infection. Only *Plasmodium falciparum* was observed in this study. Malaria prevalence in the villages varied from 51.7% to 64.5%, with the highest prevalence of 20(64.5%) in Osile village and least prevalence of 15(51.7%) in Umueri village. The intensity of malaria infection was mild 86(71.1%), moderate 32(26.4%) and heavy 3(2.5%). Mild infections were highest 8(80.0%) in Azu village and least 9(60.0%) in Umueri village. Moderate infection was highest in 6(40.0%) in Umueri village and least 2(20.0%) in Azu village. Heavy infection was highest 1(5.0%) in Osile village and least 2(4.4%) in Ifite village. The prevalence of malaria in the community yielded significant result (8.88, df=5; $p<0.05$) [Table 1] whereas there is no significant difference in the intensity of malaria among the participants using ANOVA (0.82, df=5; $p>0.05$) [Table 2].

The age group of ≥61 years (64.7%) had the highest prevalence, followed by 0-10 years (63.2%) while the age group of 41-50 years had the least prevalence (42.9%). The prevalence of malaria among the different age groups of the community is significantly different from one another using ANOVA (4.22, df=5; $p<0.05$) [Table 2]. Females 73(35.1%) were slightly more infected than men 48(23.1%) but the result was not statistically significant (0.39, df= 5, $p>0.05$). Prevalence of malaria among the participants with respect to their occupations did not show significant difference though the artisans (66.7%) were mostly affected while the traders (33.3%) were least affected (2.56, df=5; $p>0.05$) [Table 4].

A total of 110 indoor-biting and resting adult *Anopheles* mosquitoes were collected from 18 houses from the six villages of Ogbunike using PKC method, (Table 3). Osile community yielded the highest 24 (21.8%) with room density of 8 *Anopheles* mosquitoes per room per night while Ifite village yielded the least 13 (11.8%) with room density of 4 *Anopheles* mosquitoes per room per night. The relationship between malaria infection and *Anopheles* abundance in Ogbunike community is significant using correlation coefficient (r= 0.1221684).

Discussion

Although the participants were apparently healthy, a malaria prevalence of 58.2% was observed. This shows that malaria is endemic in Ogbunike. The total prevalence of malaria infection in this study population is far higher than that of Anumudu *et al.,* (2006), who in a similar research in Eastern Nigeria reported 17% prevalence rate. It is also slightly higher than that of Umeaneato *et al.*, (2006) who reported 46% prevalence rate in Nnewi, Anambra State but lower than that of Aribodor *et al.*, (2003) and Onyido *et al,* (2010), who reported 76% and 62% prevalence in Azia and Umudioka Communities in Anambra State respectively. The overall relative high prevalence could be due to abundance of fresh water swamps and ground pools that form breeding sites for the *Anopheles* vector in the Community.

Most of the participants showed mild infection, few showed moderate infection while very few showed heavy infection. The participants were apparently healthy and hence asymptomatic. Thomas *et al*, 2004, described "Stable Endemic Malaria" as a situation where members of a holo-endemic population remain asymptomatic even with considerably high levels of malaria parasitaemia. Part of this may be the reason for the above result of

malaria intensity even though it is not significant among the villages ($p>0.05$).

Osile village has the highest malaria prevalence as well as highest percentage abundance of indoor-biting *Anopheles* mosquitoes. The high prevalence in Osile village may be due to the presence of several streams and marshes and these provided lots of breeding habitats for *Anopheles* vectors hence the greater abundance of the malaria vector in that area. Also, there was a recent disaster in that village that led to destruction of houses that left a lot of the people dwelling in roofless houses with consequent exposure to mosquito bites. All these may contribute in the high prevalence of malaria and malaria vector abundance as well. The difference in the prevalence among the villages was statistically significant ($P<0.05$).

Among the age groups, the age groups 61 and above had the highest prevalence. This agrees with the work of Uneke *et al,* (2005), who recorded higher prevalence among the older age groups in similar studies in Jos, Nigeria. At old age, especially above 60 years, so many organs of the body are becoming weak and as a result the immune system may no longer be strong to fight diseases such as malaria. This may be part of the reasons why there is highest prevalence among the participants who were 61 years and above. The age group 0-10 also had high prevalence which agrees with the work of Umeanaeto *et al*, 2008 who recorded higher prevalence among the younger age group in Nnewi, Anambra State. Also, Abdullahi *et al*., (2009), in a similar research in Sokoto, North-east Nigeria recorded high prevalence of malaria in the age groups 0-5 and 5-10 years. Malaria tends to affect mainly children and pregnant women, especially in rural areas (Whitworth and Hewitt, 2005). Tragically, the health status of children under the age of five years and pregnant women has remained a major barrier to Nigeria's development. It is estimated that about 100 children under one year and 203 children under-five years out of 1000, respectively, die annually (NDHS, 2003). In other words, one out of every five Nigerian children dies before his/her fifth birthday (RBM, 2000). Malaria prevalence in relation to different age groups was statistically significant ($p<0.05$). Prevalence by occupation had no significant difference ($p>0.05$).

The prevalence among the sexes showed that females were affected more than the males, although the difference in malaria prevalence among sexes was not statistically significant, ($P>0.05$). This may be due to the physiological differences between the females and the males (childbirth,

pregnancy and ovulation) that tend to lower the female immunity thus predisposing them to malaria infections and other diseases.

The entomological survey (Pyrethrum knockdown collection of indoor-biting mosquito vectors) carried out revealed the preponderance of *Anopheles gambiae* in Ogbunike. Osile village recorded the highest *A. gambiae* while Ifite had the least. The high population of *Anopheles* in Osile village may be due to the nearly abandoned state of the village which left the houses, compounds and many routes abandoned and unkept in addition to numerous fresh water swamps in the area. This, as explained above, provided a lot of breeding grounds for mosquito vectors. It was observed that mosquitoes were not evenly distributed in the town and this may be related to several factors like, the presence or absence of streams, hilly terrains and other ecological and topographical differences.

The relatively low number of adult mosquitoes collected in some villages may be due to the use of long lasting insecticide-treated bed nets, the presence of asbestos ceiling in houses and the tendency of the mosquitoes to escape through the eaves of houses without ceilings when the insecticide is applied. *Anopheles gambiae* was not always directly proportional to the malaria prevalence in the villages but statistical analysis revealed a positive relationship between malaria prevalence and malaria vector (*Anopheles gambiae*) abundance (Onyido *et al*, 2009b).

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Table 1: Malaria Prevalence and Intensity In Different Villages In Ogbunike Community.

Villages	Number Examined	Number positive	Prevalence (%)
Amawa	30	16	53.3
Azu	18	10	55.6
Ifite	78	46	59.0
Ukalor	22	14	63.6
Osile	31	20	64.5
Umueri	29	15	51.7
Total	208	121	58.2

For prevalence: Observed f-value = 8.88, DF=5; and table value = 4.39; p<0.05.

Table 2: Malaria Intensity in Different Villages in Ogbunike Community.

illages	Mild infection (+)	Moderate infection (++)	Heavy infection (+++)
Amawa	12(75.0%)	4(25.0%)	0(0.0%)
Azu	8(80.0%)	2(20.0%)	0(0.0%)
Ifite	34(73.9%)	10(21.7%)	2(4.4%)
Ukalor	10(71.4%)	4(28.6%)	0(0.0%)
Osile	13(65.0%)	6(30.0%)	1(5.0%)
Umueri	9(60.0%)	6(40.0%)	0(0.0%)
Total	86(71.1%)	32(26.4%)	3(2.5%)

For intensity: Observed f-value = 0.82, df=5; and table value = 3.11; p>0.05.

Table 3: Malaria Prevalence among Different Age Groups Of Ogbunike Community.

Age group	Number examined	Number positive	Prevalence (%)	Males positive	Prevalence (%)	Females positive	Prevalence (%)
0-10	76	48	63.2	16	21.5	32	42.1
11-20	43	26	60.5	16	37.2	10	23.3
21-30	19	11	57.9	5	26.3	6	31.6
31-40	20	9	45.0	2	10.0	7	35.0
41-50	21	9	42.9	3	14.3	6	28.6
51-60	12	7	58.3	2	16.7	6	50.0
≥61	17	11	64.7	4	23.5	7	41.2
Total	208	121	58.2	48	23.1	73	35.1

Observed f-value = 5.56, df=5; and table value = 3.02; p<0.05.

Table 4: Malaria Prevalence among Different Occupational Groups in Ogbunike Community.

Occupation	Number examined	Number positive	Prevalence (%)
Civil servants	13	5	38.5
Farmers	27	17	63.0
Traders	18	6	33.3
Students	123	79	64.2
Artisans	9	6	66.7
Drivers	5	2	40.0
Retired/Unemployed	13	6	46.2
Total	208	121	58.2

Observed f-value = 2.56, df=5; and table value = 3.02; p<0.05.

Table 5: Table of Room Density per Night of *Anopheles Gambiae* in the Different Villages in Ogbunike

Villages	Number of *Anopheles gambiae* collected	Number of rooms sampled	Room density	(%) Abundance
Amawa	17	3	5.7	15.5
Azu	19	3	6.3	17.2
Ifite	13	3	4.3	11.8
Osile	24	3	8.0	21.8
Ukalor	17	3	5.7	15.5
Umueri	20	3	6.7	18.2
Total	110	18	6.11	100.0

Correlation coefficient r= 0.1221684, p<0.05