Research Journal of Parasitology

ISSN 1816-4943

Academic Journals Inc.

www.academicjournals.com

Research Journal of Parasitology 7 (1): 17-24, 2012
ISSN 1816-4943 / DOI: 10.3923/jp.2012.17.24

A Comparative Study of the Prevalence of Malaria in Aba and Umuahia Urban Areas of Abia State, Nigeria

[1]Kalu Mong Kalu, [2]Nwogo Ajuka Obasi, [1]Florence Onyemachi Nduka and [2]Glory Otuchristian

[1]Department of Animal and Environmental Biology, Abia State University, Uturu, Nigeria
[2]Department of Science Laboratory Technology, Akanu Ibiam Federal Polytechnic, Unwana-Afikpo, Nigeria

Corresponding Author: Kalu Mong Kalu, Department of Animal and Environmental Biology, Abia State University, Uturu, Nigeria

ABSTRACT

Malaria is an infectious disease which is as old as man and as such demands a thorough put investigation for effective prevention. In this study, a comparative study of the prevalence of malaria in Aba and Umuahia urban settings of Abia state, Nigeria were investigated in order to proffer possible preventive/control measures. A total of 500 individuals (250 in each urban setting) were examined for malaria parasites in blood specimens using standard methods. The results showed that a total number 402 (80.40%) were positive for malaria parasitaemia. In Aba, 216 (86.40%) individuals were positive while in Umuahia, 186 (74.40%) individuals were positive for malaria parasitaemia and the difference in the prevalence between these urban areas were statistically significant. Individuals of age group 21-30 years had the highest rate of infection (92.31%) in Aba while in Umuahia highest infection rate of 90.00% was observed in the age group 11-20 years. Traders were mostly infected in both urban areas with 94.34% in Aba and 93.75% in Umuahia, however, the difference was not statistically significant ($p>0.05$). Females in both urban areas were more infected than males with (91.20%) in Aba and 80.80% in Umuahia, the difference being statistically significant ($p<0.05$). *Plasmodium falciparum*, *Plasmodium vivax* and *Plasmodium malariae* occurred in both urban areas with *Plasmodium falciparum* predominating Aba and Umuahia urban were observed to be endemic for malaria.

Key words: Malaria parasitaemia, *Plasmodium* species, infection rate, urban areas, endemic, malaria control

INTRODUCTION

There has been a marked increase in the number and size of towns and cities in many developing countries, including Nigeria, without corresponding increase in such services that inhibit the breeding of vectors of malaria resulting in the increase of urban malaria. Malaria is an infectious disease which is as old as man (Sherman, 1998), caused by a single-celled protozoan parasite *Plasmodium* spp. The parasite is transmitted from human to human through the bite of infected female adult *Anopheles* mosquitoes. Four *Plasmodium* species are known to infect human. These are *Plasmodium falciparum, P. vivax, P. malariae* and *P. ovale*. *P. falciparum* is the most virulent species and accounts for over 90% of human malaria (Beier *et al*., 1999). *P. falciparum* malaria is often characterized by fever which may be acute, sometimes intermittent or continuous.

The fever in *P. falciparum* infection is sometimes accompanied by shivering and sweating. *P. falciparum* malaria often leads to complication (Ukaga *et al*., 2003).

Malaria infection is largely distributed throughout the warmer regions of the world. In Nigeria, malaria is holoendemic (Ukpai and Ajoku, 2001). More than 2 billion people are at risk of malaria. Worldwide, it is estimated that there are about 120 million cases of malaria per year (Martin and Lefebvre, 1995). The effects of malaria are particularly noticeable in rural areas where malaria frequently strikes during that period of the year when the need for agricultural work is greatest (WHO, 2002). Studies in rural areas of Africa where malaria is endemic reveal that over one-third of primary school children had malaria during a school term, more than half of this group had two or more attacks typically missing a week or more of school with each attack (WHO, 1998).

Data on the spread and control of malaria-induced diseases and economic losses may vary considerably within a relatively small area (D'Alessandro *et al*., 1995). It is also widely appreciated that there may be considerable seasonal and between year variation in all malariometric indices such that assessments undertaken in a population in different seasons or years may produce dramatically different results. The epidemiology of malaria and the ecological and social-linked distribution of malaria vectors are complicated by both seasonal and periodic variation (Thomson *et al*., 1996). In Nigeria, several studies on the pattern and distribution of malaria and its vectors in urban and semi-urban communities have been reported with little attention in the rural areas due to the spatial ecological and social complexity of malaria (Aribodor *et al*., 2003). A prevalence of malaria of 59.80% has been reported for wet season in Udi, Enugu state (Ezeanya, 1998) while a prevalence of 58.30% was reported for children aged 0-5 years in Awka, Anambra state (Mbanugo and Ejims, 2000). In Nigeria, like other tropical countries, high breeding rates of the vectors of malaria and high transmission rate occur throughout the year (Oparaocha, 2003; WHO, 2000) particularly during the rainy season (WHO, 2002; Ezeanya, 1998). In addition to the availability of numerous breeding places for malaria vectors occasioned by the incessant rainfall, other factors that tend to increase the rate of malaria transmission include unsanitary environmental condition, poverty, ignorance, poor behavioural attitudes and inadequately planned socio-economic projects (Anothonio-Nkonjio *et al*., 2006; Robert *et al*., 2003).

It is obvious that the fight against malaria is deteriorating due to some factors that should be controlled. These include poor administration, lack of proper vector-control measures and inadequate planning (Robert *et al*., 2003).

The objective of the present investigation was to ascertain the extent of malaria in relation to urbanization in Aba state and to compare the prevalence rates of the disease in the urban communities. The data reported will allow the decision markers to develop newer strategies in countering malaria and define endpoints for effective malaria control.

MATERIALS AND METHODS

Study area: This study was conducted in Aba and Umuahia, Abia state, southeast Nigeria. Aba (5°07'23"N, 7°22'108"E) is a commercial hurb of Abia state. It is a cosmopolitan town located 64 km from the state capital. Predominant occupation is trading and other commercial activities. The city is topographical as presented in Table l with sloppy sites. The flatness, in addition to poor drainage system, makes Aba prone to flood during rainy season, resulting in the formation of temporary water bodies which are numerous during rainy seasons, the presence of which makes Aba veritable breeding ground for mosquito vectors of malaria parasites. Umuahia (5°33'20"N, 7°28'52"E) is the

Table 1: Overall and residence status prevalence of malaria parasitaemia in the two urban areas

	No. of individuals examined		No. of individuals infected		Percentage infection (%)	
Urban area	Overall	Residents	Overall	Residents	Overall	Residents
Aba	250	225	216	210	86.40	93.33
Umuahia	250	204	186	164	74.40	80.39
Grand total	500	419	402	374	90.40	87.18

state capital located in the central part of the state. Residents are mostly civil servants, traders and students. Umuahia is characterized by well-paved roads, good drainage system and high degree of sanitary condition (Ijioma, 1993).

Aba and Umuahia though located in different biogeographical regions both belong to the same climatological regime. The areas are characterized by a long dry season (November, December, January-March) and a longer rainy season (April-October). The mean annual rainfall is between 2,500 and 3,000 mm. Monthly mean temperature ranges from 25-32°C while mean relative humidity ranges from 60-90%. Highest and lowest monthly mean relative humidities are observed during rainy and dry seasons, respectively (Ijioma, 1993).

Data collection: The study was carried out between the months of April and October which corresponds to the wet season in Nigeria. Blood films of 500 made up of equal number of male and female individuals attending public hospitals in the two urban communities were examined for malaria parasites.

Blood samples and responses to questionnaires were collected from clinically ill individuals at the Abia state University Teaching Hospital (ABSUTH), Aba and the Federal Medical Centre (FMC), Umuahia with their informed consent (WHO/CDC, 2003). Venous blood sample (5 mL) was collected from each individual aged above 10 years using a disposable sterile syringe and a tourniquet in line with the method described by Fleck and Moody (1998), while blood was collected from the thumb of each individual not above 10 years of age using a disposable sterile lancet by the finger-prick method.

Questionnaires were administered to the subjects covering such information as name, sex, age occupation and residential address.

Microscopy: Smears were made from the fresh blood samples collected from all the subjects and examined in accordance with the WHO guidelines (WHO, 2000).

Date analysis: Chi-square (χ^2) test was employed to establish any relationship between *Plasmodium* infections and sex, age and occupation. The significant level was fixed at $p<0.05$.

RESULTS

The results of the investigation on the prevalence of malaria parasitaemia in Aba and Umuahia Urbans showed that out of 500 individuals examined 402 (90.40%) were positive for malaria parasites. A total of 250 subjects comprising equal number of males and females were examined in each of the two urban areas. The prevalence of malaria parasitaemia was higher (86.40%) in Aba than (74.40%) in Umuahia (Table 1). Of the 216 infected subjects in Aba only six (2.78%) were non-residents of the town while in Umuahia 22 (11.83%) were non-residents.

Table 2: Gender-related prevalence of malaria parasitaemia in the two urban areas

	Urban area					
	Aba			Umuahia		
Gender	No. examined	No. infected	Infection rate (%)	No. examined	No. infected	Infection rate (%)
Males	125	102	81.60*	125	85	68.00*
Females	125	114	91.20*	125	101	80.80*

*Signification level is $p<0.05$

Table 3: Occurrence of *Plasmodium* sp. in the two urban areas

	Urban area					
	Aba			Umuahia		
Plasmodium sp.	No. examined	No. infected	Infection rate (%)	No. examined	No. infected	Infection rate (%)
P. falciparum	250	184	73.60	250	162	64.80
P. vivax	250	25	10.00	250	18	7.20
P. Malariae	250	7	2.80	250	6	2.40

Table 4: Age-related prevalence of malaria parasitaemia in Aba and Umuahia

	Aba			Umuahia		
Age cohort (years)	No. examined	No. infected	Infection rate (%)	No. examined	No. infected	Infection rate (%)
0-10	35	25	71.43	32	28	87.50
11-20	40	36	90.00	50	45	90.00
21-30	52	48	92.31	35	29	82.86
31-40	40	35	87.50	40	25	62.50
41-50	68	59	86.76	45	36	80.00
51-60	8	7	87.50	38	23	60.53
>60	8	6	75.00	10	6	60.00

Table 2 summarizes the level of parasitaemia in different sexes. There was a significant difference between males and females (χ^2, $p<0.05$). Parasitaemia was higher in females than males in both study locations. In Aba 114 (91.20%) females were positive for *Plasmodium* while 80.80% (n = 101) infection rate was recorded by females in Umuahia. It would appear that females tend to be more infected in Aba than in Umuahia but the difference was not statistically significant ($p>0.05$). Male subjects had higher infection rate (81.60%) in Aba than (68.00%) in Umuahia.

Table 3 shows that *Plasmodium falciparum* caused over 80% of the infections in the two areas. There was no case of *Plasmodium ovale* detected in both towns. While 73.60% (n = 184) *falciparum* infection was recorded in Aba, 64.80% (n = 162) of the species infection was observed in Umuahia. *Plasmodium malariae* infection was rare (2.80 and 2.40%) in Aba and Umuahia, respectively.

Table 4 shows the age-related prevalence patters in the study areas. Disparities in age-cohort parasitaemia were observed. In Aba, the highest prevalence (92.31%) and the lowest prevalence (71.43%) were evidenced among the youths (21-30 years of age) and children 0-10 years of age),respectively. In Umuahia, parasitaemia was highest (90.00%) among the adolescents (11-20 years of age) while the oldest age-group (above 60 years of age) had the least disease prevalence.

Table 5: Occupation-related prevalence of malaria parasitaemia in the two urban areas

	Urban area					
	Aba			Umuahia		
Occupation	No. examined	No. infected	Infection rate (%)	No. examined	No. infected	Infection rate (%)
Students	38	28	73.68*	56	36	64.29*
Civil servants	70	62	88.57*	50	39	78.00*
Entrepreneurs	39	36	89.74*	39	27	69.23*
Traders	53	50	94.34*	48	45	93.75*
Farmers	27	24	88.89*	30	25	83.33*
Pensioners	18	14	77.78*	19	15	78.95*
Unemployed	5	3	60.00*	8	5	62.50*

*Values are significant at $p<0.05$

Table 5 is a summary of the results of occupation-related prevalence in the two cities. Traders in both urban areas had the highest disease prevalence. There is no significant difference in parasitaemia among the traders in Aba (94.34%) and Umuahia (93.75%) ($p>0.05$), however, there is a significant relationship between occupation and malaria parasitemia at the two communities at $p<0.05$.

DISCUSSION

Once factor recognized in Aba and Umuahia is that there is high level parasitaemia within the two communities. The high prevalence rates of malaria in Aba (93.33%) and Umuahia (80.39%) reveal that malaria infection is endemic in these two urban areas (Table 1). The high prevalence of malaria in both towns could be due to some factors such as amount of rainfall, relative humidity, temperature, extent in urbanization, availability of breeding places for malaria vectors, over-crowded human populations and the behavioural attitude of the inhabitants of the areas, among others. These findings agree with reports that there has been a marked increase in the number and size of towns and cities in many developing countries without corresponding increase in such services that inhibit the breeding of vectors of malaria resulting in the increase of urban malaria (Fonterille and Simard, 2004; Fondjo *et al*., 1992). Aba which is the commercial hurb and Umuahia, the state capital, both of Abia state, Nigeria has undergone serious environmental modifications over the years owing to rapid growth in human population and urbanization. Such modifications could have lead to ecological changes that might have affected human malaria vector population structure in the two cities which might have impacted on the efficiency in transmitting malaria in the areas. These findings compare with related studies within the same geographical southeast, Nigeria which revealed that malaria prevalence was 85.50% in Okigwe and 75.00% in Owerri both in Imo state (Ukpai and Ajoku, 2001), 73.30% in Ikwuano, Abia state (Oparaocha, 2003), 76.00% in Azia, Anambra state (Aribodor *et al*., 2003) and 58.00% for children aged 0-5 years in Awka, Anambra state (Mbanugo and Ejims, 2000). These indicate that malaria parasitaemia in Aba and Umuahia were higher.

In this study, parasitaemia was higher in females than males in the two urban. This contrasts sharply with findings of two similar studies within the same geographical region: Males had high parasitaemia in Okigwe and Owerri, Imo state (Ukpai and Ajoku, 2001) and in Awka metropolis, Anambra state (Mbanugo and Ejims, 2000). Although, there is no concrete explanation

for the higher presence of parasitaemia in females observed in this present study, this finding conforms to those of the studies in Udi, Enugu state (Ezeanya, 1998) and Lagos, Lagos state (Nebe *et al*., 2002).

The results also showed that *Plasmodium falciparum, P. malariae* infections were prevalent in the two urban communities of study. This agrees with the observations of a related study carried out in Okigwe and Owerri (Ukpai and Ajoku, 2001). It, however, differs from the related studies in Azia (Aribodor *et al*., 2003) and Awka (Mbanugo and Ejims, 2000) where only *P. falciparum* infections were reported. Whether the difference found in the prevalence of *Plasmodium* parasites especially within the same geographical region was a reality or an error due to diagnosis could not be confirmed in this study.

The age-group (21-20 years) had the highest rate of infection (92.31%) while the age bracket (60 years and above) had the lowest rate of infection (75.00%) in Aba (Table 4). The high infection rate in age bracket 21-30 years could be due to inadequate protection against mosquito bites or insufficient knowledge about transmission of malaria. Moreover, the age group consists of youths who habitually expose themselves to incessant bites of vectors of malaria by remaining bare bodied especially when the weather is hot. In Umuahia, parasitaemia was highest in the age group (11-20) years (90.00%) and least among individuals in the age cohorts (51-60 years) and above (60.53 and 60.00%), respectively (Table 4). High rate of infection in age group 11-20 years could be due to lack of protection against mosquito bites or lack of knowledge of malaria transmission or both. Similar results were reported by Kachur *et al*. (1998). Though one group is regarded as being low in the rate of infection in each of the cities, the infections are generally high. This may have to do with the abundance of *Anopheles,* the vectors of malaria, in both urbans as well as the rate of exposure of the subjects to the bites of the malaria vectors.

Occupation-wise, traders were the most infected in both urban (94.34, 93.75%) in Aba and Umuahia, respectively (Table 5). The unemployed in both urban had the lowest parasitaemia of 60.00% in Aba and 62.50% in Umuahia. Similar results in occupation related rate of parasitaemia was reported by Robert *et al*. (2003). The high infection rate amongst traders could be attributed to the nature of their job which exposes them to bites of the vectors of malaria. Worse than this, the daily hustle and bustle involved in commercial activities might cause fatigue resulting in deep-sleep nights which favours the uninterrupted blood-sucking tendency of vectors of malaria.

The effort to document the prevalence of urban malaria in Abia state revealed that Aba and Umuahia urban were observed to be endemic for malaria. The cities are co-endemic for human malaria parasites (*Plasmodium* spp.) *P. ovale* being absent. *Plasmodium falciparum* had the highest rate of infection in the two urban areas (Table 3). Malaria, especially *falciparum* malaria, is acknowledged to be by far the most important tropical parasitic disease, causing great suffering and loss of lives (Ukpai and Ajoku, 2001).

CONCLUSION

The findings of the present study indicate that there is a cause for public health concern in the study towns in particular and Abia state in general. They also provide base line information for evidence-based planning and implementation of malaria control activities in the state by governments, their agencies and individuals.

REFERENCES

Anothonio-Nkonjio, C., C.H. Kerah, F. Simard, P. Awono-Ambene, M. Choual, T. Tchuinkan and D. Fontenille, 2006. Complexity of malaria transmission. J. Med. Entomol., 43: 1215-1221.

Aribodor, D.N., O.O. Njoku, C.I. Eneanya and I.O. Onyali, 2003. Studies on prevalence of malaria and management practices of the Azia community, in Ihiala Local Government Area, Anambra state, South-East Nigeria. Nig. J. Parast., 24: 33-38.

Beier, J.C., G.F. Killeen and J. Githure, 1999. Short report: Entomologic inoculation rates and *Plasmodium falciparum* malaria prevalence in Africa. Am. J. Trop Med. Hyg., 61: 109-113.

D'Alessandro, U., B.O. Olaleye, W. McGuire, P. Langerock and S. Bennett *et al.*, 1995. Reduction in mortality and in morbidity from malaria in Gambian children following the introduction of a National insecticide impregnated bed net program. Lancet, 345: 497-483.

Ezeanya, C.I., 1998. Seasonal variation in malaria episodes among residents in Udi, a semi urban community in Southeast Nigeria. Nigerian J. Parasitol., 19: 39-43.

Fleck, S.L. and A.H. Moody, 1998. Characteristics of Malaria Parasites and Diagnostic Techniques in Medical Parasitology. 1st Edn., Butterworth Publications, London, UK., Pages: 385.

Fondjo, E., V. Robert, G. le Goff, J.C. Toto and P. Carnevale, 1992. Urban malaria transmission in Yaounde (Cameroon). Etiologic study in 2 urban districts. Bull. Soc. Path. Exot., 85: 57-63.

Fonterille, D. and F. Simard, 2004. Unravelling complexities in human malaria transmission dynamics in Africa through a comprehensive knowledge of vector populations. Comp. Immunol. Microbiol. Infect. Dis., 27: 357-375.

Ijioma, M.A., 1993. Abia State\ Survey. In: Nigeria Giant in the Tropics, Udo, R.K. and A.B. Mamman, (Eds.). Gabumo Publishing Company Limited, Lagos, pp: 760-762.

Kachur, S.P., E. Nicolas, V. Jean-Francois, A. Benitez and P.B. Bloland *et al.*, 1998. Prevalence of malaria parasitemia and accuracy of microscopic diagnosis in Haiti, October 1995. Rev. Panam. Salud Publica, 3: 35-39.

Martin, P.H. and M.G. Lefebvre, 1995. Malaria and climate: Sensitivity of malaria potential transmission to climate. Ambio, 24: 200-207.

Mbanugo, J.I. and D.O. Ejims, 2000. *Plasmodium* infections in children Aged 0-5 years in Awka Metropolis, Anambra state, Nigeria. Nigerian J. Parasitol., 21: 55-59.

Nebe, O.J., G.O. Adeoye and P.U. Agomo, 2002. Prevalence and clinical profile of malaria among the coastal dwellers of Lagos state, Nigeria. Niger. J. Parasitol., 23: 61-68.

Oparaocha, E.T., 2003. The impact of haemoglobin level and concomitant infections of malaria parasitaemia and on-set of fever during malaria attack in Ikwuano Local Government Area of Abia state, Nigeria. Nig. J. Parasitol, 24: 25-32.

Robert, V., K. Macintyre, J. Keating, J.F. Trape, J.B. Duchemin, M. Warren and J.C. Beier, 2003. Malaria transmission in urban sub-Saharan Africa. Am. J. Trop. Med. Hyg., 68: 169-176.

Sherman, I.N., 1998. A Brief History of Malaria and Discovery of the Parasites Life Cycle. In: Malaria-Parasite Biology, Pathogenesis and Protection, Sherman, I.N. (Ed.). ASM Press, Washington, DC., USA., pp: 97-108.

Thomson, M.C., S.J. Connor, P.J. Milligan and S.P. Flasse, 1996. The ecology of malaria as seen from Earth observation satellites. Ann. Trop. Med. Parasitol., 90: 243-264.

Ukaga, C.N., B.E.B. Nwoke and P.I.K. Onyeka, 2003. Integrating women in disease management: Case of Malaria. Niger. J. Parasitol., 24: 53-58.

Ukpai, O.M and E.I. Ajoku, 2001. The prevalence of malaria in Okigwe and Owerri Areas of Imo state. Niger. J. Parasitol., 22: 43-48.

WHO, 1998. Malaria: Know the facts. World Health organization Newslett., 13: 6-7.

WHO, 2000. Malaria diagnosis: New perspectives. Report of a joint WHO/USAID informal consultation. http://asksource.ids.ac.uk/cf/display/bibliodisplay.cfm?ID=31482&db=keywords&display=full

WHO, 2002. Roll back malaria. World Health Organization Fact Sheet No. 203, Geneva, Switzerland, pp: 86-91. https://apps.who.int/inf-fs/en/fact203.html

WHO/CDC, 2003. Manual for the laboratory identification and antimicrobial susceptibility testing of bacterial pathogens of public health importance in developing world. WHO/CDC Report, Geneva, Switzerland, pp: 103-115.