Prevalence of malaria and social determinants of transmission among febrile patients attending Obioma Hospital, Umuahia, Abia State, Nigeria

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Abstract

Malaria prevalence was studied among 400 patients that attended Obioma Hospital in Umuahia, Abia State, between the months of September and December, 2015. Venous blood samples were aseptically collected from the patients (mean age 28.5 ± SD 12.5). Thick and thin blood smears stained with field stains A and B were made on grease-free slides and examined microscopically for the presence of malaria parasites. Structured questionnaires were used to gather socio-demographic data and knowledge, attitude and practices of the respondents regarding malaria. Out of the 400 clinically suspected malaria patients examined, 161 (40.3%) were infected with *Plasmodium*. More males (45.2%) than females (37.0%) were infected though the differences were not statistically significant (p>0.05). The age-group 6-15 years had the highest prevalence. Occupation wise, traders were more infected (56.4%) and the differences were not statistically significant (p>0.05). The prevalence of malaria parasites infection though highest in respondents with informal education (68.3%) was not significantly higher than in other groups (p>0.05). Some of the respondents (57.3%) identified mosquito bites as the cause of malaria though a few still had wrong perceptions of the cause. Many of the respondents showed adequate knowledge of the symptoms and signs. Fever (53.0%), headache (58.0%), body pains (27.8%), and bitter taste (29.3%) were some of the symptoms reported. Some respondents had knowledge of microscopy (55.8%) and some Rapid Diagnostic Tests (47.3%) as diagnostic methods for malaria. For the chemotherapy and preventive measures (52.0%), reported the use of oral drugs (35.3%), use of injection, (19%) the use of insecticides treated mosquito nets and (2.3%) the use of herbal preparation. This study has shown that clinical diagnosis alone cannot be relied upon for accurate diagnosis of malaria in endemic areas. Verifying the clinical signs and symptoms of malaria with laboratory tests before commencing treatment is highly advocated.

Keywords: Malaria prevalence; clinically suspected malaria patients; knowledge; attitude; practices.

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Introduction

Malaria is a life-threatening disease caused by the protozoa of the genus *Plasmodium*. It is transmitted to people through the bites of infected female *Anopheles* mosquitoes. Non-immune travellers from malaria-free areas are very vulnerable to the disease when they get infected (WHO, 2015a). It remains an important public health concern in countries where transmission occurs regularly as well as in areas where transmission has been largely controlled or eliminated (Olusola *et al* 2013). Among human parasitic diseases, malaria remains the world's most important cause of morbidity and mortality and has a great economic impact on growth and development of the family and the nation at large (Etusim *et al* 2013). In Africa it is responsible for the slow economic development and perpetuating cycle of poverty (Etusim *et al* 2013). Most deaths occur among children living in Africa where a child dies every minute from malaria (Ukpai and Ubiaru, 2015; WHO, 2015b). Malaria reduces work capacities and impairs physical and mental development in children, diminishes returns achieved through education and limits their potentials to contribute to the social and economic growth of their country (Etusim *et al* 2013).

Financial losses due to malaria in Nigeria are estimated to be #132 billion annually, made up of treatment cost, prevention and loss of man hours (Federal Ministry of Health, 2008). The prevalent species in Nigeria is *Plasmodium falciparum* accounting for over 90% of all diagnosed cases. *Plasmodium ovale* and *P. malariae* account for 2% and 5% respectively while *P. vivax* is not endemic (Ajumobi, 2012). There are about 100 million malaria cases and 300,000 deaths each year in Nigeria making her the country with the highest number of malaria causalities worldwide (WHO, 2015a). This is attributed to the widespread of fake and substandard antimalarial drugs and inaccurate malaria diagnosis (WHO, 2015a). Malaria is responsible for 60% of outpatient visits to health facilities, 30% of childhood deaths, 25% of deaths in children under one year, and 11% of maternal deaths in Nigeria (WHO, 2015a).

In most endemic countries like Nigeria, malaria diagnosis depends mainly on clinical evidence while thick and thin film microscopy may be used at times for laboratory confirmation. World Health Organization recommends parasite-based diagnosis prior to commencement of antimalarial treatment. However, empirical treatment and over prescription of antimalarial drugs remain a common phenomenon at clinical settings and homes in Nigeria because of presumed high malaria prevalence. This is compounded by inadequate information on accuracy of malaria diagnosis (Ajumobi, 2012). With the introduction of high cost antimalarials (Artemisinin-based therapies), the need for accurate diagnostic tools for monitoring malaria elimination successes become a task that must be achieved (Olusola *et al* 2013).

Conventional light microscopy of a blood smear remains the reference standard for malaria diagnosis and the established method for the laboratory confirmation of malaria, with a threshold sensitivity of 5 to 50 parasite/μL (depending on the microscopist expertise) (Amexo *et al* 2004). It provides information on parasite species and their circulating stages; aids quantification of the parasite densities and assessment of parasitological response to chemotherapy in severe malaria cases. However, the time span between sample taking and availability of results is often too long which allows for clinical diagnosis (presumptive diagnosis) of malaria cases by physicians. Clinical diagnosis often leads to empirical treatment of febrile persons by physicians. As a result, anyone showing symptoms of fever is presumptively treated with Artemisinin-based combination therapy (ACT), leading to mistreatment of other potentially life threatening illnesses.

The indiscriminate treatments of non-malaria febrile persons without parasitological diagnosis have been linked to drug resistance to the available antimalarial drugs which are expensive and to progression of malaria despite treatment. This study therefore determines the prevalence of malaria among the clinically suspected individuals that attended Obioma hospital in Umuahia North LGA of Abia State, Nigeria, and the knowledge, attitude and practices of respondents regarding malaria.

Materials and methods

Study area

This study was conducted in Umuahia North LGA of Abia State in the eastern part of Nigeria (Longitude 5^0 32′ 14.8″ N Latitude 7^0 29′ 50.3″ E) (Wikimapia, 2010). It has a rain forest belt with dry and wet seasons typical of the West African sub-region. Umuahia is an urban area with temperature ranges from 27^0C-32^0C. The population is predominantly civil servant. Others are traders, students, farmers, and artisans. Blocked drainage systems create stagnant water for mosquito breeding. Other predisposing factors include open containers of water for house use, discarded empty tins, leaf foliages which trap water and serve as breeding sites for mosquitoes. The practice of going bare bodies exposing some parts of the body in the evenings because of heat, cooking outside, not screening the house all help to predispose individuals to the bites of mosquitoes

Ethical approval

Ethical permission was gotten from the ethical committee of the post graduate board of the Zoology and Environmental Biology Department of Michael Okpara University of Agriculture, Umudike, Abia State. Permission was also obtained from the management of the hospital, and from the head of the laboratory/technical staff section of Obioma Hospital before the commencement of the study on the agreement that patient anonymity must be maintained and that every finding would be treated with utmost confidentiality for the purpose of this research only. Consent of the patients was also sought and received before being included in the study. For the children, consent was received from their parents before they were included in the study.

Data collection

Blood samples were gotten from Obioma Hospital in Umuahia, Abia State, between September and December, 2015. Sample questionnaires were administered to obtain information on the socio-demographic profile of the respondents and their knowledge, attitude and practices regarding malaria. The protocol of the study was properly explained to each of the subjects prior to blood collection by the health practitioner.

Study size determination

Sample size was estimated by proportion method of Cochran's formula for determining sample size for cross sectional studies based on the previously reported prevalence of malaria in Umuahia as 58% (Etusim *et al* 2013). Sample size calculation was done at 95% confidence interval with 0.05 precision which gave a total of 400 subjects.

Collection of blood samples and examination for malaria parasites

Three milliliters (3 mL) of venous blood was collected aseptically from each respondent using sterile syringe by the health practitioner in the hospital and dispensed into an Ethylene diamine tetra-acetic acid (EDTA) bottles and gently mixed. The samples were taken immediately to the Parasitology Laboratory of O' Event Laboratory, Umuahia, Abia State, for processing. Blood was collected from EDTA bottle with a capillary pipette and a drop of each was placed two clean grease-free slides to prepare thick and thin smears. The slides were properly labelled to allow for proper identification of each respondent's result. The thick smears were air-dried for 30 minutes while the thin smears were air-dried for 15 minutes, both at room temperature. The thin smears were fixed for one minute in methanol before staining. Staining was done according to Ochei and Kolhatkar (2008) using Field's stains A and B. Each fixed thin blood smear was dipped in Field stain B (Eosin) for 5 seconds and was immediately washed off with tap water. The slide was dipped in Field stain A (Methylene blue) for 10 seconds and was immediately washed off with tap water. Each unfixed thick smear was immersed in Field stain A (Methylene blue) for 3 seconds and immediately rinsed with tap water. It was then immersed in Field stain B (Eosin) for 3 seconds and rinsed immediately with tap water. The slides were carefully air-dried and placed in vertical positions. The blood smears were examined under microscope using x 40 and later x 100 objectives lens for morphological features of *Plasmodium* species. Two independent laboratory technologists also viewed the slides. All slides with malaria parasites were recorded as positive while slides without malaria parasite were recorded as negative. Parasites density was calculated by counting the asexual stage parasite numbers using semi quantitative count scale of thick film and multiplying the average number of parasites per high power field (x100 objective and x10 eye piece) by 500 (Cheesbrough, 2005).

Statistical analysis

Data obtained from the study was transformed into simple percentages and analyzed using Paleontological Statistics Software Package (PAST) version 2.17C to calculate *chi*-square used for determining the significant differences between the gender, age, occupation, educational and marital status of the subjects. Descriptive statistics of frequencies, figure and tables were used in data presentations.

Results

The average parasites' density recorded was 147 parasites/µL. The socio-demographic characteristics of the respondents are shown in (Table 1). The overall prevalence of *P. falciparum* was 40.3%. More males (45.2%) than the females (37.0%) were infected (Table 2). The difference was not statistically significant. Occupation wise, the traders were more infected (56.4%) (Table 2) ($x^2 = 4.5034$, ($p>0.05$). Educational status-related prevalence showed that persons without formal education were more infected (68.3%) (Table 2) ($x^2 = 0.4156$, $p>0.05$). Marital status-related prevalence showed that single persons were more infected (43.5%) (Table 2). Age-related prevalence showed that persons within the age-group 6-15 years and 56-65 years recorded the highest rates of infection of 74.0% and 71.4% respectively (Table 2).

Results of the knowledge, attitude and practices (KAP) of the respondents regarding malaria showed that (57.3%) attributed the cause of malaria to the bites of mosquitoes (30.0%), to excessive fried oil and (16.3%) to transfusion of infected blood (Table 3). On the knowledge of signs/ symptoms of malaria, more than half of the respondents or guardians reported headache (58.0%) and fever (53.0%) as major symptoms of malaria (Table 3). On the sources of information about malaria (35.4%), reported it was from school, (25.0%) television programmes (20.3%), from internet and (19.8%) from newspaper (Table 3). On knowledge on methods of diagnosing malaria, more than half of the respondents (55.8%) knew about microscopy while (47.3%) knew about rapid diagnostic tests (RDTs) (Table 4). Regarding chemotherapy and preventive measures employed against malaria, more than half of the respondents (52%) used oral medication (drugs), (43.3%) used insecticides, (19.0%) used insecticide treated nets (17.5%), reported the use of ordinary mosquito nets while (22.0%) emphasized on good environmental sanitation (Table 5).

Table 1. Socio-demographic characteristics of the respondents (*n* = 400).

Categories	Variables	No. of respon -dents	Percen- tage (%)	*p*-value
Age (years)	6-15	50	12.5	*p*>005
	16-25	142	35.5	
	26-35	101	25.3	
	36-45	67	16.8	
	46-55	26	6.5	
	56-65	14	3.5	
Occupation	Civil	99	24.8	*p*>005
	servant	86	21.5	
	Farmers	99	24.8	
	Students	110	27.5	
	Traders	6	1.5	
Educational status	Artisans	93	23.3	*p*>005
	Primary	109	27.3	
	Secondary	116	29.0	
	Tertiary	82	20.5	
	Informal			
		145	36.3	*p*>005
Marital status	Married	255	63.8	
	Single	0		
	widowed			

Table 2. Related-prevalences with respect to different social determinants.

Categories	**Variable**	**No. Examined**	**No. Infected (%)**	***p*-value**
Gender	Male	157	71 (45.2)	p>0.05
	Female	243	90 (37.0)	
Age	6-15	50	37 (74.0)	p>0.05
	16-25	142	54 (38.0)	
	26-35	101	28 (27.7)	
	36-45	67	18 (26.9)	
	46-55	26	14 (53.9)	
	56-65	14	10 (71.4)	
Occupation	Civil	99	28 (28.3)	p>0.05
	servants	86	39 (45.4)	
	Farmers	99	30 (30.3)	
	Students	110	62 (56.4)	
	Traders	6	2 (33.3)	
	Artisans			
Educational status	Primary	93	32 (34.3)	p>0.05
	Secondary	109	49 (45.0)	
	Tertiary	116	24 (20.7)	
	Informal	82	56 (68.3)	
Marital status	Married	145	50 (34.4)	p>0.05
	Single	255	111 (43.5)	

Table 3. Knowledge, Attitude and Practices (KAP) of the respondents towards malaria (n = 400).

Categories	**Variable**	**No. of respon-dents**	**Percen-tage (%)**
A. Causes of malaria	Bites of mosquitoes	229	57.3
	Excessive fried oil	120	30.0
	Contaminated food and water	87	21.8
	Excessive alcohol intake	59	14.8
	Infected blood transfusion	65	16.3
B. Signs and symptoms	Fever	212	53.0
	Headache	232	58.0
	Cough	103	25.8
	Catarrh	89	22.3
	Chills/Coldness	100	25.0
	Joint pain or general body pains/ache/weakness	111	27.8
	Vomiting	94	23.5
	Diarrhoea	78	19.5
	Nausea	89	22.3
	Abdominal pain	86	21.5
	Bitter taste	117	29.3
C. Sources of information	Newspaper	79	19.8
	School	141	35.4
	Television	100	25.0
	Internet	81	20.3
	Others	89	22.3

N.B. Multiple responses allowed.

Table 4. Knowledge on diagnostic methods for malaria (n = 400).

Categories	Variable	No. of respondents	Percentage (%)
Diagnostic methods	Microscopy	223	55.8
	Rapid Diagnostic Test	189	47.3

Table 5. Knowledge on chemotherapy and preventive measures employed against malaria (n = 400).

Categories	Variable	No. of respondents	Percentage (%)
Chemotherapy and preventive measures	Oral drugs	208	52.0
	Injection	141	35.6
	Herbal preparation	9	2.3
	Use of ordinary mosquito net	70	17.5
	Use of insecticides treated nets	76	19
	Use of mosquito coils at home	13	3.3
	Use of sprays (insecticides)	173	43.3
	Good environmental sanitation	88	22.0

N.B. Multiple responses allowed.

Discussion

Malaria is a life-threatening disease and remains an important public health concern in countries where transmission occurs (Olusola *et al* 2013; WHO, 2015). The socio-demographic characteristics of the respondents in this work showed that all the age-group had representation though more persons were within the age bracket of 16-25 years (35.50%) and 26-35 years (25.25%).

More malarial infection recorded among male subjects is in agreement with other works such as those of Ukpai and Ajoku (2001), Etusim *et al* (2013) and Adekunle *et al* (2014) where more males were infected than females but disagrees with the work of Oparaocha (2003), and Okore *et al* (2015) who reported more females to be infected than their male counterparts. This could be attributed to the fact that males expose themselves to the bites of mosquitoes and other vectors more than the females, especially when the weather is hot and during farm work by removing their shirts for fresh air.

Traders (56.36%) had the highest rate of infection (56.4%) among the different occupation. This could be as a result of the traders staying in an environment that favours the breeding of mosquitoes especially during trading activities in the late hours of the evening which will invariably expose them to the bites of mosquitoes. This disagrees with the work of Odukaesieme (2015) who reported farmers to be more infected. The respondents that were single (43.53%) were more infected than those that were married (34.38%). The higher prevalence of malaria among those that are single is in contrast with the work of Ajumobi (2012) who reported that the married were more infected. Infection affected all the various age-groups though the age-group 6-15 years had the highest rate of infection (74.0%). This conforms to the findings of Adekunle *et al* (2014), and Okore *et al* (2015) who reported more children were infected in their works. This may be attributed to low-acquired immunity of malaria. This contrasts with the work of Etusim *et al* (2013) where patients of 70 years and above were reported to have had the highest infection rate.

The average parasites density observed in this study was 147 parasites/µL and is similar to the report of 159 parasites/µL reported by Ajumobi (2012) but different from >8000 parasites/µL recorded by Mosanya and Odujoko (2008). Parasite density is dependent on transmission season (Ajumobi, 2012). The parasites density recorded in this study was low as WHO considers *P. falciparum* parasitaemia to be heavy when more than 5% of red cells are parasitized, and (250,000 parasites/µL) are recorded, and a very high risk of mortality when more than (10% of red cells are parasitized), and 500,000 parasites/µL are recorded (WHO, 2010).

Clinical diagnosis is not precise but it still remains the basis for therapeutic care for the majority of febrile patients in malaria-endemic areas where laboratory support is out of reach. Clinical diagnosis also known as presumptive diagnosis is the least expensive and most commonly used method of diagnosis and forms the basis for self-treatment in endemic countries. Overlap of malaria symptoms with those of other tropical diseases such as typhoid fever, respiratory tract infections and viral infections impairs the specificity of presumptive diagnosis thereby encouraging unnecessary and indiscriminate use of anti-malaria in the endemic-regions. Symptoms such as fever, headache, weakness, myalgia, dizziness, abdominal pain, nausea, vomiting, diarrhoea and anorexia are usually used as the basis for clinical diagnosis (Ajumobi, 2012). Similar symptoms and bitter taste in the mouth were observed in this work. The most common symptom reported was headache (58.0%), followed closely by fever (53.0%). The respondents thus demonstrated adequate knowledge of the clinical manifestations of uncomplicated malaria. This agrees with the works of Osero *et al* (2006), and Adewole and Faparusi (2013) where the respondents identified the correct symptoms of malaria and typhoid fever. This is also similar with the findings of Oguonu *et al* (2014). Accuracy of clinical diagnosis varies with level of endemicity, malaria season and age group. No single algorithm can therefore be regarded as a universal predictor (Wongsrichanalai *et al* 2007).

This study provides a dataset for judging the performance of clinical diagnosis in hospitals particularly in Umuahia North LGA. The study has also shown that the practice of using clinical diagnosis alone as the basis for giving anti-malarial treatment in endemic areas is not a very effective method, as out of the 400 (100%) patients suspected to have malaria, less than half 161 (40.25%) were positive for malaria.

Conclusion

This study reveals the need for complete shift from clinical diagnosis (symptom-based diagnosis) to parasite-based diagnosis as recommended by the World Health Organization. This will reduce drug wastage, help to curtail the development of drug resistance and assist in treatment of other disease causing fevers such as acute respiratory infection, typhoid fever, and meningitis. Educating and encouraging the populace on the need for laboratory confirmation of malaria before using any antimalarial drugs and encouraging medical personnel to always verify the clinical signs and symptoms of malaria of their patients with laboratory tests before commencing treatment are advocated.

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References

Adekunle, N. O., Sam-Wobo, S. O., Dedeke, G.A., Ojo, D. A., Abimbola, W. A., Adeleke, M. A. and Surakat, O. A. 2014. Evaluation of Rapid Methods in Malaria Diagnosis from persons attending primary health facilities, Ogun State, Nigeria. *Nigerian Journal of Parasitology*, *35 (1-2):* 19-25.

Adepoju, G. K. A. 2005. Evaluation of the attitudes and perception of city dwellers to the traditional medicinal practices in Nigeria. *Journal of Medical and Pharmaceutical Sciences*, *1 (1)*: 113-118.

Adewole, A. and Faparusi, F. 2013. Assessment of caregivers/mothers knowledge, attitude and practices in prevention and treatment of childhood malaria in Yewa south Local government area of Nigeria. *Nigerian Journal of Parasitology*, *34 (2)*: 33-40.

Ajumobi, O. O. 2012. Assessment of Malaria Rapid diagnostic test and utilization of laboratory services for malaria diagnosis at Makarfi General Hospital, Kaduna State. An M.Sc Dissertation, Department of Community Medicine, Ahmadu Bello University Zaira, Nigeria, 114pp.

Amexo, M., Tolhurst, R., Barnish, G. and Bates, I. 2004. Malaria misdiagnosis: Effects on the poor and vulnerable. *The Lancet 364 (9448)*: 1896-1898.

Cheesbrough, M. 2005. *District Laboratory Practice in Tropical Countries. 2nd Edition,* Cambridge University Press, UK, p. 251.

Etusim, P. E., Nwosu, E. C., Uzoanya, C. E., Melariri, P. E. and Ukpai, O. M. 2013. Sensitivity of Three Diagnostic Methods (*PF* Antigen Test, QBC and Blood Smear) in Determining Malaria Prevalence among Patients Referred to Goodnews Medical Laboratory, Umuahia, Nigeria. *Journal of Medical and Applied Biosciences 5 (1)*: 46-55.

Eze, N. C. E., Nzeako, S. O. and Amadi, E. C. 2010. Current status of malaria and urban schistosomiasis infections in the mammy market free zone of the 34 Field Artillery Brigade in Obinze, Owerri. *Nigerian Journal of Parasitology*, *31 (2)*: 68-72.

Federal Ministry of Health 2008. National Malaria and Vector Control Division. Annual Report, pp. 1-66.

Hlongwana, K. W., Mabaso, M. L. H., Kunene, S., Govender, D. and Maharay, R. 2009. Community knowledge, attitudes and practices (KAP) on malaria in Swaziland: A country earmarked for malaria elimination. *Malaria Journal 8*: 29-39.

Mosanya, M. E. and Odujoko, J. B. 2008. Evaluation of a rapid immunochromatographic technique for the diagnosis of *falciparum* malaria. *International Journal of Malaria and Tropical Diseases, 4:* 132-135.

Ochei, J. and Kolhatkar, A. 2008. *Medical Laboratory Science. Theory and Practice.* New Delhi. Tata McGraw-Hill Publishing Company Limited, p. 68.

Odukaesieme, O. P. 2015. Study on the Knowledge, Attitude and Practices (KAP) and diagnostic methods for malaria and HIV. Unpublished M.Sc Thesis, Department of Zoology and Environmental Biology, Michael Okpara University of Agriculture, Umudike, 139 pp.

Oguonu, T., Shu, E., Ezeonwu, B. U., Ligo, B., Deirick, A., Umeh, R. E. and Agbo, E. 2014. The performance evaluation of a urine malaria tests (UMT) kit for the diagnosis of malaria in individuals with fever in South East Nigeria. Cross sectional analytical study. *Malaria Journal*, *13*: 403-408.

Okell, L.C., Bousema, T., Griffin, J. T., Ouedraogo, A. L., Ghani, A. C. and Drakeley, C. J. 2012. Factors determining the occurrence of submicroscopic malaria infections and their relevance for control. *Nature Communications, 3*: 1237-1240.

Okore, O. O., Ubiaru, P. C. and Nwaogwugwu, U. G. 2015. Prevalence of malaria and typhoid fever co-infection: Knowledge, attitude and management practices among residents of Obuda-Aba, Abia State, Nigeria. *American Journal of Public Health Research, 3(4)*: 162-166.

Olusola, O., Olunike, O. A., Sunday, S. T., Oyebode, A. T. A., Olugbenga, A. O., Taiwo, A. O., Oloyede, S. B. and Oluwaseyi, A. A. 2013. Assessment of Clinical Diagnosis, Microscopy, Rapid Diagnostic Tests, and Polymerase Chain Reaction in the Diagnosis of *Plasmodium falciparum* in Nigeria. *Malaria Research and Treatment*, 308069-308074.

Oparaocha, E. T. 2003. The impact of haemoglobin level and concomitant infection on malaria on-set during malaria attack in Ikwuano LGA, Abia State, Nigeria. *Nigerian Journal of Parasitology*, *23*: 23-27.

Osero, J. S., Otieno, M. F. and Orayo, A. S. 2006. Mothers' knowledge on malaria and vector management strategies in Nyiama district, Kenya. *East African medical Journal, 83 (9)*: 507-514.

Ukpai, O. M. and Ajoku, E. I. 2001. The prevalence of malaria in Okigwe and Owerri areas of Imo State. *The Nigeria Journal of Parasitology, 22 (192)*: 43-48.

Ukpai, O. M. and Amaechi, E. C. 2013. Knowledge, Attitude and Practices about malaria among mothers and care-givers in Aba South Local Government Area, Abia State, Nigeria. *Animal Research International*, *10 (3)*: 159-164.

Ukpai, O. M. and Ubiaru, P. C. 2015. Impact of the 2014/2015 Ebola Virus disease epidemic on malaria cases and control in some West African countries: A mini review. *American Journal of Medical Case Reports, 3 (10)*: 325-328.

Uzochukwu, B. S. C., Obikeze, E. N., Onwujekwe, O. E., Onoka, C. and Griffiths, U. K. 2009. A cost effectiveness analysis of rapid diagnostic test, microscopy and syndromic approach in the diagnosis of malaria in Nigeria: implications for scaling-up deployment of ACT. *Malaria Journal 8*: 265-273.

Wikimapia. 2010. Longitude, latitude, GPS coordinates of Umuahia North. (Online) available at *www.gps-latitude-longitude.com/gps-coordinates-of-umuahia-north.* Accessed 28 September, 2015.

Wongsrichanalai, C., Barcus, M. J., Muth, S., Sutamihardja, A. and Wernsdorfer, W. H. 2007. A review of malaria diagnostic tools: microscopy and rapid diagnostic test (RDT). *The American Journal of Tropical Medicine and Hygiene*, *77 (6)*: 119-127.

World Health Organization. 2010. *Basic Malaria Microscopy-Part I. Learner's Guide, 2nd edition*. Geneva, p. 23.

World Health Organization. 2015a. Malaria (online). available www.who.int/mediacentre/factsheets/fs094/en/. Accessed 25 June, 2015.

World Health Organization. 2015b. World Malaria Day: Malaria in the time of Ebola. (online) available at www.worldmalariaday.org/archives/14031. Accessed 25 June, 2015.

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