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PREVALENCE OF MALARIA INFECTION AMONG VULNERABLE GROUPS IN WUSHISHI LOCAL GOVERNMENT AREA OF NIGER STATE, NIGERIA

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ABSTRACT

Malarial is a chronic endemic life treating parasitic disease that obstructs social and economic development of underdeveloped counties like Nigeria. It is caused by protozoan of genus plasmodium, which is transmitted by female anopheles mosquitoes and it is a major cause of high morbidity and mortality among pregnant woman and children. This study is therefore aimed at determining the prevalence of malaria among vulnerable group of people especially pregnant woman and children in Wushishi Local Government area of Niger State, Nigeria. This was done by collecting and screening 1000 samples (500 for each group) to detect malaria using microscopic examination of blood film and in-vitro diagnostic kits. Questionnaires were also administered in order to evaluate the use of insecticides, conventional and local treatment and accessibility to hospital in the area of this study. The result of the study reveals higher rates in children of age 1-5 years in both microscopic (25.8%) and RDT (25.0%), while higher prevalence was recorded in Kwata, Maito and Akare geopolitical wards with the least prevalence in Kanwan and Kodo wards. The result from the questionnaires revealed that majority of the groups under this study uses mosquito coil as a means of mosquitoes control, 65.3% of the groups have no hospital accessibility. Thus, it could be concluded that malaria is endemic among the vulnerable groups studied and non-usage of mosquito treated net was a contributing factor. Government in such area should also provide access to hospital and health facility closer to the people in the area of study so as to facilitate early diagnosis and prompt treatment of infected patients.

KEYWORDS: Malaria, Plasmodium, pregnant women, prevalence, hospital.

INTRODUCTION

Malaria is a chronic endemic disease that obstructs social and economic development. It is the leading cause of mortality and morbidity around the world with an estimated 225 million malaria cases and 781,000 deaths being reported globally in 2009 (USAID, 2011). Malaria is both a modern and ancient plague. Most of the reported malaria cases occur in tropical and subtropical regions where the atmospheric condition (temperature and rainfall) are favorable for the development of vectors and parasites (Green wood *et al*., 2008). The mortality occurs mostly in young children and pregnant women (Ogunlana and Ademowo, 2009). Ninety percent of global malaria burden occur in Africa south of Sahara where malaria in pregnancy has been most evaluated (Agomo and Oyibo, 2013). Seventy percent of pregnant women in Nigeria suffer from malaria with maternal and foetal nutrition complications which contribute to the low birth weight, premature delivery, mental retardation and 60% miscarriages (WHO, 2000). In hyperendemic areas like Nigeria, malaria is a common cause of anaemia in pregnancy in both immune and non-immune individuals and is aggravated by poor socioeconomic circumstances. Most pregnant women with malaria infestation are asymptomatic thus are undetected and untreated (Okpere, 2004).

Major anopheles mosquitoes in Nigeria are *An. gambiae*, *An. arabiensis*, *An. funestus* and *An. melas* (WHO, 2010). *A. gambiae* is omnipresent in Nigeria, because of its indiscriminate breeding habitats (Ayanda, 2009). It is highly endophilic, anthropophagous, considered as wet season vector, but can occasionally be zoophilic and exophilic (Ayanda, 2009). The publication of *A.* gambiae genome should help to identify the genes involved in resistance and to design chemicals for attacking new targets in the mosquito as reported by (Holt, 2002).

The pathogenesis of severe and complicated malaria, which is always due to *P. falciparum*, has been intensively studied in recent years (Schull, 1999). In the 1960s the theory of increased capillary permeability as the cause of pathology prevailed. Considerable studies have since been advanced to show that microvascular obstruction by parasitized red blood cells explains many of the disease process (Schull, 1999). It has long been

known that *Plasmodium falciparum* schizont rarely appear in peripheral blood; it is now clear that red cells containing them are sequestered in deep capillary beds throughout the body, most crucially in the brain and kidneys, and importantly in bone marrow, liver and the placenta in pregnancy (Chen *et al*., 2000).

Sequestration allows the malaria parasites to avoid destruction in the spleen. This results from increased adherence by parasitized red cells to capillary endothelium (Cowan, 1993). The resulting capillary stasis in vital organs produces metabolic arrest without causing total vascular occlusion. In cerebral malaria, brain cells in particular are unable to perform aerobic glycolysis to obtain energy and so depend on inefficient anaerobic glycolysis; these results in lactic acidosis and total brain dysfunction leading to coma and death (Schull, 1999).The continuous spread of the *Plasmodium falciparum* resistance to the commonly use anti-malarial drug including the newly introduced Artemisinin combination therapy (ACT) has resulted in resurgence in treatment failure (Oseni and Akwetey, 2012). However, malaria has for years been the major cause of high level of morbidity and mortality among pregnant women and under five children who are considered the most vulnerable people to malaria infection. Hence, this research was aimed at determining the prevalence of malaria among vulnerable people especially pregnant women and children under the age of 0 – 5 years in Wushishi local Government, Niger state, Nigeria. This was done using in-vitro diagnostic kit and microscopic view of blood film, meanwhile, the research was limited to pregnant women and children within the age of 0 – 5 years in Niger State.

MATERIAL AND METHOD

Study Area

This study was conducted in Wushishi Local Government area, which is one of the 25 Local Government areas within Niger State, Nigeria. It is on the guinea savannah with an annual rainfall between the months of April to October. Wushishi Local Government Area is situated in the middle belt (north central) Zone of Nigeria and lies along longitude $9^0$43'N and latitude $6^0$4'E cover land area of 1,879km^2 with an estimated human population of about 81,783 (2006 census).

Sample Collection

One thousand blood samples (500 from pregnant woman and 500 from children under the age of 5 years) were collected from the eleven wards under Wushishi Local Government Area, Niger state via-puncture of the cubital veins. The site was disinfected using 70% isopropyl alcohol in water and 1% of iodine for one minute and allowed to air dry. Precautions were taken to avoid recontamination of the site and a drop of blood sample was collected for film preparation as well as for the rapid test from an individual on the spot.

Serological Examination

Material parasite was detected using the in-vitro diagnostic kit (malaria antigen card test) manufactured by Lab. Diagnostic Ltd.

Making Thick and Thin Blood Films

The Hobe of the finger was cleaned using a swab with 70% v/v alcohol and allowed to dry. A sterile lancet was then used to prick the finger and squeezed gently to obtain a large drop of blood. After which clean grease free glass slide was used preferably, a malaria slide card to add a small drop of blood to the center of the slide a large drop of about 15mm to the right. A smooth edge slide spreader was immediately used to spread the thin film. The large drop of blood was spread without delay to make a thick smear to cover evenly an area about 15/15mm. There after a black lead was used to label the slide with the date, patients name and number. The prepared film slides were allowed to air dry in a horizontal position and placed in a café cabinet.

Thin Film Fields Staining Technique

The methanol fixed thin films were placed on the slide on a staining rack and covered with 0.5ml of diluted fields stain B. Equal volumes of fields' stain A was added and mixed the diluted fields stain B, It was then allowed to stain for 1 minute. The stained film was then washed with clean water, and wiped the back of the slide clean then placed in a draining rack for the film to air dry.

Thick Film Fields Staining Technique

The dried thick films were held facing down wards, clipped into fields stain A for 5 seconds. Excess stain was drained off by touching a cover of the slide against the slide of the container. It was washed gently for about 5 seconds in clean water, drained off excess stain and washed gently in water. The back was wiped and placed the slide upright in a draining rack for the film to air-dry.

GIEMSA Staining Technique

The Giemsa stain was diluted as required immediately before use. 10% solution was used to stain for 10 minutes. The slide was faced down wards in a shallow tray supported on two rods or in a staining rack. Thick blood film was allowed to dry thoroughly while thin blood film was fixed with methanol for 2 minutes. The diluted stain was poured into the shallow tray and allowed for 10 minutes. After which the stain was washed from the container using clean water. The back of each slide was cleaned finally then placed in a staining rack to air dry.

Microscopy

Blood films were examined microscopically using the 40x and 100x objectives with a drop of immersion because these give a brighter and clearer image.

RESULTS AND DISCUSSIONS

Table 1: Prevalence of malaria among vulnerable groups in Wushishi Local Government Area.

		Children	Pregnant women	Both groups
Parameters	**Results**	**Freq (%)**	**Freq (%)**	**Freq (%)**
Rapid Diagnostic Test	Positive	125 (25.0)	92 (18.4)	217 (21.7)
	Negative	375 (75.0)	408 (81.6)	783 (78.3)
Smear Microscopy	Positive	129 (25.8)	102 (20.4)	231 (23.1)
	Negative	371 (74.2)	398 (79.6)	769 (76.9)

Table 1 shows prevalence of malaria among vulnerable groups in Wushishi local government area. The table reveal higher rates in children of age 1 – 5 years, in both microscopy 129 (25.8%) and RDT 125 (25.0%) compared to pregnant women rate of 102 (20.4%) under microscopy and 92 (18.4%) for RDT. The two vulnerable groups shows overall prevalence for smear microscopy as 231 (23.1%) and 217 (21.7%) for RDT methods. The total number of 1000 samples were screened during these study (500 samples each) examined from the ten political wards of Wushishi LGA.

Table 2: Distribution of Malaria in Relation to Method used among Children in Various Wards.

		KW	KA	MA	TA	KO	ZU	SA	LO	AK	TU		
Parameters	**Results**											**Factor**	**P**
Rapid Diagnostic Test	Positive	31	6	20	11	6	7	7	8	19	9	65.12[a]	0.00
	Negative	19	44	30	39	44	43	43	42	31	41		
Microscopy	Positive	32	6	22	12	6	8	8	8	19	9	70.93[a]	0.00
	Negative	18	44	28	38	44	42	42	42	31	41		

n = 50; data analyzed using chi-square. Values with superscripts [a], are significantly different **(p** ≤ 0.05). KW= Kwata, KA= Kanwuri, MA=Maito, TA=Tangwagi, KO= Kodo, ZU=Zungeru, SA=Sabongida, LO=Lokogoma, AK=Akere, TU= Tukunji.

Table 2 Shows there is a statistical significant different (P≤ 0.05) with either methods of analysis. Higher prevalence was recorded in Kwata, Maito and Akare when compared to others wards in the prevalence of malaria among children in the ten wards. While lowest prevalence was observed in Kanwuri and Kodo wards.

Table 3: Distribution of Malaria in Relation to Method used among pregnant Women in the various Wards.

		KW	KA	MA	TA	KO	ZU	SA	LO	AK	TU		
Parameters	**Results**											**Factor**	**P**
Rapid Diagnostic Test	Positive	29	3	9	7	6	3	6	9	11	9	66.28[a]	0.00
	Negative	21	47	41	43	44	47	44	41	39	41		
Microscopy	Positive	30	4	10	10	7	3	6	10	12	10	63.26[a]	0.00
	Negative	20	46	40	40	43	47	44	40	38	40		

n = 50; data analyzed using chi-square. Values with superscripts [a], are significantly different (**p** ≤ 0.05). KW = Kwata, KA = Kanwuri, MA = Maito, TA = Tangwagi, KO = Kodo, ZU = Zungeru, SA = Sabongida, LO=Lokogoma, AK=Akere, TU=Tukunji.

Table 3 shows that there is a statistical significance difference (P≤0.05) with either increase or decrease in RDT, Microscopy Malaria test carried out in all the wards for the pregnant women. Higher increases of prevalence were found in Kwata ward when compared to other wards .The lowest malaria prevalence was obtained in Kanwuri and Zungeru ward.

Table 4: The Distribution of Malaria in Relation to Method and the Vulnerable Groups in Various Wards.

		KW	KA	MA	TA	KO	ZU	SA	LO	AK	TU		
Parameters	**Results**											**Factor**	**P**
Rapid Diagnostic Test	Positive	60	9	29	18	12	10	14	17	30	18	129.75[a]	0.00
	Negative	40	91	71	82	88	90	86	83	70	82		
Microscopy	Positive	62	10	32	22	13	11	13	18	31	19	125.02[a]	0.00
	Negative	38	90	68	78	87	89	87	82	69	81		

n = 100; data analyzed using chi-square. Values with superscripts [a], are significantly different (p≤0.05). KW=Kwata, KA=Kanwuri, MA=Maito, TA=Tangwagi, KO=Kodo,ZU=Zungeru, SA=Sabongida, LO=Lokogoma, AK=Akere, TU=Tukunji.

Table 4: Shows that there is a statistical significance difference (P≤0.05) with RDT, Microscopy Malaria test carried out in all the wards for both the children (0 – 5yrs) and the pregnant women. Higher increases of prevalence were found in Kwata, Maito, and Akare when compared to other wards .The lowest malaria prevalence was obtained in Kanwuri ward.

Table 6b: Use of Insecticides, Conventional or Local Treatments and Accessibility to Hospital.

Parameters	Responses	Children (%)	Pregnant Women (%)	Both Groups (%)
Type of insecticides used	Conventional insecticides. Mosquito coil Local insecticides Others. None.	37(7.4) 192(38.4) 227(45.4) 36(7.2) 8(1.6)	17(3.4) 181(36.2) 273(55.8) 17(3.4) 6(1.2)	54(5.4) 373(37.3) 500(50) 53(5.3) 14(1.4)
Those that uses drug therapy	Yes No	485(97.0) 15(13)	488(97.6) 12(2.4)	973(97.3) 27(2.7)
Local Treatment	Yes No	100(20.0) 400(80.0)	169(33.8) 331(66.2)	269(26.9) 731(73.1)
Hospital Accessibility	Far Near	303(60.6) 197(39.4)	350(70) 150(30)	653(65.3) 347(34.7)

6 shows that 500 (50.0%) uses a locally made insecticides available in the market. 973 (97.3%) uses orthodox drug therapy for malaria treatment in which 875 (87.5%) uses ACTs antimalarial, and 731 (73.1%) do not use any traditional means of treatment. It also indicated that 653 (65.3%) of the populace of Wushishi local government area are far from the major hospitals were they can access adequate health care.

DISCUSSION

In this study the overall prevalence of malaria is relatively low (21.3%) showing the endemic nature of malaria in Wushishi Local Government Area. Malaria Rapid Diagnostic Tests (RDTs) have been recommended to improve diagnostic efficiency, which is important for preventing indiscriminate use of Artemisinin-Based Combination Therapy (ACT), thereby preventing or delaying the development of parasite resistance to this new first-line drug (Msellez *et al*., 2009). RDTs can be used as a stop-gap when microscopy services are not operating (e.g. evenings/weekends/public holidays) or as a primary diagnostic tool for rural/remote areas without microscopy services (MOH and MS, 2009).

The prevalence as shown in table 1 (23.1%) is in accordance with the report of WHO (2012) which stated that Nigeria bears up 25% of malaria disease in Africa, hence contributing significantly to the millions of lives lost per year in the country, which mostly consist of children and pregnant women. Though the prevalence in this study was rather lower than the study mentioned above, this may be attributed to the improved antenatal and postnatal malaria control strategies like distribution and use of long lasting insecticide treated nets (LLIN) or alternative intermittent preventive treatment with artemisinin-based combine therapy (ACT). The low prevalence might also be for the reason that this study was conducted during the dry season. According to Ayanda (2009), prevalence of *P. falciparum* infection is higher in the wet season than in the dry season. Minakaw *et al*., (2002) reported that the rainy season presents favourable environmental conditions that enhance mosquito breeding and survival, through the proliferation of larval habitats and improved humidity.

The statistical differences recorded in relation to methods of analysis in the prevalence of malaria among children and pregnant women in the ten wards of Wushishi Local Government was significant with $p \leq 0.05$ (Table 2) and pregnant women as shown in Table 3. High prevalence were recorded in Kwata, Maito, and Akare wards compared to other wards with significant difference (P=0.00) (Tables 2, 3 & 4). This may be attributed to the fact that Kwata and Akare are riverine communities while Maito could be as a result of the intensive gardening activities carried out in the surrounding of this area which could also create adequate conditions for mosquito breeding. These agrees with the opinion of Vogel (2002) who stated that vector larvae tends to develop in temporary bodies of water such as that typically found near agricultural sites or even in flood hoof prints. These factors couple with the lack of proper preventive measures and use of insecticide could be responsible for the high malaria prevalence in these wards.

The result obtained in both (Table 3, 4 & 5) implies that the prevalence of malaria is not dependent on method for the fact that there was no significant difference in both methods. Never the less RDT method should be regarded as a confirmatory test as it only detects *P. falciparum* species and can be used as a stop-gap when microscopy services are not operating (e.g. evenings/weekends/public holidays) or as a primary diagnostic tool for rural/remote areas without microscopy services while microscopy is a quantitative method as it reveals the presence of all the four or five species of plasmodia in a given sample. This implies that both methods are still effective and reliable but does not mean they are synonyms. This may be as a result of

access to medical care been limited in most of the rural areas and where medical services exist, they commonly lack facilities for laboratory diagnosis, and as a result, malaria treatment is mostly given on the basis of clinical or self-diagnosis.

In terms of therapy, majority of the populace 973 (97.3%) used orthodox drugs for malaria treatment particularly Artmisinin-based conbination Therapy (ACT). Whereas only 269(26.9%) used traditional treatments. It also indicated that 653 (65.3%) of the populace of the local government area are far from the major hospitals where they can access adequate health care which may be the responsible factor for the endemicity of malaria among children and pregnant women who are vulnerable to the infection. This is in agreement with the report of Ordenezalex and Avina, (2002) who stated that in the last three decades, intensive efforts have been launched to combat and control the spread of malaria. However, financial constraints, epidemiological factors, insecticide resistant and inadequate development of health services is hindering significant reduction in malaria transmission. Furthermore in regards to the use of insecticides, majority of the populace 500 (50%) used unconventional insecticides which they found more effective than both the conventional insecticides (5.4%) and mosquito coils (37.3%).

In conclusion, malaria prevalence is endemic among the vulnerable groups studied. Non-usage of insecticidal spray, insecticides treated nets were the main factors associated with an increased risk of malaria infection among vulnerable groups in Wushishi since ownership of nets does not imply its usage. This disease is an important cause of morbidity and mortality in this population and so malaria prevention strategies will tremendously reduce the burden of the disease in the Local Government Area. In view of this it can recommended there is need eliminating breeding places such as swamps while avoiding exposure to mosquito bites through the use of mosquitoes treated net and application of mosquito repellants. Early diagnosis and prompt treatment of patients is also very essential.

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