

Studies on the Pattern of *Plasmodium falciparum* among settled Fulani Pastoralists in Rivers State, Nigeria

ABSTRACT

Of the global effort to roll back malaria, very little information is known on malaria among Settled Fulani Pastoralists in Rivers State. A total of five hundred and ninety three (593) blood samples were examined for malaria infection, four hundred and sixty four (78.2%) of those examined were infected. Oral interviews with the aid of an interpreter were used to get personal data of participants. Blood film preparations and microscopy were used to detect malaria parasites in the blood. Data collected were stratified by bush encampment in various communities, age, and sex. Malaria prevalence among different bush encampment showed no significant difference ($p>0.05$). Male subjects were more infected (79.9%) than females (75.4%) however; there was no significant difference in the prevalence of the disease in relation to sex. The age group 21-30 years had the highest malaria prevalence 99(81.8%) while 51 years and above had the least 41(69.6%). Two hundred and sixteen (46.6%) of the infected pastoralists had moderate parasitaemia with parasitaemia intensity of 11-100 parasites per 100 high power field and was higher among males. Packed cell volume (PCV) in the population was 18.4% and higher among 21-30 years age group. Use of coil and burning of medicinal leaves including animal drugs are the major preventive measures used by the Fulani's and only 10.5% used insecticide treated net.

Keywords: *P.falciparum*, settled, pastoralists, prevalence, Fulani

INTRODUCTION

One of the major public health challenges in Nigeria is the very high prevalence of malaria. Malaria presents a huge burden to Africa and continues to cripple the economic development of the continent. The disease is a serious impediment to economic and social development in Nigeria (Okwa *et al*; 2009). Nigeria is known for high prevalence of malaria and it is a leading cause of morbidity and mortality in the country (Olasehinde *et al*; 2010). Available records show that at least 50 per cent of the population of Nigeria suffers from at least one episode of malaria each year and this accounts for over 45 percent of all outpatient visits (Ojurongbe *et al*; 2007). The most vulnerable groups as have been observed are the children below 5 years and the pregnant women, due to their comparative lower immunity status. It is estimated that 100 children under one year and 203 children under five years out of 1000, respectively, die annually (NDHs, 2003). Malaria is an important cause of still birth, infant mortality, and low birth weight (Snow *et.al*; 2003). In Africa, at least 24 million pregnancies are threatened by malaria each year and malaria in Africa is estimated to cause up to 45% of maternal anaemia and 35% of preventable low birth weights (Gawley *et al*; 2007)

The nomads are probably the most ignored major ethnic group as far as health care service is concerned in Nigeria (Gundiri *et.al*; 2007). In the constant search for pasture, they pass and settle in areas with high mosquito density, which expose them to intense malaria transmission. Several studies have been recorded in different parts of Nigeria on the prevalent and distribution of malaria parasites among the Fulani herdsmen. In Adamawa State, Gundiri *et. al*; recorded 80.0% prevalence. Ekpo *et al*; reported 33.6% prevalence among settled Fulani pastoralists in South Western Nigeria. However, in South- Eastern Nigeria Anosike *et al* observed 23.5% among semi-nomadic Fulani pastoralists. In South-South Nigeria, information on Malaria parasitemia among Fulani pastoralists is scanty in spite of existing ecological conditions, which favour the breeding of mosquito vectors. This present paper contains our findings in order to elucidate the status of malaria infection among the Fulani pastoralists inhabiting six bush encampments in Rivers State.

Materials and Methods

Study area and sample population

Fulani pastoralists inhabiting bush encampments in Ahoada, Bori, Elele, Eleme, Elelenwo and Oyigbo Rivers States of Nigeria were sampled. The Fulanis in each encampment live, with their families in huts made of straw or thatch without windows. The Fulani herdsmen are found with their cattle on the outskirts of the village around bush encampment in clearings similar to the description of Anosike *et al*; 2004. They move from the northern part of Nigeria during the end of the dry season to the south-eastern part, mainly for green pasture for their animals. Epidemiologically, this exposure makes them very susceptible to the attack of vectors of filariasis and *Plasmodium falciparum* infection. However, the Fulani pastoralists prefer to camp near water bodies usually at river-banks, stream or stagnant ponds. Their living near a water source was to complement for all their domestic water needs, such water source could as well serve as a major breeding site for various disease vectors affecting them.

Parasitological Studies

Blood samples were collected by simple random sampling from the Fulani pastoralists in each camp. Thick and thin blood films were stained with a 3% Giemsa solution for 45mins according to Cheesbrough (2006). The number of asexual parasites per 200 white blood cells (WBCs) was counted and parasite densities were computed assuming a mean WBC count of 8,000/ μ l

= number of parasites per microlitre of blood (parasites/ μ l).

However, the routine examination of a thick blood films was based on the examination of 100 good fields and a slide was pronounced negative only after no parasites was found in 100 fields. Thin films were used for the species identification of plasmodium parasites while the presence of rings forms of plasmodium and trophozoites of plasmodium indicate positive results. The packed cell volume was determined for the investigation of anaemia by centrifugation of blood in heparinized capillary tube (with one end sealed) using micro haematocrit reader. The results were read using Hawksley reader. Oral questionnaires, aimed at obtaining personal data and preventive measures use in controlling malaria were administered with the aid of an interpreter. (Anaemia was defined as PCV of less than 30% in this study).

Table 1: Prevalence of Malaria Parasite in Different Encampment in the Study Locations

Study locations	No.Examined	No. (%) positive
Ahoadá	89	69(77.5)
Bori	71	54(76.1)
Elele	105	82(78.1)
Eleme	112	81(72.3)
Elelenwo	115	96(83.5)
Oyigbo	1010	82(81.2)
Total	593	464(78.2)

Table: 2 Sex-related prevalence of malaria infection among Fulani Pastoralists in Rivers State

Study locations	Male		Female		Total	
	No. Examined	No.(%) infected	No. Examined	No. (%) infected	No. examined	No. (%) infected
Ahoda	57	45(78.9)	32	24(75.0)	89	69 (77.5)
Bori	45	35(77.8)	26	19(73.1)	71	54(76.1%)
Elele	69	55(79.7)	36	27(27.2)	105	82(78.1%)
Eleme	67	50(74.6)	45	31(68.9)	112	81(72.3%)
Elelenwo	67	57(85.1)	48	39(81.3)	115	96(83.5%)
Oyigbo	64	53(82.8)	37	29(78.4)	101	82(81.2%)
Total	369	292(79.9)	224	169(75.4)	593	464(78.28)

Table 3: Age- Related Prevalence of Malaria Infection among Fulani Pastoralists in Rivers State

Age group	Ahoada		Bori		Elele		Eleme		Eelenwo		Oyigbo		Total	
P	No. examined	No(%) infected	No. examined	No(%) infected	No. examined	No(%) infected	No. examined	No(%) infected	No. examined	No(%) infected	No. examined	No(%) infected		
1-10	14	11(78.6)	10	8(80.0)	18	14(77.8)	21	16(76.2)	21	17(81.0)	22	18(81.8)	106	84(79.2)
11-20	20	16(80.0)	15	12(80.0)	21	17(81.0)	22	16(72.7)	21	18(85.7)	17	14(82.4)	116	93(80.2)
21-30	22	18(81.8)	14	11(78.6)	22	18(81.8)	21	16(76.2)	23	20(87.0)	19	16(84.2)	121	99(81.8)
31-40	16	12(75.0)	13	10(76.9)	20	16(80.9)	20	15(75.0)	22	19 (86.4)	18	15(83.3)	109	87(79.8)
41-50	10	7(70.0)	12	9(75.0)	14	10(71.4)	17	11(64.7)	16	13(81.3)	13	10(76.9)	82	60(73.2)
51 +	7	5(71.4)	7	4(57.1)	10	7(70.0)	11	7(63.6)	12	9(75.0)	12	9(75.0)	59	41(69.5)
Total	89	69(77.5)	71	54(76.1)	105	82(78.1)	112	81(72.3)	115	96(83.5)	101	82(81.2)	593	464(78.2)

Table: 4 Distribution of Malaria Parasite Intensity According to Age.

Intensity of infection	1-10	11-20	21-30	31-40	41-50	51⁺	Total
+ (1-10 parasite per 100 high power field)	34 (40.55%)	39 (41.9%)	38 (38.4%)	39 (44.8%)	29 (48.3%)	20 (48.8%)	199 (42.8%)
++(11-100 parasites per 100 high power field)	38 (45.2%)	42 (45.2%)	51 (51.5%)	41 (47.1%)	26 (43.3%)	18 (43.9%)	216 (46.6%)
+++ (1-10 parasites in every high power field)	9 (10.7%)	11 (11.8%)	8 (8.0%)	7 (8.1%)	5 (8.3%)	3 (7.3%)	43 (9.3%)
++++ (more than 10 parasites in every high power field)	3 (3.6%)	1 (1.1%)	2 (2.0%)	-	-	-	6 (1.3%)
Total	84 (18.1%)	93 (20.0%)	99 (21.3%)	87 (18.8%)	60 (12.9%)	41 (8.8%)	464 (100%)

Table: 5 Intensity of infection distribution influenced by sex.

Intensity of infection	Males	Females	Total
+ (1-10 parasite per 100 high power field)	118(40.0%)	81(47.9%)	199 (42.8%)
++ (11-100 parasite per 100 high power field)	142(48.1%)	74(43.8%)	216(46.6)
+++ (1-10 parasites in every high power field)	30(10.2%)	13(7.7%)	43(9.3%)
++++ (more than 10 parasites in every high power field)	5(1.7%)	1(0.6%)	6(1.3%)
Total	295(63.6%)	169(36.4%)	464(100%)

Table: 6 Packed cell volume (PCV) Distribution among the Fulani Herdsmen based on Age.

Age group	Total No. examined	No. with PCV>30%	No. with PCV < 30%
1-10	106	85 (80.2%)	21(19.8%)
11-20	116	91(78.4%)	25 (21.6%)
21-30	121	93(76.9%)	28(23.1%)
31-40	109	90(82.6%)	19(17.4%)
41-50	82	72(89.0%)	9(11.0%)
50 ⁺	59	52(88.1%)	7(11.9%)
Total	593	484(81.6%)	109(18.4%)

Fulani's Belief on Prevention of Malaria

Prevention	Male (n-246)	Female (n-165)	Total (n-411)
	No. of respondent Yes (%)	No. of respondent Yes (%)	No. of respondent Yes (%)
Coil.	83(33.7%)	77(47.7%)	160(38.9%)
Net	31(12.6%)	12(7.3%)	43(10.5%)
Burning of medical leaves and animal drugs	63(25.6%)	45(27.3%)	108(26.3%)
Insecticide	19(7.7%)	4(2.4%)	23(5.6%)
Preventive drugs	0(0.0%)	0(0.0%)	0(0.0%)
None	27(11.0%)	11(6.7%)	38(9.2%)
Coil and net	23(9.3%)	16(9.7%)	39(9.5%)

RESULTS

A total of 593 Fulani herdsmen from different encampment in the six locations were examined, of which 464 (78.2%) were positive. Presence of ring forms and trophozoites of plasmodium indicate positive results. *Plasmodium* species isolated were all *P. falciparum*. Infection rate was higher in Elenwo with 96(83.5%) followed by Oyigbo 82(81.2%) while Eleme had the least (72.3%). It shows a little inter-community variation and the prevalence of malaria was not significant among different encampments studied ($P>0.05$) (Table 1). Males 295(79.9%) were mostly infected than the females 169(75.4%) (Table 2) although the malaria prevalence according to sex was not significant (0.920 df=5, $P>0.05$). Malaria parasite was recorded in all the age groups examined and did not show a definite pattern. Highest prevalence of malaria was recorded within the age bracket 21-30years 99(81.8%), followed by 11-20years and 1-10 years age bracket, 93(80.2%) and 84(79.2%) respectively.

The age group 21-30years was significantly higher than the age bracket 51-years and above (Table 3). Two hundred and sixteen (46.6%) of the infected Fulani pastoralist had moderate parasitaemia with parasite intensity of 11-100 parasites per 100 high power fields and was higher among males. There was no significant difference in malaria intensity between moderate (++) and low (+) parasitemia in this study ($P>0.05$) (Table 4 and 5). Anaemic conditions were observed in 109 (18.4%) Fulani

pastoralists. This was high within the age bracket 21-30years (23.1%) followed by 11-20 years (21.6%) and 1-10(19.8%) (Table 6). There was significant difference in packed cell value among the different age groups ($p < 0.05$). However, a positive correlation ($r = 0.965$) was found to exist between malaria and packed cell volume among the Fulani herdsmen in Rivers State. Four hundred and eleven Fulani respondents interviewed 43(10.5%) owned Insecticides Treated Net (ITN). Other mentioned preventive measures against malaria among the Fulani herdsmen include Coil 160 (38.9%), Burning of medicinal leaves & animal dungs 108 (26.3%) and the use of insecticides 23 (5.6%) (Table 7).

DISCUSSION

Morbidity and mortality due to malaria have been increasing due to deterioration in health system, growing drug and insecticide resistance, periodic changes in weather pattern, human migration and population displacement (Najera and Hempel, 2000). In this study, the presence of ring forms of plasmodium and Trophozoites of plasmodium indicated positive results. Results from the study showed an overall prevalence of plasmodium infection 78.2%. This is a reflection of the high rate of asymptomatic malaria parasitaemia in endemic malaria regions. This was higher than the findings of Ekpo *et al*; (2008) who reported malaria prevalence of 33.6% among settled Fulani pastoralists in Western Nigeria and also that of Anosike *et al*; (2004) who recorded malaria prevalence of (23.5%) among Nomadic Fulani's of South-Eastern Nigeria. Ojo and Mafiana (2005) also observed a malaria prevalence of 59.9% among children < 15 years in Abeokuta, South-Western Nigeria. It is far higher than the prevalence of 6% recorded by Ahmed *et al*; (2001) among donor population in Maiduguri, north eastern Nigeria. Anumudu *et al*; (2006) recorded also 17% prevalence in Eastern Nigeria. High malaria prevalence in this study was an indication that the infection is wide spread. This is in agreement with the observations of Gundiri *et al*; (2007), who recorded a prevalence of 80.0% prevalence in malaria among obligate nomadic Fulani camps in Adamawa State. Omolade *et al*; (2010) recorded a high prevalence of 83.3% in a Nigeria University.

This wide range of difference may be attributed to variance in climatic factors and behavioural patterns of people in the area which promote mosquito breeding and susceptibility of the people to vector bites. This high prevalence underscores the fact that, malaria is still a heavy burden in Nigeria, despite all that has been done. It also indicates that a large population of the people may be at very high risk of the infections if transmission remains stable and very high. Malaria prevalence was higher among the Fulani's in Elelenwo encampment (83.5%) followed by Oyigbo (81.2%) and the 1

east in Eleme encampment, though not significant. This may be due to the fact that their settlements were more remotely located in deep vegetations that are favourable habitat for mosquitoes and malaria transmission. Studies have shown that this ecology is a fertile breeding ground for *Anopheles* mosquito vector malaria (Anosike *et al*; 2005). However, it may be partly due to changes from nomadic to sedentary life styles and location of settlements close to water sources. Fulani's prefer to camp near water bodies usually at river-banks and stagnant ponds where mosquitoes breeds and malaria transmission is intense. Their houses were made of straw or thatch without windows and this offer no protection against mosquito bites. In most settlements, these houses were temporally constructed, but became permanent dwelling places as the Fulani's eventually settles. These results in overcrowding in huts, as minimal resource were used in providing accommodation. In addition, they become easily exposed to intense malaria transmission through mosquito bites among themselves and possible through community members. Frequent mobility in the bush with herds may also expose them to mosquito's bite both in the day and in the night. The high prevalence of non-clinical malaria (low intensity) cases also ensures maintenance of infection in the population.

Malaria prevalence among the sexes was not statistically significant ($p>0.05$), but malaria parasitaemia was slightly higher among the males (79.9%) than the females (75.4%) (Table 2). This agrees with result obtained by Okonko *et al* ; (2009), Abdullahi *et al* ; (2009); Onyido *et al* ; (2010) and Umeaneto *et al* ;(2006). This again is related to exposure of the males to disease vector while herding. The females are mainly involved with household chores and the selling of "Furo and nono" in nearby town. Studies have shown that females have better immunity to malaria and this was attributed to hormonal and genetic factors (Mendel and White, 1994, Briabin and Brabin, 2005).

All the age bracket of the study population was affected. Malaria prevalence was not statistically significant in the various age groups ($p>0.05$). The age bracket 21-30 years had the highest prevalence while 51 years and above had the least prevalence. Higher prevalence of 81.8% seen in the age bracket 21-30years among the Fulani herdsmen is in line with the findings of Ukpai and Ajoku (2001). This can be attributed to active work and involvement in herding and other outdoor activities which predispose them to day and night vector bites. Moreover, the above age group is the working force. Reason for the high prevalence among the adults in the study, suggests that, persons have lost some degree of immunity as a result of poor living condition in addition to lifelong exposure. High prevalence of non-clinical malaria (moderate intensity) cases recorded in all the age groups also ens

ures maintenance of infection in the population.

Moderate grade parasitaemia among the Fulani herdsmen may be attributed relatively to high immunity of malaria in the area. Differences in the gender malaria intensity load may be associated with variations in exposure and transmission rates, genetic compositions and individual susceptibility to the parasites (Kneel, 1991). Anaemia was defined as packed cell volume of less than 30% in this study according to Afolabi *et al*; (1997). Anaemic condition was recorded in 18.4% of the Fulani herdsmen. This is in agreement with the finding of Nebe *et al.*, (2002) who reported 11.4% PCV of $<30\%$ among the Lagos State coastal dwellers and Asinobi *et al.*, (2007) who reported 13.1% of anaemia among the infected children and adults in Owerri, Nigeria. But contrasts sharply with the study of Ekpo *et al*; (2008) who recorded 50.7% among Fulani's in South-Western Nigeria. Low packed cell volume observed is an indication of anaemia (WHO, 1999). Prolonged infection with malaria has been reported to contribute significantly to the aetiology of severe anaemia (Farid *et al* ; WHO 1999). However, it is likely that high cases of anaemia in the population may be due partly to malaria infection and partly to poor nutrition.

Generally, in the entire encampment visited only few respondents were seen with insecticide treated nets (TTNs). Bednets are among the most recognized methods of personal protections against mosquitoes. It reduces the degree of human vector contact and malaria transmission. The prevalence of malaria infection can be significantly lowered by the use of insecticide impregnated bednets (Erhun *et al* ; 2002). It was reported that the few insecticide impregnated bednets were given to their children by the Ministry of Health Rivers State. This is not encouraging nor a right step towards curbing the menace of mosquito and malaria in Nigeria which is the aim of ITN project. This study has shown that malaria infection is very high among Fulani herdsmen in Rivers State. The observed prevalence is of public health significance and could be a threat to important socioeconomic activities in the area if not checked. There is need to establish feasible control programmes in the area.

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