



Full Length Research Paper

Perception of Fever and *Plasmodium* Infection Among Nomadic Fulani Children of Northeastern Nigeria.

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ABSTRACT

Malaria is a deadly disease which is widely spread in the tropical regions of the world. This study was conducted to investigate mother's perception of fever and *Plasmodium* infections in under-five nomadic Fulanis children of northeastern Nigeria. Two hundred and seventy two(272) mothers were interviewed on the perception of fever in 672 under-five children alongside measurements of ambient temperature. Blood samples of under-five children were analyzed for *Plasmodium* infections. Results show that 269 (98.8%), and 247(90.8) mothers of under-five children perceived prevalence and severity of fever in the nomadic Fulanis camps respectively. There was a significant association (X^2 , $p<0.05$) between mothers diagnosis of fever with clinical temperature. Similarly, *Plasmodium* infections showed a significant association (X^2 , $p<0.05$) with clinical temperature of under-five children. *Plasmodium* infections were detected among 247 (36.8%) under-five children. There was gender difference of malaria infections with more males 129 (37.0%) infected than females 118 (36.5%), although the difference was not significant (X^2 , $p>0.05$). Of the three clans investigated for *Plasmodium* infections, the Kiri clan had higher 145(44.8%) significant burden (X^2 , $p<0.05$) of *Plasmodium* infections with *P. falciparum* responsible for more than ninety percent of the infections. Mothers perception of fever in under-five children may still require laboratory confirmation. However, in the absence of laboratory diagnosis, perception of fever by mothers of under-five could still be used as a guide for the treatment of *Plasmodium* infections in the nomadic Fulanis camps.

Key words: Fever, *Plasmodium* infections, Under-five, Nomadic Fulanis

INTRODUCTION

Fever is said to occur when the body temperature is above 37°C (98.6°F). It occurs when various infectious and non-infectious disease process interact with the host immune mechanism (Kliegman, *et al.*, 1992). Fever is either due to identifiable microbiologic agent or occurs during exposure to excessive environmental heat or during heavy physical work (Al-Eissa, *et al.*, 2000). Fever is a passive rise in body temperature that subsides after a short time. The illness is one of the most common morbidity of childhood diseases (Kliegman, *et al.*, 1992). *Plasmodium* infection account for most fever illnesses in Nigeria and other Sub-Saharan African countries (Oshikoya and Sanbanjo, 2008). In most cases, the fever has three stages, beginning with uncontrollable shivering for an

hour or two, followed by a rapid spike in temperature (as high as 106°F), which lasts three to six hours. Then, just as suddenly, the patient begin to sweat profusely, which will quickly bring down the fever (Al-Eissa, *et al.*, 2000). As the fever subsides, the patient typically feels exhausted and falls asleep. This cycle of fever occur every other day, or every third day, and may last for between a week and a month. Those with the chronic form of *Plasmodium* infection may have a relapse as long as 50 years after the initial infection (Kliegman, *et al.*, 1992; Al-Eissa, *et al.*, 2000).

The genus *Plasmodium* are obligate eukaryotic parasites best known as the etiologic agent of human malaria. There are four species that infect humans: *P. Falciparum*, *P.vivax*, *P. Malariae* and *P. Ovale*. *Plasmodium* is

innoculated to man through the bite of some species of infected female anopheline mosquitoes (Oyerinde, 1998). During this bite, the parasite first settles in the liver and multiplies; then enters the red blood cells which it later destroys, releases some pyrogenic substances into the blood stream leading to pyrexia (Roger and Robert, 1986). Malaria symptoms include fevers, chills, and headache, and muscle pains, enlargement of the spleen, convulsion, and cold sores around the mouth, enlargement of the liver, vomiting, cough and loss of appetite (Hughes and Kelly, 2006; Cox, *et al.*, 2005).

The nomads have an estimated population of 75 million in the developing World; over 60% of them are in Africa spread over more than twenty one countries. Although they contribute to the National economies of their countries (Abdikarim and Jolian, 1999), but are usually have less access to health care than the settled population (Chabasse, *et al.*, 1985). Akogun, *et al.* (2012) reported that government programmes in Nigeria to Roll Back Malaria is yet to be felt by the nomadic Fulanis. The nomads are virtually ignored from the health services because it is usually in the hands of the settled populations which do not relate well to them (Abdikarim and Joilan, 1999). They live in small temporary camps close to rivers and water holes where exposure to mosquitoes is very intense and form pool of susceptible populations. Anosike, *et al.* (2004) recovered 14 different parasitic infections among the nomadic Fulanis of South Eastern Nigeria, which malaria is just one example of such infections. This is similar to the reports of Akogun, *et al.* (2012) and Gundiri, *et al.* (2007) that malaria is a serious health problem among the nomads. This study aimed to investigate mother's perception of fever and *Plasmodium* infections among nomadic Fulanis children.

MATERIALS AND METHODS

Study area.

The study was conducted in Adamawa State, Nigeria. Adamawa state is located in the north-eastern Nigeria between latitude 7° and 11° N and between longitude 11° and 14° E. The state has a boundary with Borno State to the

north, Gombe State to the south-west and Taraba State to the south-east. Adamawa state has an international boundary with Cameroon Republic along its eastern border. The area has two seasons. The dry season starts from November and ends in March; and the rainy season starts in April and ends in October with a mean annual rainfall between 900 and 1100 mm, and an average minimum temperature of 18°C, and an average maximum temperature of 37°C. The hottest months are March and April with maximum temperature of 40°C (Adebayo and Tukur, 1997).

Study Population

The nomadic camps of study are located in the Benue-trough pastoral block at the confluence of rivers Benue and Gongola in Adamawa State Nigeria, spread across four local government areas (Dema, Numan, Lamurde and Shelleng). The study covered twenty three camps spread across the Benue-trough pastoral block.

Pre-survey Contact and Mobilization

Informal visits and discussions were made with the camp leaders in the market places where many nomads mingle, and as well as in the camps. The visits were to negotiate and develop confidence with the camp leaders and the community as well as gain acceptance. This was necessary to ensure maximum co-operation from the nomadic Fulanis and was successfully carried out. The informal discussion was helpful in the development of tools for data collection.

Determination of febrile illness

a. Mothers assessment of fever

In order to determine fever in under-five nomadic Fulani children, a personal data of each child was first recorded which include: age, sex and clan. There after questionnaires on the perception of fever were administered to 272 mothers of under-five children between April, 2007 and November, 2008.

b. Clinical Assessment of fever

In order to compare the mother's perceived fever with clinical assessment, the

axillary temperature of 672 under-five children were measured. Electronic digital thermometers (Hartman digital, Germany) were used in measuring the axillary temperature. Fever was assessed in the study as temperature greater or equal to 37.5°C, while those without fever were assessed as temperature less than 37.5°C (Lepers, *et al.*, 1990). The spleen abnormalities were assessed by palpation for probable enlargement.

Determination of Plasmodium

The method for *Plasmodium* detection and species identification was followed as described by Cheesbrough (1998).

Ethical Considerations

Ethical clearance was obtained from Adamawa State Ministry of Health. Households were visited and informed consent was obtained from individuals, mothers, household heads and guardians of children. Participation was voluntary and refusal to participate did not attract any penalty with regards to the benefits of the study. Procedures that were painful and time wasting, for example blood sampling and interviews were explained to the volunteers and their consent sought before participation. The participants were given privileges to ask questions before commencement of the study. Under-five children tested positive for *Plasmodium* were treated by a health personnel with Artemisinin Combination Therapy (ACT) obtained from the National Malaria Control Programme.

Data analysis

Data were entered into a database created in Epidata version 3.1. Data was then transferred to Statistical Analysis System (SAS) version 8.0 and were analysed. Statistical significant difference were indicated by $p < 0.05$ and no statistical difference by $p > 0.05$.

RESULTS

Mothers of under-five children perceived the prevalence of fever in the camps to be very high 269 (98.9%). There was high

similarity in perceived prevalence of fever by mothers of under-five with age. Although, the age group between 26-35 years and 36-45 years perceived higher prevalence (100.0% each respectively) as compared to other age groups of mothers. It was observed that the Kitaku clan perceived prevalence of fever more 43 (100.0%) than Jahun 98 (99.0%) and Kiri clan 128 (98.5%). However, there was no significant difference (X^2 , $p > 0.05$). Also there was no significant difference (X^2 , $p > 0.05$) between the different parity groups of mothers with perceived prevalence of fever. The perception of fever was generally accepted irrespective of age, clan and number of births a mother had.

The perceived severity of fever 247 (90.8%) as a major problem within the nomadic population was equally similar (X^2 , $p > 0.05$) irrespective of age, clan and number of births a mother had (Table 1).

Table 1: Mothers perceived prevalence and severity of fever based on age, clan and parity.

	No. Interviewed	Perceived prevalence No.(%)	Perceived severity No.(%)
Age(Years)			
15-25	143	141(98.6)	127(88.8)
26-35	110	110(100.0)	105(95.5)
36-45	13	13(100.0)	10(76.9)
≥ 46	6	5(83.3)	5(83.3)
Clan			
Kiri	130	128(98.5)	118(90.8)
Kitaku	43	43(100.0)	37(86.0)
Jahun	99	98(99.0)	92(92.9)
Parity			
1	17	17(100.0)	13(76.5)
2-3	103	102(99.0)	94(91.3)
4-5	91	90(98.9)	86(94.5)
6-7	37	38(97.4)	35(89.7)
8-9	16	16(100.0)	13(81.3)
≥ 10	6	6(100.0)	6(100.0)
Total	272	269(98.9)	247(90.8)

Clinical temperature of 188 (28.0%) of under-five children was $\geq 37.5^\circ\text{C}$. Similarly, there was significant association (X^2 , $p < 0.05$) between mothers diagnosis of fever with clinical temperature. Also there was significant

association (X^2 , $p < 0.05$) between *Plasmodium* infection with clinical temperature (Table 2).

Table 2: Under-five children with normal and abnormal clinical temperatures based on mothers diagnosis of fever and *Plasmodium* infections.

	No. examined	Temperature <37.5°C No.(%)	Temperature ≥37.5°C No.(%)
Mothers diagnosis			
Has fever	200	82(41.0)	118(59.0)
Does not have fever	472	402(85.2)	70(14.8)
<i>Plasmodium</i> infection			
Infected			
Non-infected	247	116(47.0)	131(53.0)
	425	368(86.6)	57(13.4)
Total	672	484(72.0)	188(28.0)

Results show that 51 (7.6%) of under-five children had enlarged spleen. There was significant association (X^2 , $p < 0.05$) between mothers diagnosis of fever with spleen enlargement. Similarly, there was significant association (X^2 , $p < 0.05$) between *Plasmodium* infections with spleen enlargement in under-five children (Table 3).

Table 3: Under-five children with normal and abnormal spleen based on mothers diagnosis of fever and *Plasmodium* infections.

Age (Years)	No. examined	Normal spleen No.(%)	Enlarged spleen No. (%)
Mothers diagnosis			
Has fever	200	166(83.0)	34(17.0)
Does not have fever	472	455(96.4)	17(3.6)
<i>Plasmodium</i> Infection			
Infected			
Non-infected	247	211(85.4)	36(14.6)
	425	410(96.5)	15(3.5)
Total	672	621(92.4)	51(7.6)

Plasmodium infections was 247 (36.8%) in the study population. The burden of *Plasmodium* infections was more 52 (42.3%) in age group between 24-36 months and least 11 (22.9%) in age group of 0-6 months, although the difference was not significant (X^2 , $p > 0.05$). The burden of *Plasmodium* infections was more 129 (37.0%) among males than in females 118 (36.5%) and was not significantly different from one another (X^2 , $p > 0.05$). Similarly, the burden

of *Plasmodium* infections was more 145 (44.8%) in Kiri and less 66 (26.6%) in Jahun clan, and was significantly different (X^2 , $p < 0.05$) (Table 4). Majority (96.0%) of the burden of *Plasmodium* infections in the nomadic Fulanis camps was due to *P. falciparum* (Table 5).

Table 4: *Plasmodium* infections based on age, sex and clan.

	No. Examined	Non infected No.(%)	Infected No.(%)
Age			
(Months)	48	37(77.1)	11(22.9)
0-6	91	63(69.2)	28(30.8)
6-12	99	64(64.6)	35(35.4)
12-24	123	71(57.7)	52(42.3)
24-36	128	76(59.4)	52(40.6)
36-48	183	114(62.3)	69(37.7)
48-60			
Sex			
Male	349	220(63.0)	129(37.0)
Female	323	205(63.5)	118(36.5)
Clan			
Kiri	324	179(55.2)	145(44.8)
Kitaku	100	64(64.0)	36(36.0)
Jahun	248	182(73.4)	66(26.6)
Total	672	425(63.2)	247(36.8)

Table 5: Percentage of *Plasmodium* species among nomadic Fulani children.

<i>Plasmodium</i> species	Frequency	Percentage
<i>P.falciparum</i>	237	96.0
<i>P.malariae</i>	9	3.6
<i>P.ovale</i>	1	0.4
Total	247	100.0

DISCUSSION

Perception of fever as a major illness of under-five children was perceived high by nomadic Fulanis mothers in the camps. Mothers of under-five children between the age groups of 26-35 and 36-45 years, had perceived the prevalence of fever higher among the under-five children. Of the three clans interviewed the

Kitaku clan perceived prevalence of fever higher in under-five children than Jahun and Kiri clan in the camps. Probably because they combined herding with petty trading and interact more with the settled population. There was no difference between parity of mothers and their perception of fever in under-five children. May be because parity is the number of pregnancies that usually occurred from 28 weeks of conception to delivery stage irrespective of mothers age, and most likely those who were temporarily barren may obtain similar experience with the multiparous mothers.

There was high report by mothers of under-five in the camps that fever is a severe illness. This corresponds with the higher perception of fever earlier reported by nomadic Fulanis mothers in this study. Probably because fever was known to be a severe illness among the nomads, and pregnant mothers and children less than five years of age suffer more than any other group. This is in Accordance with the report of the World Health Organization (2005) that linked most fevers to *Plasmodium* infections which is a debilitating disease with over one million deaths occurring every year especially in under-five children and pregnant mothers.

Mothers perception of fever and clinical temperature measurements in under-five children were associated. This implies that the presence of fever in under-5 can be predicted by nomadic mothers. It was observed that clinical temperature and *Plasmodium* infections are associated. This defines the importance of clinical temperature $\geq 37.5^{\circ}\text{C}$ associated with *Plasmodium* infections as it has been shown to be the threshold by various authors to detect malaria (Lepers, *et al.*, 1990; Oshikoya and Sanbajo, 2008; Ikeh and Teclair, 2008). Results of the study (Table 3) show splenomegaly and *Plasmodium* infections to be associated. Parasites especially *Plasmodium* is one of the factor implicated in spleen enlargement in the tropics and sub-tropical areas of the world (Lepers, *et al.*, 1990).

Malaria prevalence in under-five nomadic Fulanis children were lower compared to other studies elsewhere (Okwa, 2004;

Oshikoya and Sanbajo, 2008). This in accordance with the report from Burkina Faso and Mali which indicated that the nomadic Fulanis had lower malaria prevalence compared to their settled population (Modiano, 1999). Similar studies from Chad was reported by Murray *et al.* (1978) which indicated that nomads drinking milk as the main source of food were less affected with malaria compared to their Kanuri counterparts. Murray *et al.* (1978), and Oppenheimer (2001) observed that nomadic Fulanis children subsisting almost exclusively on milk and milk products deprive malaria parasites of essential nutrients such as paraminobenzoic acid, that happen to occur in low amounts in milk, thereby creating an unsatisfactory intracellular environment which does not favour the multiplication of malaria parasites. In this study, *Plasmodium* infections among the under-five nomadic Fulanis children was higher when compared to their counterparts in southeastern and southwestern Nigeria as documented by Anosike, *et al.* (2004), and Ekpo, *et al.* (2008). The high prevalence could be probably due to local environmental factors of the different areas or the behavioural practices of the nomads concerned. The origins of the nomadic Fulanis in the western and eastern part of Nigeria may differ from the northeastern part which may play a significant role in the differences of malaria prevalence. Despite differences in age and sex malaria infections was equally distributed among the children. This is in accordance to the report of Ajayi and Falade (2006), from southwestern Nigeria, that the distribution of malaria among children irrespective of age and sex was similar. *Plasmodium* infections varied significantly with clan. These findings agreed with the results of Anosike, *et al.* (2004), and Ekpo, *et al.* (2008), probably due to environmental factors especially location of camps in relation to the breeding sites of the mosquitoes. The results of the study (Table 4) showed that the burden of malaria parasite among age group 0-6 months was low. The low prevalence may be due to the persisting maternally derived antibodies which are present in each child's serum from time of birth.

However, from the period of 48-60 months of life, the prevalence of malaria begins to decline. A similar result was obtained by Mbanugo and Ejims (2000), and Nebe, *et al.* (2002).

The burden of *Plasmodium* infections showed that males were found to be more infected than the females. This was in accordance with the results of Molineaux and Cramicara (1980) who reported better immunity to malaria infection and variety of other parasitic diseases in females than the males. This could be attributed to genetic or hormonal factors. In addition the male nomadic Fulanis children spend time more frequently till dusk for outdoor activities than the females. Some of the nomadic Fulanis male children slept outdoor with their cattle without proper cover with the belief that they will not be bitten by mosquitoes. However, some zoophilic species of mosquitoes may become vectors of malaria (David and Herbert, 2003).

The burden of *Plasmodium* infections was higher in Kiri than the Jahun clan. The Kiri clan camp by the river banks close to the water ponds where mosquito breeds. The Jahun clan camp on the uplands far away from the river banks and ponds of water. This was in accordance with the report of Akogun *et al.* (2012) that nomads tend to avoid mosquito-infested areas in their encampments by moving to the uplands during the wet season.

P. falciparum was highest in the infected population. This was in accordance with the report of Ekpo, *et al.* (2008) and Nebe, *et al.* (2002) that *P. falciparum* was more prevalent in Nigeria. The results of the study (Table 5) confirm the predominance of *P. falciparum* which is known to be responsible for 90-95% for malaria infections in Nigeria. The high prevalence of *P. falciparum* could be probably due to the longevity and favourable conditions for the multiplication of the parasite in the host and vector.

This study showed high prevalence of fever among the under-five children as reported by the nomadic Fulanis mothers. Despite the high reported prevalence of fever in the camps, the rate of *Plasmodium* infections in under-five

children was lower compared to the prevalence rate in non-nomadic Fulanis elsewhere. In the absence of laboratory diagnosis, perception of fever in under-five children by nomadic Fulanis mothers can be useful to assess malaria for treatment, which has the advantage of being easy to detect, fast and requires no elaborate test. The study recommend that subsisting exclusively on milk and milk products could reduce malaria infection in children.

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