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Prevalence and Severity of Malaria Infection among Pregnant Women across the Three (3) Tiers of Healthcare Facilities in Kano Metropolis, Kano State, Northern Nigeria

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Abstract
High prevalence of malaria infection has been recorded in different parts of Nigeria including Kano State. In this study, three levels of healthcare facilities were represented, in order to assess the general prevalence of malaria infection among pregnant women across the three tiers, in Kano metropolis. A hospital-based cross-sectional prevalence study was carried out to establish the prevalence and severity of peripheral malaria parasitaemia in pregnant women. A total of six hundred participants were selected from the three categories of healthcare facilities. Thick and thin blood smears were prepared by Giemsa staining, for the presence, identification and quantification of the parasites. The overall prevalence of malaria infection among pregnant women in Kano metropolis was 59.7% and most cases (70.7%) had scanty infection (+). The most prevalent species was *P. falciparum*, accounting for 98.9% of positive cases. All the participants from the primary healthcare facility were parasitaemic and accounted for 55.9% of all the positive cases, whereas the secondary and tertiary accounted for only 17.3% and 26.8% respectively. There was a high (59.7%) prevalence of malaria infection among pregnant women in Kano metropolis. There should be more efforts towards controlling malaria infection among pregnant women in Kano metropolis. Also, this epidemiological study needs to be repeated at regular intervals for monitoring purpose.
Key words: Kano, Malaria, Pregnancy, Prevalence, Healthcarefacilities.

BACKGROUND

Although malaria is an entirely preventable and treatable mosquito-borne illness, it is one of the most severe public health problems worldwide. It is a leading cause of death and disease in many developing countries (CDC, 2014). It affects 3.3 billion people, or half of the world's population, in 106 countries and territories. The Word Health Organization (WHO) estimates that 216 million cases of malaria occurred in 2010, 81% was in the African region. It also estimates that there were 655,000 malaria deaths in 2010, and 91% was in the African Region. Nigeria, Democratic Republic of Congo (DRC), Ethiopia, and Uganda account for nearly 50% of the global malaria deaths (United States Embassy in Nigeria, 2011). Malaria is endemic throughout Nigeria, with moderate-to-high transmission in all states; and the entire population of over 174.5 million is at risk (WHO, 2013a; USAID, 2013). Nigeria is reported to account for more cases of malaria infection and deaths than any other country in the world; also, one-quarter of all malaria cases in Africa occur in Nigeria (United States Embassy in Nigeria, 2011and USAID, 2013).

Malaria remains a major public health problem in Nigeria and represents one in every four deaths of children and one in ten deaths of pregnant women (UNICEF, 2010). High prevalences of malaria infection in pregnancy have been recorded in different parts of Nigeria (Okwa, 2003; Roberts *et al.,* 2011) including Kano state (Taura and Oyeyi, 2009; Gajida *et al.,* 2010). However, in Kano state repeated studies have not been carried out at regular intervals to detect changes over time. Also, the studies carried out so far focused on particular categories of healthcare facilities (primary, secondary or tertiary) at a time. In this study, all the three levels of healthcare facilities were represented, in order to assess the general prevalence of malaria infection in pregnancy across the three tiers of healthcare facilities in Kano metropolis.

MATERIALS AND METHODS

Study Design

A hospital-based cross-sectional prevalence study was carried out to establish the prevalence and severity of peripheral malaria parasitaemia in pregnant women across the three tiers of healthcare facilities (primary, secondary and tertiary) in Kano metropolis.

Kano metropolis comprises of eight (8) local government areas, made up of Dala, Fagge, Gwale, Municipal, Nassarawa, Tarauni, Kumbotso and Ungogo. Presently, the population of Kano metropolis is estimated to be around 3.5 million, with a population density of about 1000 inhabitants per km^2 within the Kano closed-settled zone compared to the national average of 267 inhabitants per km. It is also one of the most crowded local governments in Kano State (Nabegu, 2010).

The study was carried out in three (3) selected public State and Federal Government healthcare facilities, within Kano metropolis, which have antenatal clinics (ANCs) and were well attended. One (1) healthcare facility was selected from each of the three (3) levels of public healthcare facilities. There was a total of 119 public healthcare facilities in Kano metropolis out which there was only one(1) tertiary healthcare facility, ten (10) secondary healthcare facilities and one hundred and eight (108) primary healthcare facilities.

A facility survey was carried out to determine the healthcare facilities to be used as sample study sites from each of the three categories of healthcare facilities. According to Gay and Airasian (2000) a sample of 10 to 20 percent is adequate for descriptive study. However, in this study a total of 40 (34%) which is one-third of the 119 available facilities were selected in order to get a better and more generalisable result, as Korzilius (2010) asserts that the greater the size of the sample, the more accurate the estimate from the population expected. Since there was only 1 Tertiary and 10 Secondary hospitals, all of them were included in the survey. To obtain the remaining 29 hospitals to be surveyed, samples were selected from the 108 Primary healthcare facilities, by listing them according to the local government and sorting them alphabetically by ward. Numbers were assigned to them and selection was then made based on the n^{th} number and the sampling interval "n" was calculated using the formula for calculating sampling interval (sampling frame/sample size) (Cresswell, 2008).

Survey Sampling

Subsequently, the 3 sample study sites were selected from the 40 facilities surveyed. Selection was made on the basis of the ANC attendance. The facility with the highest ANC attendance was chosen from each level of health care; the average of monthly ANC attendance for the previous one year in each of the facilities were used for the selection (Akinleye *et al.*, 2009).

A survey of the prevalence and severity of malaria in pregnancy in Kano metropolis was conducted using data collection forms and laboratory investigations, as suggested by Parise *et al*. (2003) and Bouyou-Akotet *et al*. (2003).

Study Population

The study population comprised of all consenting pregnant women selected by systematic random sampling from those attending the selected antenatal clinics on their first booking clinic day as suggested by Araoye (2003) and Akinleye *et al*. (2009).

The minimum sample size for the antenatal clients required was 329, calculated using Fisher's formula for estimating minimum sample size for descriptive studies (Araoye, 2003). However, to allow for non-response by respondents, and in order to have a fair proportion of sample size allocated to each of the 3 study sites, the sample size was raised to 600; thus 200 antenatal clients were sampled from each of the 3 study sites.

Sample Collection

Capillary blood samples were collected from each volunteer through finger pricking using disposable lancets as described byCheesbrough (2000). These were used to prepare thick and thin blood smears by Giemsa staining technique and were examined microscopically for the presence and quantification of malaria parasitesand identification of their species.

Data obtained were summarized using frequency tables andcharts. An analytical software package, PASW (Predictive Analytical Software), version 20, was used for data analysis.

RESULTS

Socio-Economic Characteristics of the ANC Clients

In terms of educational attainment, majority (55.5%) of the ANC clients in the tertiary healthcare facility had up to tertiary level of education and a substantial portion of them (37.5%) had up to secondary level; whereas, only 4.5% and 7.5% of the ANC clients in the primary and secondary healthcare facilities respectively had up to tertiary level of education, with 34.5% and 26% respectively having only Qur'anic education, while 41% and 42% respectively had up to secondary level of education. Majority of the women did not have income.

Overall Prevalence and Severity of Malaria Infection in Pregnancy

The overall prevalence of malaria infection among pregnant women in Kano metropolis from July 2012 to March 2013 was found to be 59.7% (Fig. 1).

The severity of infection is shown in Fig. 2. Out of the 358 positive cases, 70.7% were found to be cases with scanty infection (+), 22.9% cases of mild infection (++) and only 6.4% cases of severe infection (+++). The most prevalent species was *P. falciparum*, occurring in 98.9% of positive cases; with *P. malariae* being encountered in only 1.1%of positive cases.

Prevalence and Severity of Malaria Infection in Pregnancy, in Relation to Category of Healthcare Facility

The prevalence and severity of malaria infection in relation to the category of healthcare facility in Kano metropolis is shown in Table2. All (100%) of the women in the primary healthcare facility were infected, whereas only 34% and 48% of the women in the secondary and tertiary healthcare facilities respectively were infected. All (100%) of the positive cases in the tertiary healthcare facility were cases with scanty infection; while 60.5% of the infected pregnant women in the primary healthcare facility had scanty infection, 36.5% had mild infection and only 3% had severe infection; in the secondary healthcare facility 58.1% had scanty infection, 14.5% had mild infection and 27.4% had severe infection.

Distribution of Malaria Parasitaemia and its Severity Across the Three Categories of Healthcare Facilities

When the overall distribution of malaria parasitaemia across the three (3) categories of healthcare facilities was considered, it was found that the primary healthcare facility accounted for the majority (55.9%) of the overall positive cases, whereas the secondary and tertiary healthcare facilities accounted for only 17.3% and 26.8% respectively, as shown in Table 3.

Majority (47.8%) of all the cases of scanty infections were from the primary healthcare facility, with the secondary and tertiary healthcare facilities accounting for 14.2% and 37.9% respectively. Likewise, almost all (89%) cases of mild infection were from the primary healthcare facility, with the remaining 11% being from the secondary healthcare facility. However, the secondary healthcare facility accounted for 73.9% of the severe cases of infection, while the primary healthcare facility accounted for only 26.1% leaving the tertiary healthcare facility without any severe case of infection, as shown in Table 4.

Table 1: Socio-Economic Characteristics of the ANC Clients

Variables	Type of Facility			
	Primary (N= 200)	Secondary (N=200)	Tertiary (N=200)	Total (N=600)
Educational Status				
Qur'anic	9(34.5)	52(26.0)	9(4.5)	130(21.7)
Primary	40(20.0)	49(24.5)	5(2.5)	94(15.7)
Secondary	82(41.0)	84(42.0)	75(37.5)	241(40.2)
Tertiary	9(4.5)	15(7.5)	111(55.5)	135(22.5)
Total	**200(100.0)**	**200(100.0)**	**200(100.0)**	**600(100.0)**
Monthly Income				
<6000	48(24.0)	102(51.0)	15(7.5)	165(27.5)
6000-20000	19(9.5)	15(7.5)	25(12.5)	59(9.8)
21000-35000	2(1.0)	6(3.0)	14(7.0)	22(3.7)
36000-50000	1(0.5)	1(0.5)	12(6.0)	14(2.3)
Above 50000	2(1.0)	0(0.0)	11(5.5)	13(2.2)
No sure income	31(15.5)	10(5.0)	27(13.5)	68(11.3)
No Income	97(48.5)	66(33.0)	95(47.5)	259(42.9)
Total	**200(100.0)**	**200(100.0)**	**200(100.0)**	**600(100.0)**

Table 2: Prevalence and Severity of Malaria Infection in Relation to Category of Health Facility

Infection (%)	Type of facility: Primary Frequency (%)	Secondary Frequency (%)	Tertiary Frequency (%)
Positive	200(100.0)	62(34.0)	96(48.0)
Negative	0(0.0)	138(69.0)	104(52.0)
Total	**200(100.0)**	**200(100.0)**	**200(100.0)**
Severity			
+ (Scanty infection)	121(60.5)	36(58.1)	96(100.0)
++ (Mild infection)	73(36.5)	9(14.5)	0(0.0)
+++ (Severe infection)	6(3.0)	17(27.4)	0(0.0)
Total	**200(100.0)**	**62(100.0)**	**96(100.01)**

Table 3: Distribution of Malaria Parasitaemia across the three (3) Categories of Health Facilities

Category	Frequency	(%)
Primary	200	(55.9)
Secondary	62	(17.3)
Tertiary	96	(26.8)
Total	**358**	**(100.0)**

Table 4: Severity of Malaria Infection across the three (3) Categories of Health Facilities

Category of Health Facility	Severity of Infection: + (Scanty infection) Frequency (Percentage)	++ (Mild infection) Frequency (Percentage)	+++ (Severe infection Frequency (Percentage)
Primary	121(47.8)	73(89.0)	6(26.1)
Secondary	36(14.2)	9(11.0)	17(73.9)
Tertiary	96(37.9)	0(0.0)	0(0.0)
Total	**253(100.0)**	**82(100.0)**	**23(100.0)**

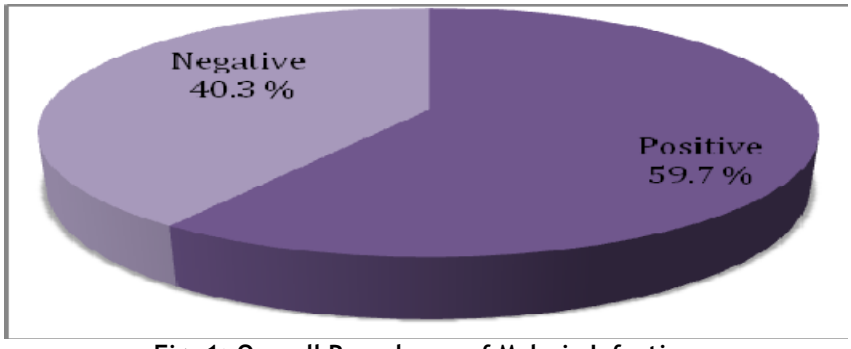

Fig. 1: Overall Prevalence of Malaria Infection

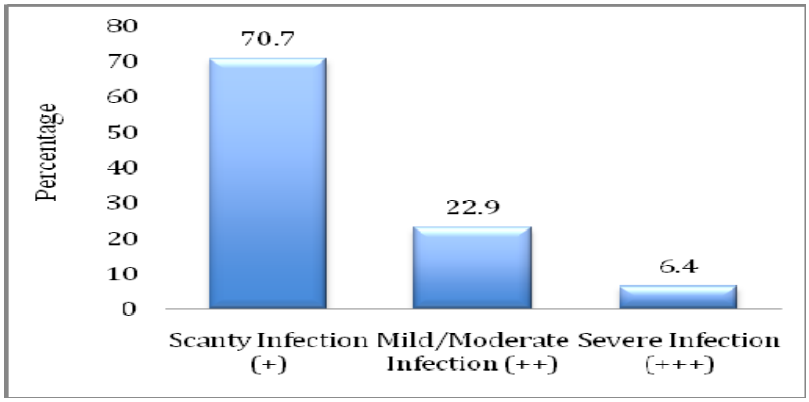

Fig. 2: Severity of Malaria Infection

DISCUSSION

The prevalence of peripheral malaria parasitaemia in pregnant women in Kano metropolis from July, 2012 to March, 2013, was high (59.7%). This rate is higher than what has been reported by Gajida *et al.* (2010), who estimated a rate of 39.2% in a study carried out at some primary healthcare centres in Kano. The wide difference in prevalence rates between these two studies may be because in Gajida *et al.*'s (2010) study only PHC centres were studied, whereas this study included all three levels of healthcare facilities (i.e. primary, secondary and tertiary). The timing of the studies may have also contributed to the great variance between the prevalence rates. The disparity between the prevalence rates may also suggest that there could be some factors that may have contributed to an increase in the rate of infection; such as an increase in unsanitary conditions that may favour the breeding of mosquitoes, the vectors of malaria parasite and non adherence toIntermittent Preventive Treatment during Pregnancy (IPTp) and other malaria preventive measures by pregnant women in the region concerned. This calls for repeated observations, at regular intervals in order to detect changes over time.

The prevalent species identified for malaria infection in the study area was *P. falciparum*, occurring in 98.9% of positive cases. This is in-line with reports by many literatures (Tasawar *et al.*, 2003; USAID, 2007; WHO, 2012). In spite of the high rate of malaria infection, the severity of infection was found to be mild, with 70.7% being scanty infection.

The prevalence of malaria infection in relation to the category of healthcare facility revealed thatin the primary healthcare facility all (100%) of the study population had malaria infection, whereas in the secondary and tertiary healthcare facilities less than half of the study population (34% and 48% respectively) were infected. This suggests that malaria infection in pregnancy in the study area is more common among women attending primary healthcare facilities. Similarly, the overall distribution of malaria parasitaemia across the three categories of healthcare facilities revealed that the primary healthcare facilityaccounted formajority (55.9%) of the overall infection, and also had the most (89%) cases of mild/moderate infection. On the other hand, the tertiary healthcare facility accounted for a relatively lower infection rate (26.8%) and with all the positive cases being scanty infection. This could be attributed to the fact that majority of the women who attended the tertiary healthcare facility were more educated and gainfully employed, and thus were of higher socio-economic status than their counterparts attending the primary healthcare facility. This is clear from the data generated from the investigation on the ANC clients' socio-economic characteristics (Table 1), in which it can be seen that the majority (55.5%) of the ANC clients from the tertiary healthcare facility had up to tertiary level of education and a substantial portion of them (37.5%) had up to secondary level; compared to their counterparts from the primary and secondary healthcare facilities, where only 4.5% and 7.5% respectively, had up to tertiary level of education; with 34.5% and 26% respectively, having only Qur'anic education. Also, if the ANC clients' monthly income is considered, there were more women from the tertiary healthcare facility earning from N6000 to above N50000, than women from the primary and secondary healthcare facilities, who had significant numbers, 24% and 51% respectively, earning less than N6000 per month, while only 7.5% of women from the tertiary healthcare facility fell in that category.

In a study of socio-demographic and maternal factors in anaemia in pregnancy at booking in Kano, northern Nigeria, Nwizu *et al*. (2011) reported the absence of severe anaemia among their study participants which contrasted with results from other study areas; the researchers explained that selection factors may be responsible for their low values, as the hospital (AKTH) where they carried out their study is a fee-paying center attracting clients mainly (94.3%) from the middle to higher socio-economic strata. The tertiary healthcare facility used for this study (AKTH) is the same as that used by Nwizu *et al*. (2011), and similarly, selection could be responsible for the low prevalence of malaria infection and parasite density obtained for the tertiary healthcare facility, as compared to the values for the primary and secondary health centers.

Conclusion and Recommendations

There was a high (59.7%) prevalence of malaria infection among pregnant women in Kano metropolis as at 2012/2013.Most (70.7%) were cases with scanty infection (+). The most prevalence species was *P.falciparum* accounting for 98.9% of positive cases. All the participants from the primary healthcare facility were infected, accounting for majority (55.9%) of the overall positive cases, whereas only 34% and 48% from the secondary and tertiary healthcare facilities respectively were parasitaemic. In the tertiary healthcare facility all positive cases were scanty infections, whereas the mild and severe infections were found in primary and secondary healthcare facilities.

There should be more efforts towards controlling malaria infection among pregnant women in the study area. More prevalence studies should be carried out regularly in Kano state in order to have up to date information on the prevalence of malaria infection in pregnancy. Also, there should be more vigilance concerning the prevention and treatment of malaria in the primary healthcare facilities, which is mostly patronized by pregnant women from the lower socio-economic class. This could be achieved through intensifying health education programmes on the management of malaria in pregnancy, especially for women of low educational status. Also, all women should be economically empowered so that they can afford to have full benefits of malaria treatment, preventive and control measures available.

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