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Full Length Research Paper

Malaria in Sokoto, North Western Nigeria

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Malaria remains a major cause of mortality among children under the age of five years; it is endemic throughout Nigeria with seasonal variation in different geographic zones of the country. Malaria prevalence studies had been undertaken in many parts of Nigeria but there is probably no data available from the far North Western region. This research study was undertaken to determine the prevalence, monthly distribution of malaria in Sokoto, North Western Nigeria in order to generate base-line information. A total of 1,297 blood samples were collected by simple random sampling, from patients attending the two health centres over the twelve calendar months. Thick and thin blood films were Giemsa stained and observed for the presence of malaria parasites. A total of 354 (27.29%) were positive for malaria parasites with the highest prevalence rate being recorded in the month of August with 72 (59.5%) positive cases and the month of March having the least infection rate of 9 (9.18%). The infection rate according to gender showed that males had the higher infection rate of 192 (n = 635) or 30.24% than the females who had a total 162 infection (n = 662) or 24.47%. The age group 0 - 5 years had the highest infection rate of 123 (43.77%) while the age group 36 - 40 years had the least infection rate of 10 (9.8%). The study has revealed the presence of malaria transmission throughout the year in Sokoto, North Western Nigeria and the infection rate can be considered as moderately high.

Key words: Malaria, prevalence, *Plasmodium falciparum.*

INTRODUCTION

Malaria is the most important tropical parasitic disease affecting about 247 million people each year among the 3.3 billion people at risk, resulting in nearly a million deaths, mostly children under the age of five years (WHO, 2008). Nearly 90% of these deaths occur in Africa south of the Sahara thereby making it the leading cause of under-five mortality, killing an African child every 30 s (WHO, 2005a). Pregnant women and their unborn children are also particularly vulnerable to malaria, which is a major cause of prenatal mortality, low birth weight and maternal anaemia. It accounts for 40% of public health expenditure, 30 - 50% of in-patient admissions and up to 50% of out-patient visits in areas with high malaria transmission (WHO, 2005b).

In Nigeria, malaria is endemic and stable, being a major cause of morbidity and mortality, resulting in 25% infant and 30% childhood mortality (FMH, 2005a). It was ranked as the highest cause of death in 1978 and 1982 (Osisanya, 1985). Tragically, the health status of children under the age of five and women has remained a major barrier to Nigeria's development. It is estimated that about 100 children under one year and 203 children under-five years out of 1000, respectively, die annually (NDHS, 2003). In other words, one out of every five Nigerian children dies before his/ her fifth birthday (RBM, 2000). Among pregnant women, malaria is responsible for more than one in 10 deaths and accounts for consi-derable proportion of low birth weight babies born to these mothers. These babies born with low birth weight

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are usually at higher risk of dying from infant and childhood illnesses (RBM, 2005).

Malaria is endemic throughout Nigeria with seasonal variation in different geographic zones of the country. More than 90% of the total population is at risk of malaria and at least 50% of the population suffers from at least one episode of malaria each year. Beyond the impact on children and pregnant women, it affects the general population (RBM, 2005; FHM, 2005b). The disease is the commonest cause of outpatient attendance across all age groups with about 66% of clinic attendance due to malaria (FMH, 2000) and thus constituting a great burden on the already depressed economy.

Epidemiological patterns of malaria are widely different from one place to another (Himeiden et al., 2005). Specific data of a place collected can help in the making of a tailor-made design of improved programme for strategic malaria control for a particular location. There are available effective low-cost strategies for the treatment, prevention and control of malaria. But any attempt to prevent or control a disease such as malaria in any area or in a locality should first of all be preceded by an extensive evaluation of the magnitude of the prevailing situation. Malaria has been the subject of study in many parts of Nigeria (Molineaux and Gramaccia, 1980; Adams and Eze, 2000; Fawole and Onadeko, 2001; Ukpai and Njoku, 2001; Okafor and Oguonu, 2006; Falade et al., 2008; Ibekwe et al., 2009; Agomo et al., 2009).

In Sokoto, there had been a number of researches on malaria (Elueze et al., 1990; Jiya, 2001; Hassan and Umar, 2001) but there is probably no published epidemiological information concerning the study area. A comprehensive study of malaria situation of the locality is expected to provide base-line information, which will be useful in the effective formulation of control measures, which could thus help move the locality towards achieving the Millennium Development Goals (MDGs). The aim and objectives of this study were therefore to determine the prevalence and monthly distribution of malaria in Sokoto, North Western Nigeria.

MATERIALS AND METHODS

Study area and the population

Sokoto is the capital city of Sokoto State, lies between latitude 13° 3' 490N, longitude 5° 14' 890E and at an altitude of 272 m the sea level above. It is located in the extreme North Western part of Sokoto North and South local government areas and also some parts of Kware LGA from the North, Dange Shuni LGA from South and Wamakko LGA to the West. Sokoto metropolis is estimated to have a population of 427,760 people (NPC/FGN, 2007) and by the virtue of its origin, the state comprises mostly Hausa/Fulani and other groups such as Gobirawa, Zabarmawa, Kabawa, Adarawa, Arawa, Nupes, Yorubas, Ibos and others. Occupation of city inhabitants include trading, commerce, with a reasonable proportion of the population working in private and public sectors (MOI, 2008).

The Sokoto township is in dry Sahel surrounded by sandy terrain and isolated hills. Rainfall starts late that is in June and ends early, in September but may sometimes extend into October. The average annual rainfall is 550 mm with peak in the month August. The highest temperatures of 45°C during the hot season are experienced in the months of March and April. Harmattan, a dry cold and dusty condition is experienced between the months of November and February (Udo and Mamman, 1993). Modern Sokoto city is a major commerce centre in leather crafts and agricultural products (MOI, 2008).

Sample size

The sample size was determined according to Cochran, (1999) using the formula:

$n = (z^2 p q) / d^2$

Where n = minimum sample size, z = standard normal deviation and probability i.e. 0.05 at 95% confidence limits, p = prevalence or proportion of value to be estimated from previous studies, q = 1 – p, and d = tolerance limit, the minimum is 0.05.

Ethical consent

The research got ethical clearance from the Ethical Committee of the Usmanu Danfodiyo University Teaching Hospital, Sokoto and consent were given from the Ministry of Health, Sokoto, Nigeria, Sokoto North and South Local Government Areas. The subjects were fully briefed about the research and their permission was sought after to take and use their blood samples.

Data collection

Blood samples were collected by simple random sampling, from patients attending the Primary Health Centre, Yar Akijja, Marafa Danbaba Road and Microbiology Department, Specialist Hospital, Sultan Abubakar, Road, Sokoto metropolis. Thick and thin blood films were stained with a 3% Giemsa solution for 45 min according Cheesebrough, (2006) and observed according to the procedure of Hanscheid (1999); 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/ µl. A slide was defined as negative if no asexual forms were found after counting 1,000 WBCs. Thin films were used for the species identification of *Plasmodium* parasites. Further confirmation of a positive sample was undertaken by an independent microscopist from the School of Medical Laboratory Sciences, Usmanu Danfodiyo University, Sokoto, Nigeria to ensure quality control.

Data analysis

The data was subjected to statistical analysis using Instat® statistical package to determine any significant relationship between infection rate, age and gender.

RESULTS

A total of 1,297 blood samples from individuals were collected between March 2005 and February, 2006 out of which 354 representing 27.29% were positive for *Plasmodium falciparum* parasites. The results of the prevalence study showed that the highest prevalence rate was

Table 1. Malaria prevalence in Sokoto Metropolis between the months of March, 2005 and February, 2006

Month of the year	No of samples examined	No. of positive samples	Prevalence (%)
March (2005)	98	9	9.18
April	110	17	15.45
May	115	26	22.61
June	114	32	28.01
July	117	56	47.86
August	121	72	59.5
September	113	46	40.71
October	84	24	28.57
November	111	20	18.01
December	93	22	23.66
January (2006)	118	18	15.25
February	103	12	11.65
Total	1297	354	27.29

Table 2. Malaria prevalence according gender in Sokoto Metropolis between March, 2005 to February, 2006.

Gender	No. of samples examined	No. of positive samples	Prevalence (%)
Male	635	192	30.24
Female	662	162	24.47
Total	1297	354	27.29

recorded in the month of August with 72 (59.5%) positive cases, followed by July and September having prevalence of 56 (47.86%) and 46 (40.71%) positive cases, respectively. The month of March had the least infection rate of 9 (9.18%) followed by February and January having 12 (11.65%) and 18 (15.25%), respectively (Table 1).

The gender-specific infection rate showed that males had the higher infection rate of 192 (n = 635) or 30.24% than females, who had a total 162 infection (n = 662) or 24.47% (Table 2). The study according to age showed that the age group 0 - 5 years had the highest infection rate of 123 (43.77%), followed by 6 - 10 and 11 - 15 years age groups having 71 (38.59%) and 44 (27.85%), respectively. The age group 36 - 40 years had the least infection rate of 10 (9.8%) followed by age groups 41 - 45 and 31-35 years which had prevalence rates of 13 (14.61%) and 15 (15.96%), respectively (Table 3).

DISCUSSION

The total prevalence of malaria infection in the study population was 27.29%, for a disease like malaria that debilitates; it can be described as moderately high. These results are higher than those of Anumudu et al. (2006) who in a similar research in Eastern Nigeria reported 17% prevalence rate, but lower than those of Umeaneato et al. (2006) who reported 46% prevalence in Nwewi, Anambra State and even much lower than that of Aribodor et al. (2003) who had reported 76% prevalence in Azia, Anambra State. This result is also lower than the 40% annual prevalence rate found in Nigeria (FMH, 2005a). The overall relative low prevalence could be due to absence of breeding sites for the Anopheles vector in some months of the year.

The males had a relatively higher prevalence rate of 30.24%, compared with their female counterparts that had prevalence rate of 24.47% that was statistically significant ($p < 0.05\%$). Similar reports had indicated higher prevalence in males than females (WHO, 2005b; WHO, 2006), but there no scientific evidence to prove the higher prevalence being related to gender as susceptibility to malaria infection is not influenced by gender (Gilles and Warrell, 1993). The higher prevalence rate could just be by chance, or due to the fact that males engage in activities which make them more prone to infective mosquito bites as compared to their female counterparts that are mostly at home and protected from such infective bites, this further buttressed such claims made by World Health Survey, 2006.

The higher prevalence of malaria among children age group 0-5 and 6-10 years seen in this study is in line with several studies (WHO, 2005b; Umar and Hassan, 2001;

Table 3. Malaria prevalence in Sokoto Metropolis according to age, between March 2005 to February, 2006.

Age group (years)	Samples examined	Positive samples	Percentage prevalence
0 to 5	281	123	43.77
6 to 10	184	71	38.59
11 to 15	158	44	27.85
16 to 20	101	27	26.73
21 to 25	121	22	18.18
26 to 30	125	22	17.6
31 to 35	94	15	15.96
36 to 40	102	10	9.8
41 to 45	89	13	14.61
46+	42	7	16.67
	1297	354	27.29

Ukpai and Ajoku, 2001; Salako et al., 1990). Generally, there is slow acquisition of active immunity to malaria (Perlmann and Troye-Blomberg, 2000). Therefore, it is not surprising the situation is the same in Sokoto. Children born to immune mothers are protected against the disease during their first half year of life by maternal antibodies. As they grow older, after continued exposure from multiple infections with malaria parasites over time, they build up an acquired immunity and become relatively protected against disease and blood stage parasites (Plebanski and Hill, 2000) hence lower prevalence of malaria among the older age groups. The difference between infection rate and the age group 0 - 5 years was statistically significant with $p < 0.05\%$.

Limitation of the study

The study was conducted using two health centres, though located in the strategic locations of the township; these results may reflect what is happening in other similar heath centres in the metropolis. The results obtained are within limits compared to similar researches (Anumudu et al., 2006; Umeanaeto and Ekejindu, 2006; Aribodor et al., 2003; Upkai and Ajoku, 2001) and also within the limits of the malaria prevalence rate reports in Nigeria (WHO, 2008; RBM, 2005; FMH, 2005b). This base-line data could be useful in effective planning of tailor-made prevention and control measures in the Sokoto and other similar townships.

Conclusion

The research study has revealed the presence of malaria infection throughout the year is Sokoto Township North West Nigeria. The overall infection rate could be said to be moderate when compared to other studies. Further studies could be undertaken to investigate other epidemiological parameters. On the side of the authority, Sokoto State Government could reduce the infection rate further down by embarking on health education campaigns and training on malaria prevention, particularly educating people on the importance of not providing conducive dwelling places for mosquitoes. The Government should also embark on extensive vector control to reduce the vector population and should subsidize anti-malarial drugs; children under the age of five years should be given free malaria diagnosis and treatment. It should also provide and distribute insecticide impregnated nets, free, at the State as well as at the Local Government levels.

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