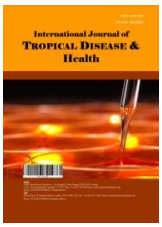

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Five Year Retrospective and Current Prevalence of Malaria in Bunkure Local Government Area of Kano State, Nigeria

A. S. Bukhari[1], A. M. Yayo[1*], N. T. Dabo[2], M. Safiyanu[3], A. Ado[4], B. R. Hussain[1] and M. J. Gambo[5]

[1]Department of Medical Microbiology and Parasitology, Bayero University, Kano, Nigeria.
[2]Department of Biological Sciences, Bayero University, Kano, Nigeria.
[3]Department of Biochemistry, Yusuf Maitama Sule University, Kano, Nigeria.
[4]Center for Infectious Diseases Research, Bayero University, Kano, Nigeria.
[5]Department of Pediatrics, Aminu Kano Teaching Hospital, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Authors ASB and AMY designed the study, wrote the protocol and conduct the laboratory analysis. Authors NTD and MS wrote the first draft of manuscript. Authors AA and BRH performed the statistical analysis. Authors MJG and MS managed the literature search. All authors read and approved the final manuscript.

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ABSTRACT

Background: Malaria is one of the most severe public health problems worldwide, particularly in Africa, with Nigeria having the greatest number of cases. This study evaluated a five-year (2012-2016) retrospective and a current trend (August-December 2017) of malaria prevalence in Bunkure Local Government Area of Kano State, Nigeria.
Methods: The retrospective review was conducted by extracting data on malaria cases from the Summary Record Book at Bunkure Primary Health Care Facility. In the current survey, a total of 400 participants were examined using peripheral blood sample obtained by venous puncture to estimate the current malaria prevalence. All data obtained were analyzed using SPSS version 20.

**Corresponding author: Email: Yayoabdulsalami@gmail.com;*

Results: In the retrospective period, a total of 12,387 suspected malaria patients were diagnosed using Rapid Diagnostic Test kit, out of which 9,746 (78.7%) were positive for malaria. The infection was higher in females (45.27%) and in subjects above or equal to 5years of age. There was no significant difference in prevalence between the gender (P= 0.322) and the age groups (P = 0.630). Of the 400 participants examined, 193 were found positive for *malaria,* representing a prevalence rate of (48.3%), much lower than the prevalence rate in the retrospective period (78.7%). The higher prevalence of the infection was found in males (32.25%) and the age group between 5-12 years (14.25%). The difference in prevalence was statistically not significant between the genders (p = 0.87) and the age groups (p = 0.142).

Conclusion: Based on the findings of this study, there was a significant decline (P < 0.05) in trend of malaria prevalence in the study area, which may be attributed to the effectiveness of the ongoing control interventions in the locality. This study indicates the need for continuous monitoring of malaria prevalence using both microscopy and RDT for assessment of impact of malaria intervention in the area.

Keywords: Malaria; prevalence; retrospective; Bunkure; Kano.

1. INTRODUCTION

Malaria is still the most prevalent disease of public health significance in sub Saharan Africa accounting for about 92% of the global 228 million cases [1]. Nigeria bears up to 25 percent of the regional malaria burden with about 100 million clinical cases annually and 97% of the inhabitants at risk of malaria infection [2]. However, the distribution of malaria risk and its prevalence at the State and local government levels is heterogeneous. Considerable variations have been reported in the proportion of positive cases of malaria between study populations sampled from forest and the savanna ecological belts of Nigeria as well as between the States and the Local Government Areas (LGAs) within a State [3-5]. Out of the 493 children aged 6 – 59 months examined by RTD in the forest zone, 37.7%-46.9% were positive for malaria parasites compared to 53%-66.6% in the savanna. The highest percentage of malaria positive cases were recorded in the North west geopolitical zone of the savanna and Kano State was the second highest in malaria prevalence. Recent health facility based studies which were conducted at Kano municipality reported widely different levels of malaria prevalence 84% [6], 64.9% [7] and 37.8% [8]. The current malaria situation across the state analyzed by pooling data on malaria cases treated at health facilities from twenty out the 44 LGAs have shown quarterly prevalence ranging from 58.2%-61.1% (2016) and 54%-61% (2017) [5]. Bunkure was not included among the 20 LGAs subjected to the situational review. Previously, we investigated the entomological parameters of malaria transmission in the LGA and reported high indoor resting density and man biting rate predominantly by *An. gambiae* sl [9]. This study is design to compare the retrospective and current prevalence of malaria and parasitaemia in the study population at Bunkure LGA. The specific objectives were to assess change in trend of five years retrospective prevalence of malaria, and to determine the current prevalence and parasitaemia in the study population.

2. MATERIALS AND METHODS

2.1 The Study Area

Bunkure Local Government Area of Kano State, North-western Nigeria, is located approximately around latitudes 10º33' N to 12º03' N and longitudes 7º34' E to 8º32' E. It has an area of 487 km^2 and a population of 170,891.The climate of the state is mainly Sudanese type of the tropical wet-dry season which is characterized by 5-6 months of rainfall (from May to October) and 6-7 months of dry season with the mean annual rainfall of 792 mm [10]. The temperature is averagely warm to hot throughout the year at about 25± 7ºC [11].

2.2 Study Population

The study population for the cross sectional survey were 400 adults and children of all ages selected from the households. For retrospective study, results of 12,387 febrile patients suspected of malaria and tested in the laboratory at the Bunkure Primary Health Care Facility laboratory, from August 2012 to December 2016 were collected and analyzed.

2.3 Inclusion/ Exclusion Criteria

The inclusion criteria in this study were individuals not on anti-malaria therapy that were

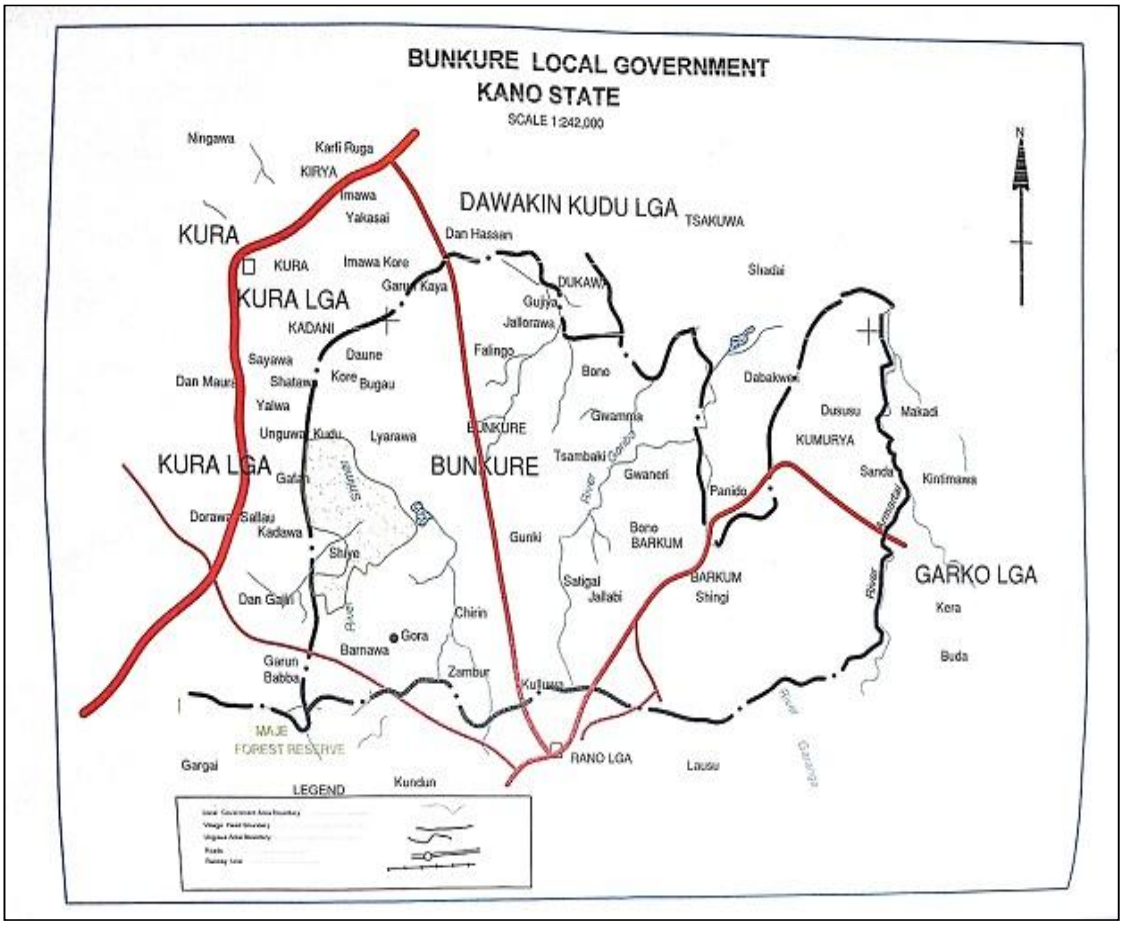

Fig. 1. Map of study area

residents of Bunkure Local Government Area while, individuals who are in transit within the study area and those on anti-malaria therapy were excluded in the study.

2.4 Sample Collection

Five year malaria cases data from August 2012 to December 2016 was obtained from monthly Summary Record Book for malaria cases at Bunkure Primary Health Care Facility. Rapid Diagnostic test was used to confirm the presence *Plasmodium* parasite in the period. Variables such as the date, age, number of individual examined and confirmed positive for malaria parasite, species of plasmodium parasite and type of malaria were recorded and extracted. Data were stratified into two age groups, <5 years and ≥ 5 years. Peripheral blood samples were collected by venipuncture as outlined by WHO protocol [12]. The blood was transferred into the ethylenediaminetetra acetic acid (EDTA)-containing tube and was taken to Microbiology laboratory of Aminu Kano Teaching Hospital for laboratory analysis.

2.5 Preparation of Smear and Microscopy

Thick and thin blood films were prepared on clean slides as described in WHO manual [12]. Giemsa's staining procedure was used for both thick and thin smears. Microscopic examination of the blood film was also performed according to WHO manual (WHO, 2015). A minimum of 100 fields were examined before a blood film was reported negative. The level of parasitaemia was recorded as low (<1000 parasites/µl of blood), moderate (1000–9999 parasites/µl of blood), and severe (≥10,000 parasites/µl of blood) [13].

2.6 Data Analysis

All data collected were analyzed by statistical package for social science (SPSS) version 20.

Descriptive statistics was carried out. Variation was tested using chi-square. Results were considered statistically significant at the P-value <0.05.

3. RESULTS

3.1 Retrospective Study of Malaria in the Study Area

The result of the retrospective study of malaria cases from August 2012 to December 2016 at Bunkure Primary Health Facility is presented in Table 1. A total of 12,387 suspected malaria patients were diagnosed using Rapid Diagnostic Test kit. Out of these cases, 9,746 (78.7%) were positive for malaria. On average 2,477 febrile patients and 1,949 malaria confirmed cases reported at the health facility each year. All the malaria infections were of *P. falciparum*. The number of suspected and confirmed cases of malaria showed a fluctuating trend in the years. There was a significant rise in the number of suspected and confirmed malaria cases in 2013 (3,266) compared to 2012 (1,798) and in 2015 (2,925) compared to 2014 (1,993), but lower in 2016 (2,405) compared to 2015. However, malaria prevalence was higher (98.1%) in 2012 than subsequent years (2013 (96.6 %) 2014 (58.3%) 2015 (79.1%) 2016 (56.3%)). There was a significant decline in the trend of malaria prevalence from 2012 to 2016 in the study area (χ^2) =47.65, P < 0.05) Table 1.

Overall positive cases of malaria in relation to gender and age groups from August 2012 to December 2016 at Bunkure Primary Health Facility are presented in Table 2. In terms of gender, 5231 (42.23%) of the total patients examined were males and 7156 (57.77%) were females. Malaria infection was higher in females (45.27%) than males (33.41%). The difference was statistically not significant (χ^2=0.975, p= 0.322). Individual greater than or equal to 5 years of age 6,250 (50.46%) were affected by malaria infection than individual less than 5 years of age 3,496 (28.22%). Malaria infection was statistically not different between the age groups (χ^2 =0.231, p=0.630).

3.2 Current Prevalence of Malaria Infection in the Study Area

The social-demographic characteristics of the participants in this study are presented in Table 3. A total of 400 individuals drawn from 5 different listed villages comprised of 269 (67.2%) male and 131 (32.8%) females participated in the study. 172 (43%) of these subjects were adults aged 20 years and above, while 68 (12.5%) were 13-19 years Table 3.

The prevalence of malaria among the participants according to age, gender and location, are presented in Table 4. Out of 400 participants examined for malaria parasite, 193 were found positive. The overall prevalence of malaria among the population studied was 48.3%. The prevalence of infection in males (32.25%) was not statistically different compared to females (Chi square (χ^2) = 0.03; p = 0.87). The age group 5–12 years had highest infection rate (14.25%) compared to other age groups (< 5 years (11.50%), 13-19 years (12.75%) and ≥ 20years (9.75%)). However there was no significant difference in prevalence of malaria among the age groups (χ^2=2.155 p=0.142). Based on location, the subjects at Bunkure had the highest prevalence 97 (24.25%) of the disease and the least 10(2.50%) was recorded from subjects at Falingo. Similarly there was no significant difference in the prevalence of malaria with respect to location (χ^2=9.161; P= 0.061).

Table 1. Malaria cases from august 2012 to December 2016 at Bunkure primary health care facility

Year	No. of Individual tested for malaria parasite	No. of individual positive for malaria parasite	Prevalence of malaria parasite (%)
2012	1978	1763	98.05
2013	3266	3156	96.63
2014	1993	1161	58.25
2015	2925	2313	79.07
2016	2405	1353	56.25
Total	12387	9746	78.67

χ^2 = 47.65, P < 0.05

Table 2. Overall positive cases of malaria in relation to gender and age groups from August 2012 to December 2016 at Bunkure primary health care facility

Variables	No. of individual tested for malaria parasite	Percent in sample	No. of individual positive for malaria parasite	Percent infected
Gender				
Male	5231	42.23	4138	33.41
Female	7156	57.77	5608	45.27
Total	12387	100	9746	78.68
		X^2=0.975, P=0.322		
Age				
<5	4430	35.76	3496	28.22
>5	7957	64.24	6250	50.46
Total	12387	100	9746	78.68
		X^2=0.231, P=0.630		

Table 3. Socio-demographic characteristics of participants at Bunkure local government area

Socio-demographic characterisics	Frequency	Percentage (%)
Gender		
Male	269	67.2
Female	131	32.8
Total	400	100
Age		
0-4	83	20.75
5-12	77	19.25
13-19	68	17.00
20 and above	172	43.00
Location		
Gurjiya	98	24.50
Bunkure	195	48.75
Jallabi	40	10.00
Falingo	35	8.75
Bono	32	8.00
Total	400	100

The parasite density and level of parasitaemia in the subjects were presented in Table 5.

All infections were of *P. falciparum.* Majority 181 (93.8 %) of these subjects constituted low parasitaemia (<1000 parasites/µl of blood), 12 (6.2%) cases were moderate (1000–9999 parasites/µl of blood) and there was no severe cases (Table 5).

4. DISCUSSION

The significant rise in malaria prevalence in 2015 compared to 2014 in the study area may be due to occurrence of epidemics attributable to differences in climatic, environmental or human behavioral risk factors such as lackadaisical attitudes towards the use of insecticide treated nets. The high number of febrile patients in 2016, in contrast to lower prevalence of malaria compared to previous years suggests the rise of non-malaria related febrile illnesses in the locality. In general, despite a fluctuating trend, the health system data showed a successive and significant decline in malaria prevalence. This significant declining pattern of malaria cases in the population studied, points to the effectiveness of the control measures being implemented in the area. This is in line with similar studies reported in Nigeria [14,15] Eritrea [16], Kenya [17] and Ethiopia [18,19].

The overall prevalence of 48.3% reported in this study was high but lower compared to previous years within the studied period in this locality. The prevalence is lower than that reported at Kura, Gwarzo, Bebeji, Shanono and Minjibir in Kano State [20]. The difference could probably

Table 4. Prevalence of malaria among the participants at Bunkure local government area of Kano State

Variables	No. of participants examined	No. positive for malaria parasite	Percentage infected
Gender			
Male	269	129	32.25
Female	131	64	16.00
Total	400	193	48.25
	X^2=0.03, P=0.87		
Age group			
0-4	83	46	11.5
5-12	77	57	14.25
13-19	68	51	12.75
20 and above	172	39	9.75
Total	400	193	48.25
	X^2=2.155, P=0.142		
Location			
Gurjiya	98	51	12.75
Bunkure	195	97	24.25
Jallabi	40	23	5.75
Falingo	35	10	2.50
Bono	32	12	3.00
Total	400	193	48.25
	X^2=9.161, P=0.061		

Table 5. Malaria parasite density among the subjects at Bunkure local government area

Level of parasitaemia	Number of subject	Percentage
Low (<1000 parasites/µl of blood)	181	93.80
Moderate (1000–9999 parasites/µl of blood)	12	6.20
High (≥10,000 parasites/µl of blood)	00	0.00

be our study was conducted during the dry season when the population of Anopheline malaria vectors and hence transmission of malaria in the area is low [21]. The prevalence rate obtained in this study is also lower than was reported in Kaduna [22], Abuja [23], Maiduguri [24], Ogun [25], Bayelsa [26] and Imo State [27]. The three states Bayelsa, Ogun and Imo are located in the forest ecological zone where the annual rainfall is much more than that of savanna and malaria transmission and is predictively higher than expected in kano [4]. Similarly, difference in rainfall part ten between Kaduna, Abuja in Guinea savanna and Kano in the Sahel could be explain the differences in malaria prevalence reported from these areas compared to Kano. However, the unusually high prevalence reported in Maiduguri compared to Kano may be attributed to local ecological variations or perhaps deteriorating health systems due to ongoing Boko haram insurgency which resulted in high number of internally displaced persons (IDPs). Lower malaria prevalence rates have also been reported previously in Kano [28], Katsina [29], Oyo [30] and Rivers State [31]. In this study, the prevalence rate obtained is consistent with studies conducted in Plateau State [32], Niger [33], Benue [34] and Ebonyi State [35]. This differential pattern is supported by malaria risk maps which shows that malaria prevalence in Nigeria varied from less than 20% in certain areas to over 70% in others [3]. In other sub-Saharan countries endemic for malaria, the prevalence rate obtained in this study was similar to that reported in the Democratic Republic of the Congo [36], Equitorial Guinea [37], Mozambique [38] and Papua, New Guinea [39]. The figure was however higher than what was reported in Ghana [40], Gambia [41], Tanzania [42] and Kenya [43].

Lack of statistical difference in malaria among males and females subjects in this study, suggests that the distribution of malaria risk is heterogeneous. This is in line with similar studies reported in Nigeria [24,44,45]. Similarly, this was

reported in Democratic Republic of Congo [36], Ghana [40], Tanzania [42] and Mozambique [38]. The observed shift in prevalence of malaria from children < 5 years of age to those ≥ 5 years old, may be related to the malaria control policy, which was focused on children under the age of 5 years and pregnant women.

5. CONCLUSION

Based on the findings of this study, there was a significant decline ($P < 0.05$) in trend of malaria prevalence in the study area, which may be attributed to the effectiveness of the ongoing control interventions in the locality. This study indicates the need for continuous monitoring of malaria prevalence using both microscopy and RDT for assessment of impact of malaria intervention in the area.

CONSENT

As per international standard or university standard written parents consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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