Research Article

A Three-Year Hospital-Based Retrospective Study of the Prevalence of Malaria among Patients Visiting Kabba Specialist Hospital, Kabba, Kabba/Bunu Local Government Area, Kogi State, Nigeria

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Abstract

Background: Malaria remains a public health concern in tropical countries, notably Nigeria. The study establishes the prevalence and frequency of malaria in health facility located in the Guinea Savannah ecological zone for 3 consecutive years in Kogi State, Nigeria.

Methods: A hospital-based retrospective study was conducted at Kabba Specialist Hospital, Kabba, in Kabba/Bunu Local Government Area (LGA), Nigeria, spanning from January 2021 to December 2023, using data extracted from the clinical register of patients obtained from the Laboratory Department. Descriptive statistics and chi-square tests were used to understand how the infection was distributed across different ages and seasons.

Results: A total of 5409 patients underwent malaria diagnostic tests, with a general malaria prevalence of 74.7%. The highest malaria prevalence was observed at the beginning of the rainy season of all the years studied. Among positive cases, the most represented age groups were < 10 and 11-20 ($p < 0.0001$), while the age group >30 years was the least represented. Annual trends in malaria prevalence varied significantly (p=0.0001) from 2021 to 2023, rising to a peak of 79.6% in 2021 and declining to 70.6% in 2022.

Conclusion: This study sheds light on the previously overlooked risk of malaria in Kabba. These findings underscore the need for enhanced surveillance and sustained interventions, particularly among individuals lest than 25 years of age at the onset of the rainy season.

Keywords: Malaria; Prevalence; Seasonal; Hospital; Kabba

Introduction

Malaria remains a major public health concern, particularly in sub-Saharan Africa, which accounts for 579,414 deaths worldwide [1]. In Nigeria, this scourge is exacerbated by the displacement of the population due to farmers vs herdsmen and arms conflicts, lack of drinkable water, sustainable distribution of long-lasting insecticide-treated nets (LLINs), and displacement of populations and destruction of healthcare facilities [2]. Malaria results from six known Plasmodium parasites, which are *Plasmodium falciparum, Plasmodium vivax, Plasmodium malariae, Plasmodium ovale, Plasmodium knowlesi and Plasmodium cynomolgi* and is transmitted by bites from infected female *Anopheles* mosquitoes. The most predominant malaria parasite species that pose the greatest threat to mankind are *P. falciparum and P. vivax* [3]. In Nigeria, there were an estimated 66.7 million cases of malaria in 2022, resulting in 194,000 deaths. This accounts for approximately 27% of the worldwide prevalence and approximately 31% of deaths from malaria. Thus, remains one of the top countries carrying the heaviest estimated burden of malaria cases [4]. Malaria accounts for 60% of outpatient visits and 30% of hospitalizations

among children under five years of age in the country [2]. The total Nigerian landmass is considered endemic for malaria, with about 27% of the world's cases of malaria. Reductions in this rate need to be accelerated if the GTS (Global Technical Strategy for Malaria 2016–2030) milestone of a 90% reduction in morbidity and mortality rates is to be achieved [5]. Supported by the High Burden to High Impact (HBHI) strategy, Nigeria has re-energized and implemented a data-driven approach to contextualize interventions at the subnational level that encompasses: treatment fees and their impact on health centres access, larviciding roles and their impact, and recurrent cases among Seasonal Malaria Chemoprevention (SMC), among others [6]. Since 2000, malaria deaths declined steadily from 861,000 to 567 000 in 2019 worldwide. However, in 2020, this downward trend of malaria prevalence was interrupted by the COVID-19 pandemic which resulted in an estimated 597,000 deaths between 2021 and 2023 [4]**.** However, over the past 5 years, between 2019 and 2023, there were substantial increases in estimated 6.8 million new cases of malaria in Nigeria [2]. To reiterate its commitment to eradicate

malaria by 2030, the Nigeria End Malaria Council (NEMC) has recommended the following interventions: 1) the promotion of Long-Lasting insecticide treated mosquito nets (LLINs); 2) seasonal malaria chemoprevention (SMC), 3) intermittent preventive treatment for pregnant women (IPTp) and artemisinin-based combination therapy (ACT) [7]. Despite these various interventions, malaria still inflicts an excruciating burden, accounting for 30.9% of deaths in Nigeria, therefore impeding socioeconomic development in endemic areas [2]. In 2024, Nigeria co-signed the Yaoundé Declaration, pledging its "unwavering commitment" to the principle that "no one should die from malaria," given the tools and systems available [5]. To mitigate the negative impact of malaria in rural high endemic areas, the World Health Organization (WHO) recommends 4 doses of "RTS,S″ malaria vaccine in children from 5 months of age, that have demonstrated a 30% reduction in malaria-related mortality in a *P. falciparum* highly endemic in west Africa However, the protective effect of the vaccine is guaranty for only 3 years [9].

The locality of Kabba in 2023 hosted the creation of Kogi State University, Kabba within its territory and the influx of thousand students could heighten the risk of exposure of mosquito's bite. Malaria can negatively impact academic excellence and reduce staff productivity. It is thus necessary to acknowledge that the newly admitted students might be aware of the preventive measures such as a cleaner environment, sanitation practices, broader health consciousness, ownership and use of LLINs. These students, being more informed, could serve as a link between health authorities and the host communities. The Kabba locality has recently witnessed an urban boom and constructed drainage by the Kogi State Government. The incoming of students in this locality might also lead to a diminished prevalence of malaria in these populations, provided that health authorities could harness them. Scale up of interventions such as Water, Sanitation, and Hygiene (WASH) practices, distribution of LLINs by international bodies such as Partnership to End Malaria (Roll Back Malaria), Global Fund, and WHO in conjunction with local health authorities, could significantly reduce the burden of the disease. Robust malaria burden studies from the communities are the cornerstone of vaccine introduction decisions and sustained other non-vaccine prevention interventions.

There is a paucity of studies on the prevalence of malaria reported in Kabba, Kabba/Bunu Local Government Area, Kogi State. Malaria continues to impose an unbearable economic burden on Nigerians. Due to shortcomings in surveillance and information systems, an increase in drug-resistant malaria and a high incidence rate in Nigeria, recent estimation of the malaria burden at the local level is imperative. The objective of this study is not only to gain an insight into malaria in Kabba, but also to re-strategize targeted preventive measures, and ultimately inform policy adjustments.

Methods

Study area

Kabba is located in Kabba–Bunu Local Government in Kogi State, and it falls within the Guinea Savannah zone. The local government area is located in the western part of the State, which falls between latitudes 7° and 31° N of the equator and longitudes 5° 41' and 6° 15 ' E with an estimated population of 145, 446 (Nigeria National Population Commission, 2006). Kabba has a tropical savannah climate with distinct wet (April to October) and dry (November and March) seasons. The annual temperature varies between 27 °C and 37 °C with relative humidity between 30% and 40% in January and rises between 70% and 80% in July to August (Mohammed et al., 2016). The soil in the LGA is predominantly sandy loam in texture. People living in these areas are subsistence farmers of various agricultural products such as yam, cassava, cocoyams, maize, millet, rice guinea corn, palm produce, cowpea and others. These farmers are also engaging in the rearing of livestock and fish. The population who lives there consists of several ethnic groups, namely, *Kabba* clans and *Omodo* clan, who are indigenous, and then the Fulani, Hausa, and Igbo, considered as non-native (Ojo and Singh, 2020). The locality of Kabba has neither a water distribution nor a sewage disposal system.

Study Design

A health facility-based retrospective study was conducted to determine the 3-year trend prevalence of malaria by reviewing the laboratory registration book that contains thin and thick smears for the detection of Plasmodium at the Kabba Specialist Hospital, Kabba, Kabba/Bunu LGA from January 2021 to December 2023.

Study Participants and Quality Control

The study participants were all individuals who were suspected for Plasmodium infection and gave a blood sample for laboratory diagnosis during the study period. Socio-demographic and laboratory results were reviewed from the laboratory registration book and collected by Excel worksheet designed for the purpose. According to standard operating procedure (SOP) of the Kabba Specialist Hospital, blood examinations were done using thin and thick blood films stained with 10% Giemsa for malaria parasite test performed on each blood sample. Thick blood films were taken as positive if one or more malaria parasites have been observed and, negative if no parasites were seen after examining 1,000 white blood cells. After blood examinations completed, infected patients were treated based on the national guideline.

Data Source

The Kabba Specialist Hospital, Kabba, provides a secondary level of care. It is a 30-bed facility with both inpatient and outpatient services. An average of 70 patients per day is being diagnosed by qualified medical personnel. The laboratory section of the facility is headed by a qualified medical laboratory scientist. The laboratory only processes requests from within the hospital and case of referrals. In the health facility, malaria tests are conducted when requested by the physicians.

Inclusion and Exclusion Criteria.

Participants with a complete set of data, such as age, year and date of diagnosis were included in the study, whereas individuals who had incomplete recorded information in the laboratory register were excluded.

Data Collection

Relevant data were methodically extracted from the hospital's laboratory records using a structured Excel spreadsheet. The extracted variables included age and diagnostic test results for malaria. Age was

categorized into brackets of < 10, 11–20, 21–30, > 30 years. Diagnostic methods comprised blood smear microscopy examination. Data collectors were trained vis-à-vis the data extraction tool, variables of interest, and the objectives of the study.

Statistical Analysis

Prior to the statistical analysis, data were coded and checked for its completeness using Excel software. SPSS Statistics software version 20.0 (IBM Co., Armonk, NY, USA) was used for analysing data. Descriptive statistics was used to show the distribution of malaria and typhoid prevalence in terms of individuals' sex, year and season. The counted data were expressed as a percentage and compared by Chi-square test. $P < 0.05$ was considered statistically significant.

Results

General Characteristics of Data Collected

A total of 5407 patient records were extracted from the laboratory records of those who attended the Specialist Hospital, Kabba, and required laboratory tests done during the studied period. Out of these, there were a total of 1503 (27.8%) patients in 2021, 1952 (36.1%) in 2022 and 1952 (36.1%) in 2023. There were 27.0% (1459) children under 10 years, 7.5 % (407) patients in the age group 11–20 years, 14.7 % (793) patients in the age group 21–30 years, and 50.8% (2748) patients in the age group >30 years. Males made up 75.4% (3006) of positive cases of malaria while female made up of 78.7% (1035).

Distribution of Malaria Prevalence by Age Group over Time (2021–2023)

The prevalence of malaria was grouped by age according to time and presented in Table 1. Irrespective of the age group, malaria's prevalence remains very high each age group. The highest prevalence was found in the age groups of <10 (82.4%) and 11-20 (82.8%), while the age group >30 years had the lowest prevalence (68.9%).

Seasonal Malaria Prevalence/Frequency and Variation over Time (2021-2023)

The highest malaria prevalence in 2021 (Figure 1) was observed beginning of the rainy season (March and April), while the lowest prevalence was observed during the long rainy season (May). In 2022

Table 1: Malaria prevalence by year and age group over the period of 2021–2023.

| Year	Negative n (%)	Positive n (%)	Total	P-value
	Malaria Parasite		**Total**	**P-value**
2021	306 (20.4%)	1197(79.6%)	1503 (28%)	
2022	574(29.4%)	1378(70.6%)	1952 (36%)	0.0001
2023	486(24.9%)	1466(75.1%)	1952(36%)	
Total	1366(25.3%)	4041(74.7%)	5407(100%)	
Age				
Male	412 (24.6%)	3006 (75.4%)	3418 (53.2%)	
Female	954 (21.3%)	1035 (78.7%)	1989 (46.8%)	0.0001
Total	1366(25.3%)	4041(74.7%)	5407(100%)	
Age group				
<10	257 (17.6%)	1202(82.4%)	1459 (27%)	
20-Nov	70(17.2%)	337(82.8%)	407(7.0%)	
21-30	185 (23.3%)	608(76.7%)	793 (15%)	0.0001
>30	854 (31.1%)	1894(68.9%)	2748 (51%)	
Total	1366(25.3%)	4041(74.7%)	5407(100%)	
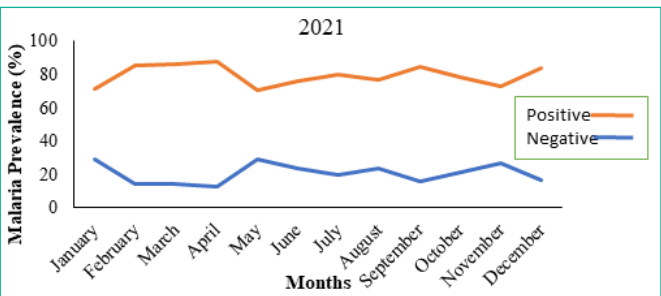
Figure 1: Seasonal trend of malaria prevalence in Kabba Specialist Hospital, Kabba, 2021.
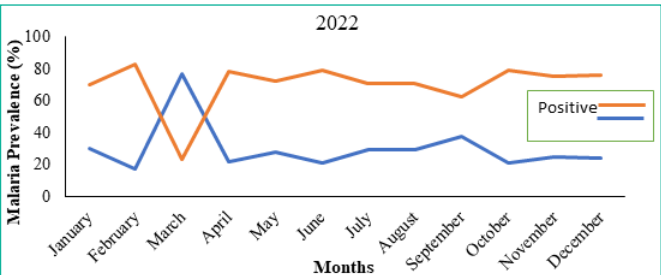

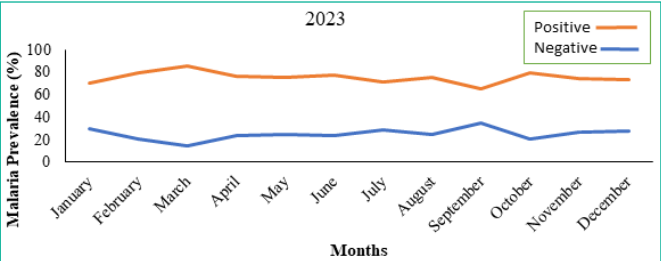**Figure 2:** Seasonal trend of malaria prevalence in Kabba Specialist Hospital, Kabba, 2022.

Figure 3: Seasonal trend of malaria prevalence in Kabba Specialist Hospital, Kabba, 2023.

Figure 4: Annual trends of malaria positivity rate in Kabba Specialist Hospital, Kabba, Kogi State Nigeria (2021–2023).

recorded the high malaria prevalence in February (Figure 2) while in 2023, the month March was the highest (Figure 3).

Annual Trends in Total Malaria Cases

Figure 4 depicts a seasonal variation in malaria prevalence observed over the 3 examined years, with a significant difference (p < 0.0001). Malaria was found in 4041 (74.7%) of the 5407 suspected cases using microscopy. The highest proportion of malaria cases was observed in 2021 followed by 202023, while 2022 had the lowest. On average, 1347 cases of malaria were registered annually. Consecutive to a short decline of the proportion of confirmed malaria cases in

2022, the year 2023 recorded a steady upsurge of malaria cases. In general, the proportion of positive slides increased by 6% from 2022 to 2023 (Figure 4).

Disussion

To get back the world on track to sustain gains to achieve the GTS goals by 2030 aiming at accelerating the reduction of malaria incidence and mortality in the top 10 countries contributing to 70% of the malaria burden through enhanced political will, use of data for action, it is crucial to contextually investigate the epidemiological panorama and the yearly trend of malaria. Based on hospital records, the study established malaria's prevalence over 3 years in the Kabba Specialist Hospital, Kabba. Our findings indicated that malaria remains a major public health challenge in the study area from 2021 to 2023. Over these 3 years, the average hospital malaria prevalence of about 75.1% was reported during each year. Knowing that part of the population might have exhibited a poor health seeking behaviour for malaria, this prevalence is under-estimated for the entire community, or may represent only severe cases leading to consultation. The results contrasted with findings from other investigations. Studies in Arsi Negelle Health Center, Kombolcha Health Center and Dembecha Health Center found that overall prevalence was 11.45%, 7.52%, and 16.34%, respectively [10,11,12]. Moreover, our findings represent one of the higher rates of infection compare to the subnational average malaria prevalence which is pegged at 22% [2,6]. However, the high malaria prevalence in the present study was consistent with findings from Forest–Savannah Transition Ecozone of Central Cameroon (60%) and in Uganda (65.8%) [13,14].

The locality is crossed by rice field and urban farming which could be responsible for the proliferation of mosquito breeding habitats, as seen in Ethiopa [15]. Malaria's prevalence was higher at the beginning of the rainy season than during the other seasons, regardless of the year. This could be explained by the fact that at beginning the raining season, the pools of water (potential breeding sites) and rice fields which favour the development of anophelines are more abundant. In addition, there is intensification of daily activities such as planting that may increase inhabitants contact with breeding sites such as rice field and cultivated areas. It is worthy notice that, more than four years have elapsed since the last distribution of LLINs according to hospital authority, therefore, reexposing inhabitants to mosquito bites. These results are similar to those of some studies conducted in Ethiopia (2009), Brazil (2015) and Cameroon (2006) on the association between seasons, malaria's transmission and prevalence [16,17,18].

In terms of age groupings, our findings revealed that the age group of <10 years had the high prevalence of malaria, followed by 11-20. These results are in agreement with studies in Ethiopia [11,19,20]. This study found that a higher prevalence of malaria in female than males and the relationship between the sexes were statistically signifcant (p= 0.0001). This is in agreement with fndings from Sierra Leone and Nigeria where females also showed a higher prevalence of malaria [21,22].

The frequency of malaria cases peaked at 79.6%, in 2021, but dropped to 70.6% in 2022. However, in 2023, it increased to 75.1%. The decrease in malaria cases in 2022 was attributed to the fragile security caused by kidnaping and arms robbery that might have

lower the community health seeking behaviour and minimize outdoor activies. Months and seasonality are keys players in malaria transmission. Malaria prevalence was above 75% irrespective of the month and seasons in the present study, although the highest number of cases was found in March and April. These findings contrasted with findings from other investigations conducted Ethiopian [23,24]. The beginning of rain season creates an ideal breeding space for female Anopheles mosquitos to strive resulting in increased number of malaria cases. Over the three years under consideration, the malaria trend has revealed no consistent pattern of prevalence in different years. Interannual and a slight intra annual variation in malaria prevalence scenery have been observed, as there have been significant differences in the monthly disease burden distribution [25-27].

Limitations of the Study

The present research work had three main limitations. This study also did not include fatal cases. Incomplete laboratory registration book specifically on anaemia and location of the patients. The study lacks qualitative information about the ownership and usage of LLINs that have implemented for the last 8 years.

Conclusions

A high malaria prevalence was noted from hospital records in Kabba Specialist Hospital, Kabba, from 2021 to 2023. Moreover, malaria transmission peaks from March to April, coinciding with the planting seasons. The most affected group of the population were the productive age groups (>10 11-30 years old) who are engaged in farming activities. An elevated malaria prevalence could have hurt the health of school-aged children and the Kabba subsistence economy at large. Therefore, health authorities and educational institutions at all levels are required to intensify health education among the community and the daily labourers. Sustainable distribution of LLINs for the control and prevention of malaria should be ensured.

Ethical Approval and Consent to Participate

The study adhered to the Helsinki Declaration principles. Approval was granted by the Kogi State Institutional Review Board of the University and permission was obtained from the management of the Kabba Specialist Hospital. Throughout the study, stringent measures were taken to ensure compliance with ethical standards and maintain the confidentiality of patients' data.

Authors' Contribution

Conceptualization: Bonaventure Tientche, Eniola K. I. T.

Data curation: Yusuf Lamidi, Olubiyo Comfort Kehinde.

Formal analysis: Bonaventure Tientche, Yusuf Lamidi, Olubiyo Comfort Kehinde, Eniola K. I. T.

Investigation: Yusuf Lamidi, Olubiyo Comfort Kehinde.

Methodology: Bonaventure Tientche, Yusuf Lamidi.

Supervision: Eniola K. I. T.

Writing– original draft: Bonaventure Tientche,

Writing – review & editing: Bonaventure Tientche, Yusuf Lamidi, Olubiyo Comfort Kehinde, Eniola K. I. T.

Credit Authorship Contribution Statement

Bonaventure Tientche: Writing–review & editing, writing–original draft, software, methodology, Formal analysis, Conceptualization. **Yusuf Lamidi**: Writing – review & editing, Validation, Data curation, Investigation, Formal analysis. **Olubiyo Comfort Kehinde**: Writing – review & editing, Validation, Data curation, Investigation, Formal analysis. **Eniola K. I. T.** Methodology, Formal analysis, Conceptualization, Validation,.

Acknowledgments

Data Availability

All the data are freely available within the manuscript.

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