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Research Article

Prevalence of Haemozoin among Patients with *Plasmodium falciparum* Malaria in Some Selected Hospitals in Bakori and Funtua, Katsina State, Nigeria

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ABSTRACT
In malaria diagnosis and accurate assessment are critical to clinical management. Intraleukocytic malaria pigment characteristics were explored as it relates to severe falciparum malarial disease. This study evaluates the prevalence of haemozoin among patients with plasmodium falciparum malaria in some selected hospitals in Bakori and Funtua, Katsina state, Nigeria. Intraleukocytic malaria pigment (hemozoin) were detected on thin films by counting 500 leukocytes and determining the proportions of haemozoin-containing neutrophils, lymphocytes and monocytes. A total of 392 blood samples were stained and examined under the light microscope using 100x objective lens. Immunochromatography tests based on the capture of the parasite antigen from the peripheral blood using monoclonal anti-HRP-II antibodies were used for detecting Plasmodium falciparum antigens, as well as the presence and quantity of the malaria pigment in leukocytes in smears. The findings of this study recorded the highest number of intraleukocytic malaria pigment within age group 2-10years, with 40.8% prevalence rate collectively, and the prevalence of haemozoin related to sex, the females had a high prevalence compare to males this could be due to a combination of biological factors, social inequalities and challenges in accessing preventive care.

Keywords: Hemozoin; Immunochromatography; Intraleukocytic; Leukocytes; Neutrophis

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INTRODUCTION

Malaria is one of the most common and important parasitic diseases worldwide. It affects the lives of almost all people living in the area of Africa defined by the southern Sahara Desert in the north, and latitude of about 28° in the south (WHO/UNICEF, 2003). About 40% of the world's population lives in malaria-endemic areas. Over 90% of all cases of life-threatening malaria occur among African children. Majority of deaths occur in children under five years of age. Severe malaria is the commonest cause of death, particularly in rural areas that are not serviced by formal health systems. Malaria-associated immunosuppression has been widely investigated. It has been suggested that malaria pigment, also known as haemozoin may participate in the mechanisms underlying this immunosuppression (Coban *et al.,* 2002). For prognosis, malaria is a potentially life-threatening parasitic disease caused by infection with *Plasmodium* protozoa transmitted by an infective female *Anopheles* mosquito. *Plasmodium falciparum* infection carries a poor prognosis with a high mortality if untreated, but it has an excellent prognosis if diagnosed early and treated appropriately.

Rapid and accurate diagnosis and prognostic assessment are critical to clinical management. In 6027 prospectively studied patients diagnosed with

severe malaria we assess the the prognostic value of peripheral blood film counts of malaria pigment containing polymorphonuclear leukocytes (PMNs) and monocytes have been assessed among patients with severe malaria (White, 2022). Currently malaria control is heavily dependent on chemotherapy, to which resistance is quickly evolving in endemic regions (Nosten *et al.,* 2000). One of the main interventions of the global malaria control strategy for effective disease management is prompt and accurate diagnosis (WHO, 1993). In the tropics, malaria diagnosis is carried out mainly by microscopic methods while rapid diagnostic techniques (RDTs) are available mainly in non-endemic settings (Fitri *et al*., 2022). This study aimed to evaluate the prevalence of haemozoin among patients with *Plasmodium falciparum* malaria in some selected hospitals in Bakori and Funtua, Katsina state, Nigeria.

MATERIALS AND METHODS

Study Area

A randomized study was conducted in Comprehensive Hospital Bakori and General Hospital Funtua (Figure 1). The study was carried-out over a period of five months from February 2024 to June 2024.

Immunochromatography Test (ICT) tests based on the capture of the parasite antigen from the peripheral blood using monoclonal anti-HRP-II antibodies and anti-aldolase antibodies against the parasite antigen targets were used (Moody, 2002).

Thick and thin blood films as described by Benishangul (2002), were made on clean slides and labelled accordingly as recommended by (WHO, 2002). To prepare for each thick film, 2 drops of blood sample were laced on a clean grease-free glass by means of a pasteur pipette and, and the blood will be gently spread for 20 seconds using the corner of a second slide to defibrinate the blood and to obtain a round smear. The slide was immersed for 30 minutes in the staining trough, containing Giemsa solution prepared with buffered water in the ratio of 1:20. Thereafter the slide was rinsed and allowed to dry (Benishangul, 2002).

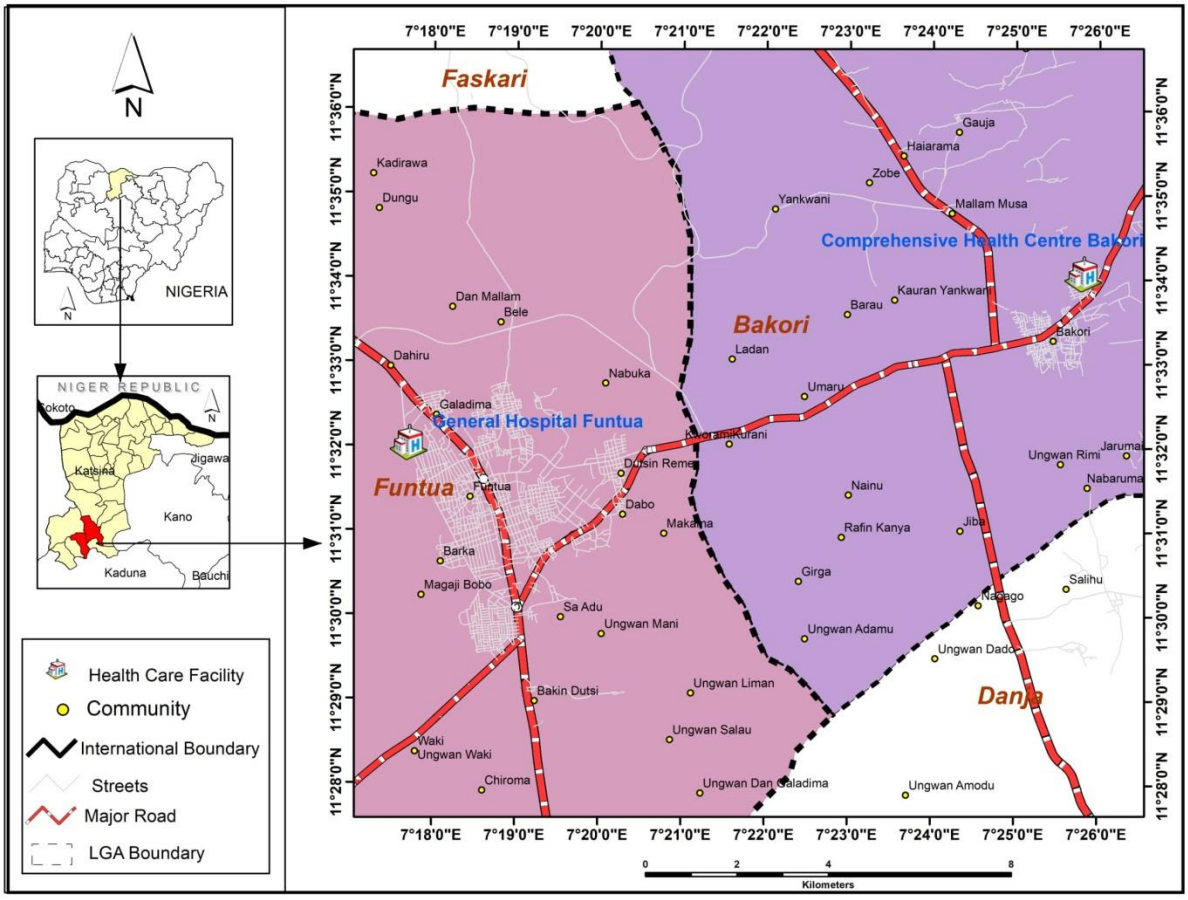

Figure1 map of Bakori and Funtua showing sampled Hospitals (GIS FUDMA 2025)

This were done using thin smears. The thin smears were fixed in absolute methanol for one minute and before staining. These smears were then stained using Giemsa. Then white blood cell differential counts manually determined. Intraleukocytic malaria pigment were detected on thin films by counting 500 leukocytes and determining the proportions of haemozoin-containing neutrophils, lymphocytes and monocytes.

Microsoft Excel and Statistical Package for Social Science (SPSS Version 20 IBM Statistics) software was used to analyse data. Inferential statistics where data was presented in the results as tables and figures. Chi square was used for prevalence association between gender and age groups based on disease severity.

RESULTS

A total of 392 were examined, 264 (67%) had a mild malaria and 59 (15.1%) had a severe malaria. The chi-square (χ^2 = 784) and p-value = 0.000 shows that there was significant association between parasitaemia with pigment (Table 1) Therefore the null (H_o) is rejected, which states there is no present of the intraleukocytic malaria pigment (haemozoin) in a patient with severe *falciparum* malaria.

General hospital Funtua had a higher prevalence of 51.5% when compared to comprehensive hospital Bakori which had a prevalence of 48.5%. The chi-square (χ^2 = 3.588) and p-value = 0.166 shows that there is no significant association between parasitaemia and health facility (Table 2).

The prevalence of parasitaemia in relation to sex, the females had a high prevalence of 55.4% compared to males 44.6%. %. The chi-square (χ^2 =**1.149**) and p-value = 0.563 shows that there is no significant association between parasitaemia and sex (Table 3).

The age group 2-10yrs had the highest prevalence of 40.8% malaria, while the age group 71-80yrs had the lowest prevalence of 0.3% malaria and the chi-square (χ^2 =14.268) and p-value = 0.579 shows that there is no significant association between parasitaemia and age group (Table 4).

Table 1: The prevalence of parasitaemia in respect to pigment in Bakori and Funtua (n=392)

Parasitaemia/Pigment level	Frequency	Prevalence (%)
Mild (P+)	264	67.3
Moderate (P++)	69	17.6
Severe (P+++)	59	15.1
χ^2	784.000	
p-value	0.000	

Table 2: The prevalence of parasitamia in relation to health facility

	Health facility	
Parasitaemia	CHB	GHF
P+	120	144
P++	40	29
p+++	30	29
Total	**190**	**202**
Prevalence (%)	48.5%	51.5%
χ^2		3.588
p-value		0.166

CHB: Comprehensive Hospital Bakori. GHF: General Hospital Funtua

Table 3: The prevalence of parasitaemia in relation to sex

	Sex		**Total**
Parasitaemia	Male	Female	
P+	114	150	
P++	31	38	
P+++	30	29	
Total	175	217	392
Prevalence (%)	44.6	55.4	
χ^2			**1.149**
p-value			**0.563**

Table 4: The prevalence of parasitaemia in relation to age group

		Age group									Total
Parasitaemia		1m-1yr	2-10yrs	11-20yrs	21-30yrs	31-40yrs	41-50yrs	51-60yrs	61-70yrs	71-80yrs	
	P+	46	110	31	27	19	12	10	9	0	
	P++	10	27	6	8	7	8	2	0	1	
	P+++	9	23	7	6	6	4	3	1	0	
Total		65	160	44	41	32	24	15	10	1	392
Prevalence (%)		16.6	40.8	11.2	10.5	8.2	6.1	3.8	2.6	0.3	
χ^2											**14.268**
p-value											**0.579**

DISCUSSION

The prevalence 15.1% of severe malaria was recorded in the study localities. This prevalence is lower than 43.1% reported by Wogu *et al.* (2017) in Rivers State, Nigeria. General hospital Funtua had a higher prevalence of 51.5% when compared to comprehensive hospital Bakori which had a prevalence of 48.5%. The high prevalence in Funtua could be due to the presence of some water canals from Mai Ruwa reservoir and Gwagwaye reservoir that passes around the town of Funtua and other clogged gutters and drains. The prevalence of parasitaemia in relation to sex, the females had a high prevalence compare to males this could be due to a combination of biological factors, social inequalities and challenges in accessing preventive care. This finding is not in line with the findings of Raasti *et al,* (2024). The findings of this study recorded the highest number of intraleukocytic malaria pigment within age group 2-10 had 40.8 %. This prevalence could be due to low immunity at that age group. This finding is not in line with the findings of Raasti *et al,* (2024) who recorded high prevalence in age group of 40-60 years. This study is in line with findings (Nwaorgu, and Orajaka, 2011) in Awka North Local Government Area, Anambra State South East Nigeria.

CONCLUSION

This study recorded prevalence of severe malaria an overall 15.1% within the hospitals in Bakori (CHC) and (GHF) Funtua. Most of severe malarial cases based on my research were associated to female due to presence haemozoin and some accessed biological factors. Intraleukocytic malaria pigment (aemozoin) was more prevalent among 2-10years.

More research should be done using Sysmex XN450 Haemotology Analyzer Full Blood Count which can also provide information on the viability of complete blood count.

Microscopic examination proved to be more effective in detection of low parasite density; as such, microscopic examination should be constantly and widely employed in laboratory for adequate diagnosis and detection of malaria parasite and its kind. Parasitaemia is important in diagnosis of malaria, it should not be used only as an indicator of malaria severity.

Governmental and non-governmental organization should be continued carry out awareness campaign on the use of ITNs, Environmental hygiene, as well as preventive drugs to reduce the incidence in the study area. Also, proper environmental sanitation is required to remove mosquitoes from their breeding.

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