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In the Absence of Effective Malaria Parasite Sentinel System- a Cross-Sectional Study to Assess Prevalence of *Plasmodium spp* Infection and Malaria among Patients at Federal Medical Centre Birnin-Kebbi, Kebbi State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Short Research Article

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ABSTRACT

Aim: This research assessed the prevalence of *Plasmodium Spp* infection and malaria among patients at Federal Medical Centre Birnin-Kebbi, Kebbi State, Nigeria

Methodology: The study utilized a retrospective cross-sectional descriptive data collected from January to December, 2018 to determine the prevalence of malaria parasite infection and prevalent *Plasmodium spp* infection among different age groups and sexes among patients attending Federal Medical Centre, Birnin Kebbi. We analysed secondary data of hospital records of 5,645 feverish patients attending general out patients' department and medical laboratory department at the study area. Blood samples from the patients were collected and examined using thin and thick-blood smear slides technique for the presence or absence of parasites by trained microscopists.

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Results: The prevalence of malaria parasite in the study area was 17.1%. *P. falciparum* was the most prevalent species of malaria parasite (99.69%) among the positive cases in the study area, while *P. malariae* was identified in 3 of the positive slides representing 0.31% case. Malaria positivity was highest (52.49%) among children aged 0-10years. Test of association between malaria positivity and patients' age was statistically significant ($p<0.05$). Among patients who tested positive to malaria parasite, more than half (53.37%) of them were female.
Conclusion: Presence of *Plasmodium malariae* may be indicative of trans-border transmission of the disease due to the proximity of the study area to international border and thus calls for effective malaria parasite surveillance system and further inter boarder research.

Keywords: Malaria; Plasmodium spp; malaria prevalence; sentinel system.

1. INTRODUCTION

Globally, malaria remains one of the major public health concerns leading to high morbidity and mortality. Concerns on the importance of controlling and eventual elimination of malaria and malaria-related deaths in the world led to its inclusion in the Sustainable Development Goals (SDGs) and Goal 3 (Target 3.3) was to end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases [1]. Symptoms of malaria include fever, headaches, chills, vomiting, muscle pain and fatigue, which are often neglected or misdiagnosed as other illnesses. Hence, the high morbidity and mortality of malaria among poor populations with limited health care facilities especially in Nigeria, where elimination of malaria remains a challenge [2,3].

Malaria remains endemic in Nigeria with more than three-quarter of the population reporting more than one episode per year. Children under-five and pregnant women were at higher risk of malaria infection and death. For instance, malaria accounted for 36.3% and 23.7% (based on Expert Algorithm Verbal Autopsy vs Physician Coded Verbal Autopsy) of death among children aged 1-59 months in Nigeria [4]. Data revealed that the country's microclimate, topography, population densities, cultural practices, etc also contribute towards the spread of the disease [5]. In the last decade, the fight against malaria and its propagating agents in Nigeria and across Africa has not been as effective due to the emergence of resistant species of the parasites, coupled with the advent of vectors that appear resistant to commercially available insecticides [6].

In 2014, forty Malaria Parasite Sentinel Surveillance (MPSS) sites were established across the country to collect data on malaria incidence, signals of emergence of possible treatment failure or parasite resistance to currently administered antimalarial medicines and document non-routine data on slide positivity rate, parasite density, parasite species and strains. Establishing these sites was aimed at systematic collection of basic information on febrile cases presented in MPSS centres and provision of information on trend of malaria burden in the respective localities in the states. Invariably, a functional MPSS site plays a vital role in the quest of eliminating malaria in malaria burdened countries like Nigeria. However, in the absence of a functional MPSS, a community-based malaria surveys as a means of monitoring the impact and effectiveness of malaria control measures and programs at different levels becomes critical. Data obtained from such studies would aid in defining up-to-date malaria burden as well as develop suitable measures of intervention whilst attempting to address adequate control measures for the disease throughout the country.

To this end, this study assessed the prevalence of malaria in patients attending Federal Medical Centre Birnin-Kebbi, Kebbi State, Northern Nigeria and also attempted to establish the prevalence of *Plasmodium spp* infection among different age groups and sexes of the patients, to analyse the relationship of malaria infection and gender and to study the relationship between malaria infection and age groups. This is with a view to provide relevant policy information to relevant government agencies involved in the control of malaria. The study also assessed the incidence of other species of Plasmodium responsible for malaria infection in the health facility.

2. MATERIALS AND METHODS

2.1 Blood Samples Collection and Processing

A sterile 22G needle fitted with syringe was used to collect five milliliters (5ml) of whole blood using standard technique of vein puncture and

transferred into ethylene diamine tetra acetic acid (EDTA) bottles, allowed to properly mixed and samples properly labeled. Thick and thin blood smears were prepared together on a single slide from the blood collected in the EDTA bottles using malaria slides template. The thin film was fixed with absolute methanol, the slides were allowed to air dry and blood slides were stained with a 5% Giemsa solution.

2.2 Light Microscopic Examination

To generate the record used in the study, thick-blood smear slides were examined for the presence or absence of parasites by certified Medical Laboratory Scientists who had been trained through the World Health Organisation (WHO) External Competency Assessment for Malaria Microscopy scheme and Malaria Action Programme for States (MAPS). Each microscopist examined a minimum of 100 high-power magnification fields before the slide was classified as negative as per national and WHO guidance. Each microscopist read a maximum of 20 slides per day. Accurate malaria diagnosis was defined as concordance in the presence or absence of parasites. Two independent microscopists cross-checked each of the slides and a third senior independent microscopist was called when necessary as a tie-breaker when the first two readers disagreed.

2.3 Inclusion and Exclusion Criteria

All patients with fever attending general out patients' department and medical laboratory department of the Federal Medical Centre Birnin Kebbi in all age group and both sexes were included. All patients with fever attending general out patients' department but not medical laboratory department of the federal medical centre Birnin Kebbi in all age group and both sexes were excluded.

2.4 Data Analysis and Result

The data obtained were analyzed using STATA 12 employing relevant statistics. The analysis was done at univariate and bivariate level of the analysis to explore the objectives of the study.

3. RESULTS AND DISCUSSION

Table 1 shows the distribution of participants by their demographic characteristics and result of malaria test carried out during the study. Highest proportion (44.50%) of the patients was children (dependant/ unemployed) aged 0-10 years. The least represented patients were aged 51-60 years (2.29%). Furthermore, sex distribution among the respondents' shows that there were more females (54.33%) than males (45.67%) among the respondents. Less than twenty percent of the respondents however tested positive with malaria parasite.

Table 1. Percentage distribution of participants by demographic characteristics

Characteristics	Frequency	Percent
Age group		
0-10	2,512	44.50
11-20	1,010	17.89
21-30	976	17.29
31-40	627	11.11
41-50	232	4.11
51-60	129	2.29
61 and above	158	2.79
Sex		
Male	2,578	45.67
Female	3,067	54.33
Malaria Test		
Positive	965	17.09
Negative	4,680	82.91
Total	5, 645	100

Table 2 shows the prevalence of species of malaria parasites within the study area. A total of 5,645 cases were examined. Of the total cases examined, 965 cases were positive for malaria parasite. Further microscopic examination was carried out on the 965 positive cases to determine the species of malaria parasite presents in the study area. *P. falciparum* was the most prevalent species of malaria parasite (99.69%) among the positive cases in the study area. Other specie identified in the study area was *P. malariae* (0.31%).

Table 3 explores the relationship between malaria positivity and gender in the study area. Among the patients who tested positive to malaria parasite, more than half (53.37%) of them were females. The chi-square test of the relationship between patients' sex and malaria test result was however not statistically significant ($p > 0.05$).

Table 4 shows the distribution of plasmodium parasite species among age groups of patients in the study area. Generally, malaria parasite positivity decreased as the age increased. More than half (52.49%) of patients who tested positive to malaria parasite were aged 0-10 years. Less than three percent of patients who tested positive were aged between 51 and above. The test of relationship between malaria parasite positivity and age group was statistically significant ($p<0.01$).

3.1 Discussion

Malaria is holo-endemic and stable in Nigeria where more than 90% of the total population is at risk of malaria [7]. In this study, prevalence rate of malaria infection was 17.09% as assayed via the gold standard of malaria detection (microscopy). This is at par with the study carried out by Anumudu et al [8], who reported similar prevalence 17%. This prevalence is however lower compared to studies carried out in other different locations in Nigeria. For instance, Onyido et al [9] reported a prevalence rate of 70.8% in Anambra state. Igbenegbu et al [10] reported 21.1% prevalence rate in Iwo, Osun state while Oladele et al [6] recorded prevalence rate of 64.9% in Kano. Factors for variance in prevalence across different locations may be predicated upon the time of the year when the studies were carried out and the geographical zone of each locations. However, this present study cut across the whole period of a year.

Table 2. Distribution of various malaria *Plasmodium* species

Number Examined	Result	*P. falciparum*	*P. vivax*	*P. malariae*	*P. ovale*	*P. knowlesi*
965	Positive	962	-	3	-	-
4,680	Negative	-	-	-	-	-
5,645		99.69%		0.31%		

Table 3. Bivariate analysis of the relationship between malaria positivity and gender

Gender	Malaria Test Result			
	Positive N(%)	Negative N(%)	Chi square value (x^2)	P-value
Male	450 (46.63)	2,128 (45.47)	0.4354	0.509
Female	515 (53.37)	2,552 (54.53)		
Total	**965 (100.0)**	**4,680 (100.0)**		

Table 4. Distribution of Plasmodium species in relation to age groups

Age group	Malaria Test Result			
	Positive N (%)	Negative N (%)	Chi square value	P-value
0-10	506 (52.49)	2,006 (42.86)	92.9733	0.000
11-20	224 (23.24)	786 (16.79)		
21-30	101 (10.48)	875 (18.70)		
31-40	79 (8.20)	548 (11.70)		
41-50	26 (2.70)	206 (4.40)		
51-60	16 (1.66)	113 (2.41)		
61 and above	12 (1.24)	146 (3.12)		
Total	**964 (100.0)**	**4,680 (100.0)**		

Furthermore, findings from the study shows that only two species of plasmodium were identified in the study area viz; *P*. *falciparum* and *P*. *malariae.* The former was the most prevalent specie accounting for 99.69% cases in line with the established evidence from similar studies. For example, Mouzin [11] reported that the most prevalent malaria parasite species is *Plasmodum falciparum* (>95%).

The malaria prevalence among sexes was not statistically significant ($p>0.05$). Malaria parasitaemia was slightly higher in female (53.37%) than in male (46.63%) at the bivariate level of the analysis. One plausible reason for this may be as a result of low immunity especially among women with pregnancy, since all groups of female were included in the study. Pregnant women, especially primigravidae and secondigravidae, lose the acquired semi-immunity of adulthood, and are more prone to malaria than other adults [12].

Further analysis of the relationship between age and malaria parasite positivity among the patients in the study area was statistically significant ($p<0.01$). Children aged 0-10 years were more affected as they represent more than half of patients who tested positive to malaria parasite. Similar finding was also reported by Syafruddin et al*.* [13] and WHO [14]. The World Malaria Report showed that infants and children under 5 years were among the population at risk of malaria infection. This may be attributed to low transferred maternal immunity or infection acquired through the mother. This suggested inadequate protection, greater exposure to mosquito bites which may be predicated upon various predisposing environmental and maternal factors.

4. CONCLUSION

The study further confirms that malaria remain an epidemiological infection of concern in the study area and Nigeria in general. The infection cut across all age groups but higher among the dependants and unemployed (0-10years). This in turn can be a distraction to the employed and care givers in the society as well as affecting the economic productivity of the state as the sick ones are being taken care of. There is presence of other species of plasmodium (*P. malariae*) in Kebbi, however Plasmodium falciparum remains the predominant malaria species responsible for malaria infection in this region like most other places in Nigeria, Africa and the world generally. Meanwhile the presence of *Plasmodium malariae* may be due to the proximity of this health facility to the Republic of Niger. This may be subjected to further inter boarder research work in this direction.

CONSENT AND ETHICAL APPROVAL

Ethical approval was obtained from the Hospital Ethical Committee; Kebbi State Ministry of Health with reference number SMOH/42/S/5/5673, also individual consent from each patient was assured of anonymity and confidentiality.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. World Health Organization. World health statistics 2016: monitoring health for the SDGs sustainable development goals. World Health Organization; 2016.
2. World Health Organization. Guidelines for the treatment of malaria. World Health Organization; 2015.
3. Ragavan KV, Kumar S, Swaraj S, Neethirajan S. Advances in biosensors and optical assays for diagnosis and detection of malaria. Biosensors and Bioelectronics. 2018;105:188-210.
4. National Population Commission (Nigeria), Federal Ministry of Health of Nigeria, National Bureau of Statistics (Nigeria), Institute for International Programs at Johns Hopkins Bloomberg School of Public Health: A Verbal/Social Autopsy study to improve estimates of the causes and determinants of Neonatal and Child mortality in Nigeria, 2014. In. Abuja, Nigeria, and Baltimore, Maryland, USA; 2016.
5. Umaru ML, Uyaiabasi GN. Prevalence of malaria in patients attending the general hospital Makarfi, Makarfi Kaduna–State, North-Western Nigeria. American journal of infectious Diseases and Microbiology. 2015;3(1):1-5.
6. Oladele OV, Onuoha SC, Hamafyelto HS, Omisope O, Fauziyya A, Akindigh M, Abdullahi T, Ilu ML, Ikeh E. Prevalence of malaria infection among patients attending Murtala Muhammed specialist hospital Kano, Nigeria. African journal of clinical and experimental microbiology. 2018;19(3).

7. Sam WS, Adekunle NO, Adeleke MA, Dedeke GA, Oke OA, Abimbola WA, Surakat OA. Epidemiological factors in prevalence of malaria parasites in primary health facilities attendees, Ogun State, Nigeria. Malaria chemotherapy control & elimination. 2014;3(1):1-6.
8. Anumudu CI, Adepoju A, Adediran M, Adeoye O, Kassim A, Oyewole I, Nwuba RI. Malaria prevalence and treatment seeking behaviour of young Nigerian adults. Annals of African Medicine. 2006;5(2):82-8.
9. Onyido AE, Obinatu SC, Umeanaeto PU, Obiukwu MO, Egbuche MC. Malaria prevalence and mosquito vector abundance in Uli town, Ihiala local government area, Anambra State, Nigeria. African Journal of Biomedical Research. 2011;14(3):175-82.
10. Igbeneghu C, Odaibo AB, Olaleye DO. Impact of asymptomatic malaria on some hematological parameters in the Iwo community in Southwestern Nigeria. Medical Principles and Practice. 2011;20(5):459-63.
11. Mouzin E. Global partnership to roll back malaria: Focus on Nigeria. Geneva: World Health Organization; 2012.
12. Ned RM, Price AE, Crawford SB, Ayisi JG, van Eijk AM, Otieno JA, Nahlen BL, Steketee RW, Slutsker L, Shi YP, Lanar DE. Effect of placental malaria and HIV infection on the antibody responses to Plasmodium falciparum in infants. The Journal of infectious diseases. 2008;198(11):1609-19.
13. Syafruddin D, Asih P, Dewi RM, Coutrier F, Rozy IE, Susanti AI, Elyazar IR, Sutamihardja A, Rahmat A, Kinzer M, Rogers WO. Seasonal prevalence of malaria in West Sumba district, Indonesia. Malaria journal. 2009;8(1):1-8.
14. World Health Organization. Essential public health functions, health systems and health security: Developing conceptual clarity and a WHO roadmap for action; 2018.

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