Austin Journal of Infectious Diseases

Open Access

Austin Publishing Group

Research Article

Study of *Plasmodium* Infection among Primary School Children in Lafia Local Government Area, Nasarawa State, Nigeria

Musa A*; Uzoigwe NR; Pam VA; Ombugadu A; Maikenti JI; Adejoh VA; Ahmed HO
Department of Zoology, Faculty of Science, Federal University of Lafia, Nigeria

***Corresponding author:** **Musa A**
Department of Zoology, Faculty of Science, Federal University of Lafia, PMB 146, Lafia, Nasarawa State, Nigeria.
Email: ayshamusa11@gmail.com

Received: February 07, 2023
Accepted: March 27, 2023
Published: April 03, 2023

Abstract

Malaria is a major cause of poverty in developing nations, particularly in tropical regions. This study sought to ascertain the present prevalence of malaria among primary school children in Lafia Local Government Area (LGA), Nasarawa State, Nigeria. A total of 204 venous blood samples were collected from consenting primary school children. The blood samples were analyzed parasitologically by thin and thick blood films as well as Rapid Diagnostic Test (RDT) methods. Of the 204 school children examined, 75.9% were found positive for *Plasmodium* infection. The prevalence of *Plasmodium* infection in relation to sexes of the pupils from Agyaragu (peri-urban settlement) and Lafia (urban settlement) schools showed no significant difference (P=0.688). Generally, children aged 15-17 years old were significantly (P<0.0001) more infected with *Plasmodium* parasites in this study. The RDT showed more positive cases than microscopy test of blood samples obtained from primary school children. The PCV values between infected and uninfected school children in each school showed no significant difference (Agyaragu: P=0.8503; Lafia: P=0.2038). In conclusion, the RDT is a complementary technique to microscopy, most especially in areas that may be lacking a trained microscopist. The parents of the pupils should ensure that they key into the practice of integrated control strategies such as the use of insecticide treated bed netsso as to drastically lower malaria prevalence among these young population in the research area.

Keywords: Primary school children; Malaria; *Plasmodium;* Microscopy; Rapid diagnostic test; Peri-urban and Urban settlements in Lafia LGA

Introduction

Malaria is a disease caused by parasitic protozoa that belong to the genus *Plasmodium* [1]. Several species of *Plasmodium* are known to exist and cause malaria in humans. They include *Plasmodium malariae, P.vivax, P.falciparum* and *P.ovale* [2].

According to Dawaki *et al*. [3], 3.2 billion people worldwide are at risk of contracting malaria, with Nigeria responsible for 11.0% of maternal deaths and 30% of child deaths, particularly among children under the age of five [4].

Children under the age of five are particularly vulnerable to contracting malaria since they have not yet built up an immunity to the illness [5]. Children who survive malaria may experience long-term effects from the infection. Frequent episodes of fever and illness impair growth by decreasing appetite, limiting playtime, social interactions, and educational opportunities. Malaria is known to cause a significant part of child deaths, which are more common in households with lower incomes [5].

Despite the fact that previous studies have shown that malaria is highly prevalent throughout Nigeria [6-9], there is still a dearth of information on the prevalence of the disease in some regions of the nation, particularly among school children in La-

Citation: Musa A, Uzoigwe NR, Pam VA, Ombugadu A, Maikenti JI, et al. Study of *Plasmodium* Infection among Primary School Children in Lafia Local Governmnet Area, Nasarawa State, Nigeria. Austin J Infect Dis. 2023; 10(2): 1081.

fia LGA, Nasarawa State, Nigeria. Since it is simple to evaluate youngsters, this study will offer thorough information on the general malaria status in the host community and open up a way to successfully apply control measures.

Materials and Methods

Study Area

The study was carried out in selected primary and secondary schools in Lafia (urban settlement) and Agyaragu town (peri-urban settlement) of Lafia LGA, Nasarawa State in North central Nigeria. Lafia is located on latitude 8.4975911, longitude 8.5197792 and easting 447145.612, while Agyaragu is located on latitude 8.4038486, longitude 8.555316 and easting 451045.145.

Ethical Consideration

The study protocol was approved by the Ethical Committees of PHC Department of the Nasarawa State Primary Healthcare Development Agency (NAPHDA), Lafia Local Government Councilon 19th July, 2019 as well as from Lafia Local Government Education Authority, Lafia Central (Ref. No.: LGEA/EDU/PER/Vol. VIII). There after, the study was carried out.

Sample Collection

Two hundred and four (204) venous blood samples were collected from consenting primary school children from schools in Lafia and Agyaragu by a trained medical laboratory scientist.

Two certified medical laboratory technicians took 2ml of venous blood from each of the kids using a sterile syringe and needle [10]. The blood was put into EDTA (ethylenediaminetetraacetic acid) vials with pre-printed labels and maintained in an ice box.

Processing of Blood Sample

The blood samples were delivered to the Department of Zoology laboratory in ice pack containers for parasitological analysis [10]. Cheesbrough [11] methods were used to determine the Packed Cell Volume (PCV). Determination of parasites was according to parasitological method and Rapid Diagnostic Test [12,13].

Data Analysis

Data obtained were analyzed using R Console software (Version 3.2.2). Pearson's Chi-square test was used to compare the proportion of the prevalence of malaria parasites amongst the primary school children in relation to sex, age, as well as compared between RDT and microscopy examinations. Statistical significance was achieved if $P<0.05$.

Results

A total of 204 primary school children were screened for *Plasmodium* parasite infection. Of this number, 155(75.9%) were found positive (Table 1). Of this population, *Plasmodium* infection was more prevalent in pupils schooling in primary school in Lafia (80.0%). Nevertheless, there was no significant difference (χ^2=0.16129, df=1, P=0.688) in the prevalence of *Plasmodium* infection between primary school children in Agyaragu and Lafia, Lafia LGA, Nasarawa State.

The female children (78.0%) were more infected by *Plasmodium* parasites than their male (74.6%) counter parts (Table 1). However, there was no significant difference (χ^2=0.22957, df=1, P=0.6318) in the prevalence of *Plasmodium* infection in primary school children in Agyaragu and Lafia, Lafia LGA, Nasarawa State in relation to sex.

Table 1: Prevalence of *Plasmodium* Parasite Infection in Primary Schools in Agyaragu and Lafia, Lafia LGA, Nasarawa State in Relation to Sex.

Location	No. Examined	Female		Male		Total (%)
		No. Examined	No. Infected (%)	No. Examined	No. Infected (%)	
Agyaragu	104	42	29(69.0)	62	46(74.2)	**75(72.1)**
Lafia	100	40	35(87.5)	60	45(75.0)	**80(80.0)**
Total	**204**	**82**	**64(78.0)**	**122**	**91(74.6)**	**155(75.9)**

Generally, children aged between 15-17 years old (91.0%) were more parasitized by *Plasmodium* infection followed by those between ages 9-11 years old (86.9%) in Lafia, while the least infected age group was 9-11 years old pupils (60.0%) in Agyaragu (Table 2). There was a very high significant difference (χ^2=68.687, df=3, P<0.0001) in the prevalence of *Plasmodium* parasite infection in primary schools in Agyaragu and Lafia, Lafia LGA, Nasarawa State in relation to age groups.

Table 2: Prevalence of *Plasmodium* Parasite Infection in Primary Schools in Agyaragu and Lafia, Lafia LGA, Nasarawa State in Relation to Age Groups.

Age Groups	Agyaragu		Lafia	
	No. Examined	No. Infected (%)	No. Examined	No. Infected (%)
5-8	89	66(74.2)	24	20(83.3)
9-11	15	9(60.0)	23	20(86.9)
12-14	-	-	42	30(71.4)
15-17	-	-	11	10(91.0)
	104	**75(72.1)**	**100**	**80(80.0)**

The Rapid Diagnostic Test (RDT) (63.7%) showed more positive cases against the microscopy (48.5%) of blood samples obtained from primary school children in Lafia and Agyaragu (Table 3). However, there was no significant difference (χ^2=0.023574, df=1, P=0.878) in the detection of *Plasmodium* parasites between microscopy and RDT techniques.

Table 3: Detection of *Plasmodium* Parasite using Microscopy and RDT.

Location	Microscopy		RDT	
	No. Examined	No. Infected (%)	No. Examined	No. Infected (%)
Agyaragu	104	55(52.9)	104	75(72.1)
Lafia	100	62(62.0)	100	79(79.0)
Total	**204**	**99(48.5)**	**204**	**130(63.7)**

The children within 5-8 years in Agyaragu school of both those that were infected and uninfected did not show clear difference in their average PCV level unlike those in 9-11 years age range in which there was a distinct difference between infected and uninfected pupils as shown in (Figure 1). Although the comparison of their PCV status with the normal values showed no significant difference (χ^2=0.035619, df=1, P=0.8503).

As shown in Figure 2, PCV values of school children in primary school in Lafia were not significantly different between age groups for both infected and uninfected (χ^2=4.5973, df=3, P=0.2038).

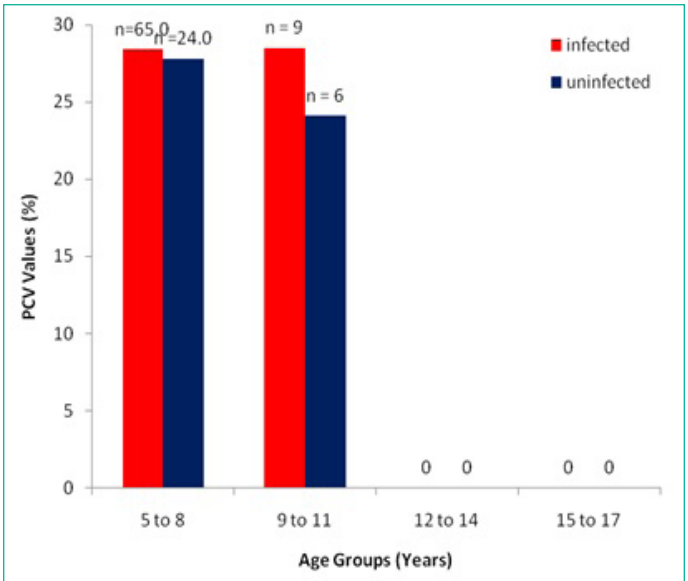

Figure 1: PCV values of infected and uninfected pupils of primary school in agyaragu.

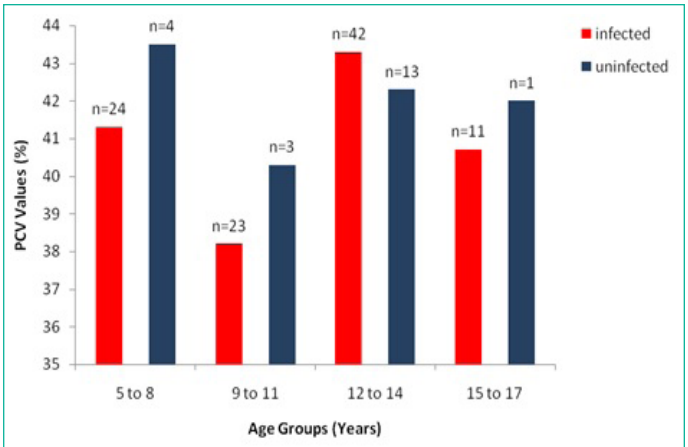

Figure 2: PCV values of infected and uninfected pupils of primary school in lafia.

Discussion

Numerous reports have indicated that malaria is endemic in many regions of Nigeria [14-16]. The current study has also demonstrated that the diseases are very endemic in the two study area's, with extremely high incidence among the primary school students evaluated.

A very high prevalence of 75.9% was observed among the children examined in this study. The observation is in agreement with reported prevalence in Anambra schools [17] and Nas*et al*. [18] in Kano. However, it was not in agreement with the lower prevalence reported by Jombo *et al*. [19] in Makurdi, Ukaga *et al.* [20] in Imo state, Nigeria and Olorunniyi *et al.* [21] in Ekiti State. In Ethiopia, Abossie *et al*. [5] reported high prevalence in children while Kuadzi *et al*. (22) in Ghana reported low prevalence. More primary school children in Lafia were infected than their counter part in Agyaragu with 80.0% and 75.0% infection respectively.

The degree of parental awareness and care for the young children in terms of knowledge of early indicators and treatment of illness may be the cause of this variation. The rural setting of the schools may be a contributing factor to the reported high prevalence of infection among school children. The reports by Habyarimana and Ramroop [23], which described the connection between malaria and rural area's, were incorporated into this.

Despite the fact that male and female students from Agyaragu and Lafia primary schools had variable degrees of *Plasmodium* infection, it does seem from this study that sex is not a significant role in *Plasmodium* parasite infection in the study group and study sites. In their research in Nigeria's Anambra state, Nwuorgu and Orajaka [24] found no difference in the prevalence of malaria infection in relation to sex. A study conducted in Maiduguri by Elechi *et al.* [25] also found no evidence of sex-related difference in malaria infection.

Furthermore, Mbanugo and Ejim [26] found no association between patient sex and high prevalence of infection in their research. The study's participants ranged in age from 5 to 15 years old. Table 2 shows that there was a definite correlation between infection burdens and children's ages in this study. Additionally, it was shown that the age groups of 9 to 11 years in primary school and 15 to 17 years experienced greater infection rates. This indicates that in these research sites, children in these age groups were more susceptible to *Plasmodium* infection. Ukaga *et al.* [20] in Imo state in a study of malaria morbidity and mortality in hospitals similarly noted high infection rates in these age categories. According to their findings, children aged 6 to 15 had the third-highest risk of malaria infection (23.9%), trailing only children under five years old (70.1%) and pregnant women (35.1%).

In a separate study, Tidi *et al.* [27] found that children between the ages of 3 and 5 were most likely to contract malaria, according to their analysis of the disease's mortality and morbidity among nomadic Fulani children. This study's observation about age and *Plasmodium* parasite infection is therefore consistent with Ukaga*et al.* [20] and Tidi *et al* [27].

The Rapid Diagnostic Test (RDT) [28] and the Microscopy approach [11] were the two diagnostic techniques utilized in the study to identify infections in school children. In this investigation, the RDT yielded a greater number of positive results than the microscope method. Hussein *et al.* [29] on the other hand found that microscopy revealed greater infection detectability over RDT. Although microscopy is the gold standard for studying malaria, the results of this study clearly demonstrate that RDT may complement microscopy [30].

Conclusion

This study shows that there is still more work to be done in the fight to eradicate malaria at these study sites. This study found a significant frequency of malaria infection. To dramatically lower malaria prevalence in these populations, it is vital to find novel and integrated control strategies. There was no connection between the children's sex and the increased prevalence of infection. However, the prevalence of *Plasmodium* infection in relation to age showed a very high significant difference.

More positive malaria findings were obtained using the RDT method. This underscores RDT as a complementary tool for malaria screening, most especially in areas that may be lacking a trained microscopist. Parental and educational efforts to teach children how to protect themselves from mosquito bites and diseases spread by mosquitoes need to be stepped up. Additionally, in order to promote public health, community leaders should implement source reduction strategies and other malaria intervention strategies in coordination with the current administration.

References

1. Ramdzan AR, Ismail A, Mohd-Zanib ZS. Prevalence of malaria and its risk factors in Sabah, Malaysia. International Journal of Infectious Diseases. 2020; 91: 68–72.
2. Sinden R, Gilles H. The Malaria Parasites. In Essential Malariology, Hodder Arnold, London. 2002. 8–34.
3. Dawaki S, Al-Mekhlafi MH, Ithol I, Ibrahim J, Atroosh WM, et al. Is Nigeria winning the battle against malaria? Prevalence, risk factors and KAP assessment among Hausa communities in Kano State. Malaria Journal. 2016; 15: 351-362.
4. Federal Ministry of Health (FMH). Malaria advocacy brief for policy makers. Abuja: Federal Ministry of Health. 2012.
5. Abossie A, Yohannes T, Nedu A, Tafesse W, Damitie M. Prevalence of Malaria and Associated Risk Factors among Febrile Children Under Five Years: A Cross-Sectional Study in Arba Minch Zuria District, South Ethiopia. Infection and Drug Resistance. 2020; 13: 363–372.
6. Ibekwe AC, Okonko IO, Onunkwo AI, Ogun AA, Udeze AO, et al. Comparative Prevalence Level of Plasmodium in freshmen (First Year Students) of NnamdiAzikwe University in Awka, South-Eastern, Nigeria. Malaysian Journal of Microbiology. 2009; 5: 51–54.
7. Gajida AU, Iliyasu Z, Zoakah AI. Malaria among Antenatal Clients attending Primary Health Care Facilities in Kano State, Nigeria. Annals of African Medicine. 2010; 9: 188–193.
8. Nmadu PM, Peter E, Alexander P, Koggie AZ, Maikenti JI. The Prevalence of Malaria in Children between the Ages 2-15 Visiting GwarinpaGeneral Hospital Life-Camp, Abuja, Nigeria. Journal of Health Sciences. 2015; 5: 47–51.
9. Onyiri N. Estimating Malaria Burden in Nigeria: A Geostatistical Modelling Approach. Geospatial Health. 2015; 10: 306.
10. Coles EH. Veterinary Clinical Pathology. 4th edition Saunders Company Philadelphia. 1986; 38-67.
11. Cheesbrough M. District Laboratory. Practice in Tropical Countries. PCV and Red Cell Indices. Edinburgh, United Kingdom: Cambridge University Press. 2003; 310 -313.
12. World Health Organization (WHO). Methods Manual for Laboratory Quality Control Testing of Malaria Rapid Diagnostic Tests: Version 7. Geneva, Switzerland: WHO Press. 2014; 299.
13. World Health Organization (WHO). Malaria Microscopy: Quality Assurance Manual, Version 2. Geneva, Switzerland: WHO Press. 2016; ISBN 978 92 4 154939 4.
14. Adekunle NO, Sam-Wobo SO, Dedeke GA, Ojo DA, Abimbola WA, et al. Evaluation of Rapid Methods in Malaria Diagnosis from Persons attending Primary Health Facilities, Ogun State, Nigeria. Nigerian Journal of Parasitology. 2014; 35: 19-25.
15. Kalu MK, Obasi NA, Nduka FO, Otuchristian G. A Comparative Study of the Prevalence of Malaria in Aba and Umuahia Urban Areas of Abia State, Nigeria. Research Journal of Parasitology. 2012; 7: 17-24.
16. Aribodor DN, Udeh AK, Ekwunife CA, Aribodor OB, Emelummadu OF. Malaria Prevalence and Local Beliefs in Transmission and Control in Ndiowu Community, Anambra State, Nigeria. Nigerian Journal of Parasitology. 2014; 35: 1-2.
17. Onyido AE, Ifeadi CP, Umeanaeto PU, Aribodor DN, Ezeanya LC, et al. Co-Infection of Malaria and Typhoid Fever in Ekwulumili Community Anambra State, Southeastern Nigeria. New York Science Journal. 2014; 7: 18-26.
18. Nas FS, Yahaya A, Ali M. Prevalence of Malaria with Respect to Age, Gender and Socio-Economic Status of Fever Related Patients in Kano City, Nigeria. Greener Journal of Epidemiology and Public Health. 2011; 5: 44-49.
19. Jombo GTA, Mbaawuaga EM, Denen Akaa P, Alao OO, Peters EJ, et al. Choices of drugs for self-treatment of malaria among adult women in a Nigerian city: Implications for the success of the ongoing 'Roll Back' malaria programme. Journal of Microbiology and Antimicrobials. 2010; 2: 57-63.
20. Ukaga CN, Obiora IE, Nwoke BEB, Ezeunala MN, Nwachukwu MI, et al. Malaria Morbidity and Mortality in Owerri Hospitals. Nigerian Journal of Parasitology. 2011; 32: 175-180.
21. Olorunniyi OF, Idowu OA, Idowu AB, Pitan OR, Babalola AS. Malaria Parasite Infection in Some Periurban and Rural Communities in Ekiti State, Nigeria. Journal of Advances in Biology & Biotechnology. 2021; 22: 1-11.
22. Kuadzi JT, Ankra-Badu G, Addae MM. Plasmodiumfalciparum malaria in children at a tertiary teaching hospital: ABO bloodgroup is a risk factor. The Pan African Medical Journal. 2011; 10: 2.
23. Habyarimana F, Ramroop S. Prevalence and Risk Factors Associated with Malaria among Children Aged Six Months to 14 Years Old in Rwanda: Evidence from 2017 Rwanda Malaria Indicator Survey. International Journal Environmental Research in Public Health. 2020; 17: 7975.
24. Nwarogu OC, Orajaka BN. Prevalence of Malaria among Children 1–10 Years Old in Communities in Awka North Local Government Area, Anambra State South East Nigeria. International Multidisciplinary Journal, Ethiopia. 2011; 5: 264-291.
25. Elechi HA, Rabasa AI, Bashir MF, Gofama MM, Ibrahim HA, et al. Uncomplicated Malaria in Children: The Place of Rapid Diagnostic Test. Nigerian Medical Journal. 2015; 56: 85–90.
26. Mbanugo JI, Ejims DO. Plasmodium Infection in Children 0-5 years in Awka Metropolis, Anambra State, Nigeria. Nigeria Journal of Parasitology. 2000; 21: 55-59.
27. Tidi SK, Akogun OB, Gundiri MA. Malaria morbidity and mortality among normadic Fulani children of Northern Nigeria. Nigeria Journal Parasitology. 2012; 33: 149-155.
28. Wongsrichanalai C, Barcus MJ, Muth S, Sutamihardja A, Wernsdorfer WJ. A Review of Malaria Diagnostic Tools: Microscopy and Rapid Diagnostic Test (RDT). Am J Trop Med Hyg. 2007; 77: 119–127.
29. Hussein M, Abdel Hamid MM, Elamin EA, Hassan AO, Elaagip AH, et al. Antimalarial Drug Resistance Molecular Makers of Plasmodium falciparum isolates from Sudan During 2015–2017. PLoS ONE. 2020; 15: e0235401.
30. Baboo KS, Ndayambaje I, Chizema EK, Silwamba G, Miller J. Effectiveness of Rapid Diagnostic Test for Malaria Diagnosis in Children under 15 Years of Age in Nchelenge District in the Luapular Province. Medical Journal of Zambia. 2008; 35: 160-165.