Asian Journal of Immunology

2(1): 72-77, 2019; Article no.AJI.53137

Malaria-related Anaemia among Children and Adolescents Attending General Hospitals in Obi and Oju Local Government Areas of Benue State

V. U. Obisike[1*], O. J. Agbo[2], M. O. Ogbu[3], J. I. Chikwendu[1] and E. U. Amuta[1]

[1]Department of Animal and Environmental Biology, Abia State University, Uturu, Abia, Nigeria.
[2]Department of Biological Sciences, Federal University Wukari, Nigeria.
[3]Department of Biological Sciences, Benue State University, Makurdi, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Authors VUO, MOO and EUA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors OJA and JIC managed the analyses of the study. Authors VUO, MOO and EUA managed the literature searches. All authors read and approved the final manuscript.

Article Information

Editor(s):
(1) Dr. Wagner Loyola, Department of Immunology, Brazilian Agricultural Research Corporation (Embrapa), Concordia, Canada.
Reviewers:
(1) Nwagu Marcellinus Uchechukwu, Edo University, Nigeria.
(2) Esraa Ashraf Ahmed ElHawary, Ain Shams University, Egypt.
(3) Florencia del Puerto, Universidad Nacional de Asuncion, Paraguay.
Complete Peer review History: http://www.sdiarticle4.com/review-history/53137

Original Research Article

Received 08 October 2019
Accepted 13 December 2019
Published 25 December 2019

ABSTRACT

Anaemia is one of the leading complications due to malaria infections. It is defined in terms of packed cell volume (PCV) as a PCV <32%. This study was focused on the prevalence of malaria-related anaemia among children and adolescents attending General Hospital in Obi and Oju Local Government Areas of Benue State. Whole blood samples for malaria test were collected by fingertip pricking and vein punctured from a total of 738 children and adolescent patients that visited these hospitals between the months of October, 2015 to February, 2016. Rapid Diagnostic Test Kit (RDT) and haematocrit reader were used to determine malaria infections and PCV respectively. Those tested positive for malaria were 207 (106 and 101 for Obi and general hospitals respectively). Positive participants were further tested for anaemia and 73 (35.2%) were found anaemic. Distribution in the general hospitals were 34 (46.6%) and 39 (53.4%) for Obi and Oju

**Corresponding author: E-mail: talk2vu@gmail.com;*

respectively. October, 2015 had the highest prevalence. Amongst those anaemic females had a higher prevalence of 43 (58.9%) than males 30 (41.1%), (r=0.95). Also age group 0-5 years were most anaemic, 31 (53.4%), (P>0.05). Conclusively, the prevalence of malaria-related anaemia among children and adolescents attending these hospitals of the study areas was high. Reducing the prevalence of malaria should be prioritized by individuals and government.

Keywords: Anaemia; rapid diagnosis; children; malaria.

1. INTRODUCTION

The tropics and developing countries have been faced with severe public health problems which anaemia is one of the health challenges facing the area. Anaemia occurs at all stages of the life cycle, but is more prevalent in young children and pregnant women [1] About 3.5 billion persons are affected by anaemia in developing countries [2] Loss of blood, decrease in the red blood cells production, and increase in red blood cells breakdown [3] could lead to anaemia. *Plasmodium falciparum* infection is considered the major cause of anaemia, especially in children. It retards the normal development in children, and constitutes a major public health problem in young children in the developing world with wide social and economic implications. Therefore decreased physical exercise tolerance and intellectual performance have been associated with mild anaemia, which may lead to a slowdown of growth in children [4].

A lot of work has been done on malaria such as in the areas of prevention and control, clinical and laboratory diagnosis, treatment, pathology and pathogenesis, epidemiology and genetic sequencing, yet the disease is still endemic in the tropics and developing nations, causing so much pain and sorrow to several families on the African continent and beyond [5]. Malaria is caused by parasites that are transmitted to people through the bites of infected female mosquitoes; *P. faciparum* is the most deadly malaria parasite and the most prevalence [1]. About 70% of the disease burden worldwide and her pregnant women, children are found in Africa [6]. The death accounts for 3-5 million each year and majority are children below five years, infected mainly by *P. falciparum.* Malaria associated anaemia is a major health problem in setting of intense malaria transmission [7]. The current study was aimed to investigate regarding the malaria- related anaemia in children and adolescents attending general hospitals in Obi and Oju Local Government Areas of Benue State.

2. MATERIALS AND METHODS

2.1 Study Areas

The study areas for this project work were Obi and Oju Local Government Areas of Benue State of north-central, Nigeria. They are both located in the Savannah zone. Obi Local Government Area is found in the coordinates 8º22'N and 8º46'E [3]; her Local Government Headquarter been Obarike-Ito, with 2006 population census of 9,707 people. Oju on the other hand is located in the coordinates 6º51'N and 8º25'E [3]; with Oju as her Local Government Headquarter, 2006 population census of 168,491. The people of the two Local Government Areas speak Igede as their major dialect; and their major occupation is farming.

2.2 Study Population and Sample Size

The study was conducted among the patients (Children and adolescents) attending General Hospital Obarike-Ito, in Obi Local Government Area and General Hospital Oju, in Oju Local Government Area. A total of 763 whole blood samples were collected from different patients that attended the hospitals from October 2015 to February 2016. Amongst these samples collected, 426 and 337 were obtained in Obi and Oju respectively. Malaria test was carried out, and followed by packed cell volume (PCV) test on the samples that were tested positive to malaria.

2.3 Experimental Design

The experimental design used was Variance, particularly Completely Randomized Design; from which ANOVA table was done for analysis. Also Chi-Square used as well as Correlation.

The methods employed in this study involved two haematological tests – chromatographic test (Rapid diagnostic test), for detecting evidence of malaria parasites (antigens) in human blood; and packed cell volume (PCV) tests for anemia.

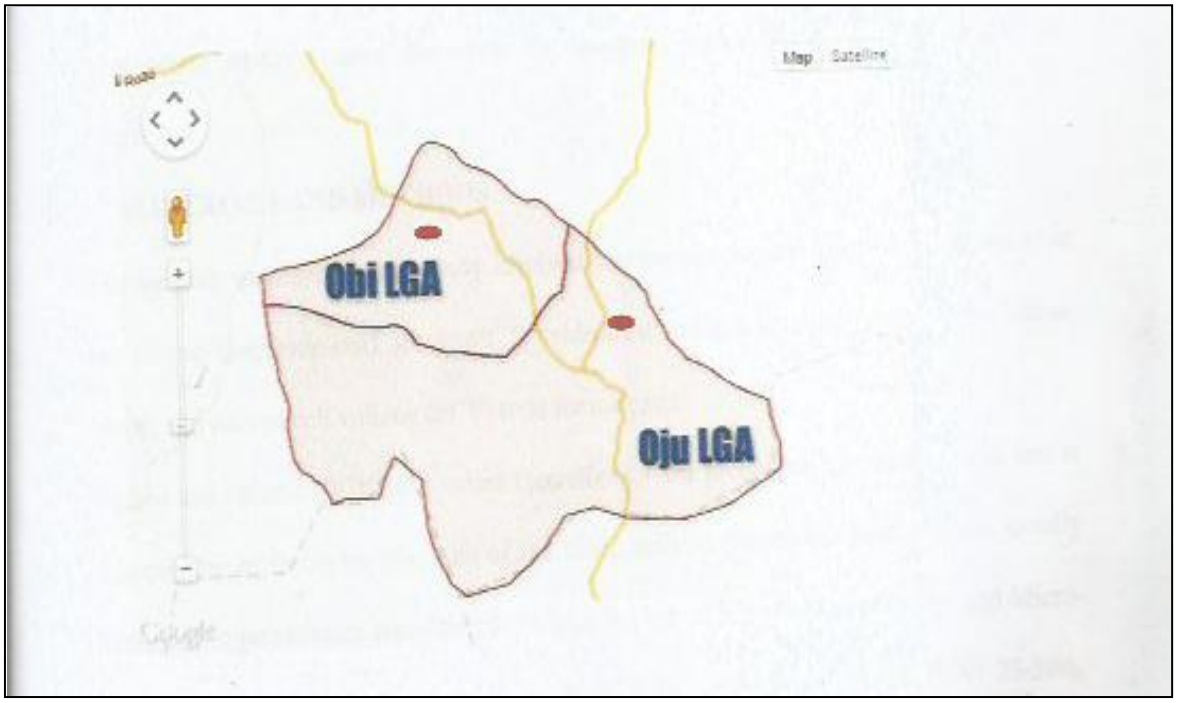

Fig. 1. Map of Obi and Oju L.G.As showing the study locations [8]

Packed cell volume (PCV) also called Hematocrit – the proportion of blood volume that is occupied by erythrocytes (the ratio of red blood cells to the whole blood volume, usually expressed in percentage) was determined with the use of Hematocrit centrifuge and Microhematocrit reader. Anaemia was defined as PCV of <30%. Mild anaemia PCV: 25-29% moderate anaemia PCV: 19-24% and severe anaemia PCV: ≤18%.

Whole blood sample was used for the two tests, (malaria and PCV) involved. The blood was either gotten through pricking of fingertip or by venous puncture.

Fingertip pricking: The finger of a patient's hand (mostly third finger of the left hand) was firmly held and cleansed using alcohol pad. A sterile lancet was then used to prick the fingertip, and blood drop was collected in a micro pipette; ready to be used [3].

Venous blood: The patient's arm was tightened with a tunicate and palpated for vein to become prominent. The skin surface of over the prominent vein was cleansed using alcohol pad or swab, then allowed to dry. The vein was punctured with a sterile needle, attached to a syringe. Whole blood was then collected in the syringe and transferred into an EDTA tube; ready to be used [3].

2.4 Test Procedures

Malaria Rapid Diagnostic Test: The whole blood, collected in a micropipette by fingertip pricking (as described above), was transferred onto the sample pad on malaria immunoassay test kit. Immediately, two drops reagent was applied onto the reagent pad, directly above sample pad; and allowed to run for 15 minutes. Appearance of two pink strips or bands was taken to be an indication that the patient is infected with either *Plasmodium falciparum* or one of the other three species responsible for human malaria [9].

For Hematocrit (packed Cell Volumme-PCV) Test: The whole blood collected in EDTA tube (as described above) was fed into a capillary tube (2/3 half-filled), from one end. The other end of the capillary tube was sealed with a sealant and mounted onto the micro-haematocrit centrifuge and centrifuged for 3 minutes at 10,000 RPm (revolution per minute). The capillary, having the packed erythrocytes after centrifugation was then dismounted from the centrifuged and placed on the haematocrit reader, and the reader, and the reading was taken and recorded.

3. RESULTS

From the months of October, 2015 to February, 2016, a total of 738 blood samples were

collected from children and adolescents for malaria test; out of which 207 were tested positive for malaria Tables 1 and 2. In General Hospital, Obi, a total number 106 was obtained; while general Hospital, Oju had a total number of 101; with the prevalence of 24.9% and 30.0% respectively. Among the 207 samples tested positive to malaria, 73 were tested anaemic, with percentage prevalence of 35.2%. Also, Obi had a number of 34 amongst those tested anaemic; while Oju had a number of 39, with prevalence of 32.1% and 38.6% respectively.

From the Fig. 2, October, 2015 had the highest prevalence of 50.7%; while December, 2016 had the lowest prevalence of 9%; with p>0.05. Fig. 3 shows females prevalence to be 43 (58.9%), as against 30 (41.1%) for males, with chi-square value showing p>0.05. Table 3 showed that age range 0 – 5 had the highest prevalence of 40 (54.8%); while age range 12 – 17 has the lowest prevalence of 14 (17.8%). But variance analysis showed that p>0.05; which revealed a non-significant difference in the prevalence between the age ranges.

Table 1. Monthly distribution of malaria-related anaemia in Obi

Month	No examined	Positive for malaria	Anaemia
October	98	39 (36.8%)	12 (35.8%)
November	65	18 (17.0%)	5 (14.7)
December	75	22 (20.8%)	7 (20.6%)
January	96	17 (16.0%)	7 (20.6%)
February	92	10 (9.4%)	3 (8.8%)
Total	426	106 (24.9%)	34 (32.1%)

Table 2. Monthly distribution of malaria-related anaemia in Oju

Month	No examined	Positive for malaria	Anaemia
October	162	64 (63.4%)	25 (64.1%)
November	55	18 (17.8%)	7 (17.9)
December	20	3 (3.0%)	0
January	47	7 (6.9%)	3 (7.7%)
February	53	9 (8.9%)	4 (10.3%)
Total	337	101 (30.0%)	39 (38.6%)

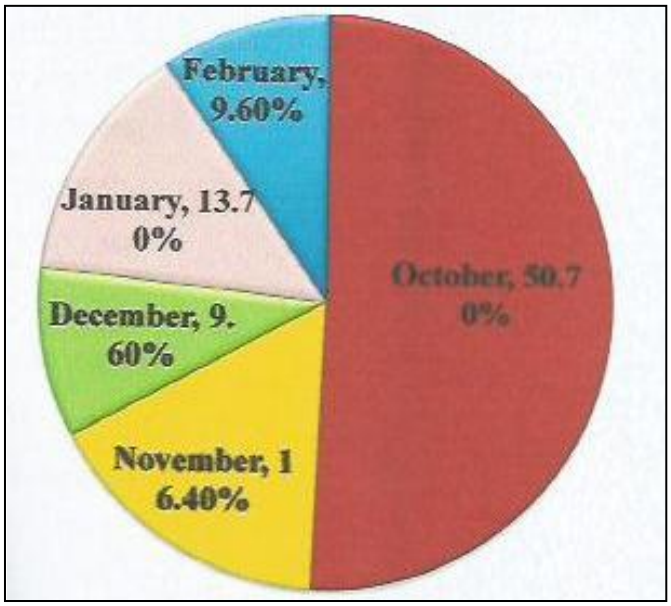

Fig. 2. Prevalence for malaria-related anaemia of each month for Obi and Oju L.G.As
r = 0.96; x^2 cal = 1.05. p>0.05; d.f = 4

Table 3. The prevalence of malaria-related anaemia with respect to age (years)

Month	0 – 5	6 – 11	12 - 17
October	17 (42.5%)	10 (50%)	4 (30.8%)
November	8 (20.0%)	2 (10%)	2 (15.4%)
December	4 (10.6%)	4 (20.0%)	2 (15.4%)
January	5 (12.5%)	3 (15.0%)	4 (30.8%)
February	6 (15%)	1 (5.0%)	1 (7.6%)
Total	40(54.8%)	20 (27.4%)	13 (17.8%)
Grand Total: 73			

F – calculated = 1.98; P>0.05

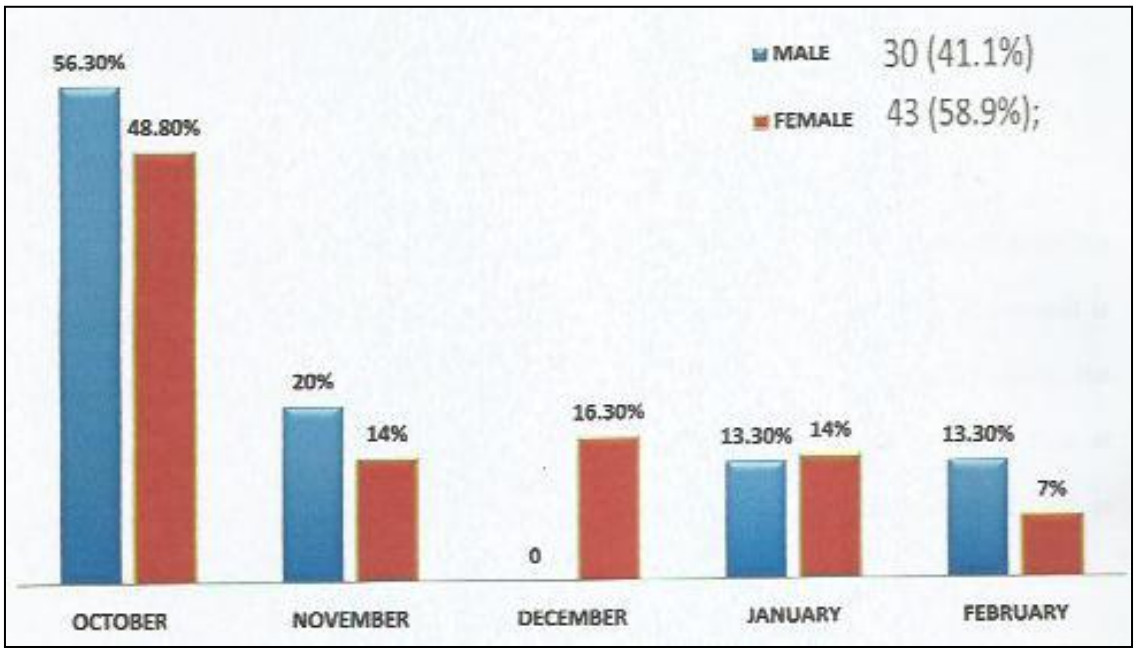

Fig. 3. Prevalence for malaria-related anaemia with respect to sex

r = 0.95; x^2 cal = 6.33; p>0.05; d.f = 4

4. DISCUSSION

This work revealed the prevalence of Malaria-related anaemia among the patients attending general Hospitals in Obi and Oju Local Government Areas of Benue State. The result is higher than that reported in Port Harcourt [10], Nigeria; but lower compared to previous report in Kano, Nigeria [11] and Benin Republic and Mali [12]. The result however, agrees with earlier report in the Brazil [13]. The reason could be the environmental conditions of the area, such factors like bushes around the residential areas, the sanitary conditions of the locality and belief.

October, 2015 had the highest prevalence. This could be due to the fact that October was partly a rainy season; and rainy season favours breeding of malaria vector (mosquito). Age distribution revealed that age range 0 – 5 years had the highest prevalence, but statistical analysis revealed a non-significant difference in the prevalence between the age groups. This is lower than the report of Imam, [11] in Kano, Nigeria, but higher than that of earlier study in Vietnam, [14]. The high prevalence recorded in this age group could be attributed to the active nature of the group which makes them often play outside leaving their bodies uncovered, thereby exposing themselves to mosquito bite. With respect to sex, female population had the higher prevalence for anaemia, however, statistical analysis revealed a non-significant difference in the prevalence between the two sexes; as well as a very close correlation, unlike the previous finding [7], in Kenya. This could also be attributed to the fact that most women in the developing nations do a whole lot of outdoor activities ranging from farm work to domestic works, making them equally exposed to mosquitoes.

5. CONCLUSION

This study revealed a high prevalence of malaria-related anaemia among children and adolescents attending the hospitals in Obi and Oju L.G. Areas, Benue State. It is an indication that anaemia as a complication due to malaria infection is a threat to the studied population of these areas. The prevalence of anaemia was highest among the females, and among age group 0 to 5 years. Though the prevalence of was high in both Local Government Areas, Oju had a higher prevalence than Obi.

CONSENT

As per international standard, patient's written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

Ethical permission was granted by the hospital management.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. WHO. Malaria fact sheet; 2015. Available:http://www.who.int/mediacentre/factshets/fs094/en/on
2. Villapando S, Shamah-Levy Y, Ramirez-Silva CI, Mejia-Rodriquez F, Rivera JA. Prevalence of anemia in children 1-12 years of age. Results from a nationwide probabilistic survey in Mexico. Salad publica Mexico. 2003;93-95.
3. Nagababu E, Gulyani S, Earley CJ, Cutler RG, Mattson MP, Rifkind JM. Iron-deficiency anaemia enhances red blood cell oxidative stress. Free Radical Research. 2008;42(9):824-829.
4. Ayodotun O, Olugbenga M. Sever malaria Anaemia in children; 2012. Available:http://www.researchgate.net/publication/221928490 on 8th December, 2015.
5. Jombo GTA, Mbaawuaga EM, Ayegba AS, Araoye MA. Anaemia, malaria burden and its control methods among pregnant women in a semi-urban community of northern Nigeria. Journal of Public Health and Epidemiology. 2011;3(7):317–323.
6. Sarkar J, Murhekar MV, Shah NK, Hutin Y. Risk factors for malaria deaths in Jalpaiguri district, west Benghal, India: evidence for further action. Malaria Journal. 2009;8(2): 93-103.
7. Obonyo CO, Taylor WR, Ogutu B, Vulule J, Grobbe DE. In - Hospital morbidity and mortality due to severe malaria anemia in Western Kenya. The American Journal of Tropical Medicine and Hygiene. 2007;77 (6):23-28.
8. Igede.org; 2013. Available: www.maps oju and obi local gov benue state
9. CDC; 2014. Available: www.cdc.gov/malaria/diagnosis treatment/rdt.html
10. George IO, Otaigbe BE. Anaemia in critically ill children. A case study from Nigeria. International Journal of Tropical Disease and Health. 2012;2(1):79-84.
11. Imam TS. Anaemia and malaria in children attending two selected paediatric clinics in Kano metropolis, Northern Nigeria. International Journal of Biomedical and Health Sciences. 2009;5(3):18-22.
12. Ngnie-Teta I, Receveur O, Kuate-Defo B. Risk factors for moderate to severe amaemia among children in Blenin and Mali: insights from a multilevel analysis. Food and Nutrition Bulletin. 2007;28(1): 12-18.
13. Leal PL, Filhol MB, Cabral de Liral PI, Figueiroa JN, Osório MM. Prevalence of anemia and associated factors in children aged 6-59 months in Pernambuco, Northeastern Brazil. Rev Saúde Pública. 2011;45(3):22-27.
14. Nguyen PH, Nguyen KC, Le Mai B, Nguyen TV, Ha KH, Bern C. Risk factors for anemia in vietnam. Southeast Asian Journal of Tropical medicine and Public Health. 2006;37(6):329-348.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/53137