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# PREVALENCE OF MALARIA INFECTION AND MALARIA ANAEMIA AMONG CHILDREN ATTENDING SPECIALIST HOSPITAL YOLA, ADAMAWA STATE, NIGERIA

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***Keywords:***
*Malaria infection, Anaemia, Malaria anaemia, Children, Parents/guadians sociodemgraphic, Adamawa State.*

## *Abstract*

Malaria associated anaemia is a huge problem in Africa responsible for a great morbidity and mortality among children. This study was designed to evaluate the prevalence of malaria and malaria anaemia being the complication of malaria in relation to children epidemiological data and parents/guardians sociodemographic characteristics. This was a prospective study considered Out-Patient children visiting Specialist Hospital Yola from July to November 2015. Thick and Thin blood film was made and stained using standard parasitological procedures. PCV was used to screen for anaemia and classified anaemia using WHO criteria. A total 310 children were recruited into the study. The overall prevalence of malaria infection and malaria anaemia was 50.6% and 41.3% respectively. High malaria infection was recorded among female (54.9%), age-group 5-9 years (58.3%), Children parents/guardians with others profession (60.0%), attended secondary education (53.4%) and children residing in quarters (54.5%). These were statistically insignificant ($p>0.05$). Malaria infection in relation to anaemia, children with moderate anaemia (52.2%) recorded highest. Malaria anaemia in relation to children epidemiological data, females (44.4%), 5-9 years (50.0%) had the highest infection rate while in relation to parents/guardians sociodemographic characteristics, children whose parents/guardians had other profession (50.0%), undergo non formal education (47.1%) and resides in quarters (45.5%) their children had the highest prevalence rate. The factors associated with malaria anaemia include children age, occupation and educational qualification of parents/guardians. Efforts need to be undertaken on the control and prevention of mosquito vector and malaria *Plasmodium* and should be routinely done by the state stakeholders and by encouraging individuals and communities participation.

## INTRODUCTION

Nigeria is one of Africa's hardest-hit, accounting for between 30 and 50 percent of malaria deaths on the continent (WHO, 2008). This magnitude of occurrence in this part of the world correlates with poverty, ignorance and social deprivation in the community (WHO, 2008). Non-immune individuals, under five children and pregnant women bear most of the morbidity and mortality due to malaria in Sub-Saharan Africa (Salako, 2002; Iloh, 2011). Malaria has been reported as the most common cause of morbidity among under-five children in urban (Chapp-Jambo, 2004; Nwolisa *et al*., 2005) and rural (Sule, 2003; Iloh *et al*., 2011; Iloh *et al*., 2012) communities in Nigeria.

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The main parasitic infections associated with anaemia include malaria and helminthic infections (Kagu *et al*., 2007). Malaria infection in humans by *Plasmodium* species is associated with a reduction in haemoglobin levels, frequently leading to anaemia. *Plasmodium falciparum* causes the most severe and profound anaemia, with a significant risk of death (Menendez *et al*., 2000). Repeat malaria infection is associated with anaemia in children and adult (Weil, 2010), also it contributes to the development of severe anaemia, which substantially increases the risk of death (Molineaux, 1997). Chronic or repeated episodes of malarial anaemia due to any Plasmodium species have been associated with adverse developmental effects as well as school attendances (Fernando *et al*., 2003; Vitor-Silva *et al*., 2009).

The burden of malarial anaemia may be under estimated in malaria endemic regions in developing countries where access to appropriate health care facilities is wanting. Furthermore, only a small proportion of patients attending public health facilities receive a diagnostic test for malaria (WHO, 2012). Improving the understanding of childhood malaria anaemia may help in the design of appropriate management strategies (Bouyou-Akotet *et al*., 2009). This study focus on determining the prevalence of malaria infection and malaria anaemia being the complication of malaria in relation to children epidemiology (sex, age) and parents/guardians sociodemorgraphic characteristics (such as occupation, educational status and place of residence).

## MATHERIALS AND METHODS

### Study Area

This study was carried out at Specialist Hospital, Yola North Local Government Areas (LGA) of Adamawa State, Nigeria.The area has a tropical climate, marked by dry and rainy seasons. The rainy season commences around May and ends in the middle or late October, rainfall is characterized by a single maximum with a mean total rainfall of 1113.3mm, August and September being the wettest months about 25% of the total annual rainfall. The dry season starts in late October and ends in April (Adebayo and Tukur, 1999). Temperature in Yola can reach 40$^{o}$ c, around April, while minimum temperature could be as low as 18.3$^{o}$ c between December and early January. Relative humidity in the area is about 26% in the months of January while February is the lowest; with high relative humidity values of 58, 69, 79, 77, and 66 respectively could be recorded during the months of May to October, particularly during the months of July and August as the peak, with about 80% relative humidity (Adebayo and Tukur, 1999). These favours the breeding and spreading of parasitic diseases. The vegetation in Yola and environs is secondary type due to human activities through construction, farming wood gathering for fuel and grazing have altered the natural vegetation (Adamawa State ministry of health, 1994; Akosim *et al*., 1999). Yola North LGA is the Administrative Centre of the State. Most indigenes of Yola are civil servants, farmers, fishers, petty traders, poultry and livestock keeping.

### Study Design And Population

Three hundred and ten (310) Out-Patients children were randomly selected who were referred to Laboratory (Haematology Unit), Specialist Hospital, Yola for malaria confirmatory test. The study commenced from July to November 2015. Children of both gender aged 6 months to 15 years were enrolled. Parents/guardians were briefed on the research and its purpose and their consent was also obtained before recruiting their children into the study.

### Sample Collection

Licensed Laboratory Scientist was assisted in the collection of blood sample. Method of sample collection employ was finger prick and venipuncture alternatively (Cheesbrough, 2006). Each blood sample was labelled and correctly tallies with the subjects number on the questionnaires.

### Parasitology Examination

The sample collected was processed within the hospital laboratory (Haematology Unit). Thick and thin blood films were prepared according to Cheesbrough (2006). Thin film was fixed using methanol, thick and thin film were stained with Giemsa (WHO, 2000) and examined microscopically using X100 objective. The slides were viewed by Medical Laboratory Scientists. Thick blood film was used to examine presence of any asexual form of malaria parasite while thin film was used to identify plasmodium species.

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**Haematology**
Packed Cell Volume (PCV) also referred to as haematocrit was use to screen for anaemia. To measure the PCV, either a plain capillary with mixed EDTA anticoagulated blood or a heparinized capillary with capillary blood was used. The technique outlined by Cheeesbrough (2006) was utilized. The Haemoglobin levels to diagnose anaemia based on WHO criterion as adopted in 1968 is as follows:

- Children 6-59 months of age: non anaemia (11g/dl and above), mild anaemia (10-10.9g/dl), moderate anaemia (7-9.9g/dl) and severe anaemia (below 7g/dl).
- Children 5-11 years of age: non-anaemia (11.5 g/dl and above), mild anaemia (11-11.4g/dl), moderate anaemia (8-10.9g/dl) and severe anaemia (below 8g/dl).
- Children 12-14 years of age: non-anaemia (12g/dl and above), mild anaemia (11-11.9g/dl), moderate anaemia (8-10.9g/dl) and severe anaemia (below 8g/dl)
- Female 15 years of age: non-anaemia (12g/dl and above), mild anaemia (11-11.9g/dl), moderate anaemia (8-10.9g/dl) and severe anaemia (below 8g/dl).
- Male 15 years of age: non-anaemia (13g/dl and above), mild anaemia (11-12.9g/dl), moderate anaemia (8-10.9g/dl) and severe anaemia (below 8g/dl) as cited in WHO, (2011).

**Ethical Clearance**
Prior to sample collection, introductory letter was obtained from Department of Zoology, Modibbo Adama University of Technology Yola to Adamawa State Ministry of Health where they issued Ethical Clearance and Specialist Hospital, Yola management were informed about the research and their permission sort and obtained. Importance of the study was explained to the parents/guardians before seeking their consent. Confidentiality was maintained.

**Data Analysis**
Data were entered into MS-Excel and analysis was done with the IBM Statistical Package for Social Sciences (SPSS) version 20 (SPSS, Inc., Chicago, IL, USA). Associations between the variables were compared using the Chi-square ($\chi^2$) test.

## RESULTS
Of the total subject examined, prevalence of malaria infection was 50.6% (310) and the malaria specie seen was *Plasmodium falciparum*. Of the children that were anaemic with malaria infection had the prevalence rate of 41.3% (128).

***Table 1: Prevalence of Malaria Infection in relation to Anaemia***

| Anaemia | No. examined | No. infected with malaria | % Infected |
|---|---|---|---|
| Non anaemia | 52 | 29 | 55.8 |
| Mild anaemia | 49 | 22 | 44.9 |
| Moderate anaemia | 136 | 71 | 52.2 |
| Severe anaemia | 73 | 35 | 47.9 |
| Total | 310 | 157 | 50.6 |

Prevalence of malaria infection among children in relation to anaemia is presented in Table 1. Children infected with malaria and had moderate anaemia (52.2%) recorded the highest prevalence rate, followed by children infected with malaria and had severe anaemia (47.9%) and the least prevalence was among those infected with malaria and had mild anaemia (44.9%). This was statistically insignificant ($p>0.05$).

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**Table 2: Prevalence of Malaria Infection and Malaria Anaemia according to Gender of Children**

| Gender | No. examined | No. (%) infected with malaria | Malaria anaemia | | | | |
|---|---|---|---|---|---|---|---|
| | | | No. (%) non anaemia | No. (%) mild anaemia | No. (%) moderate anaemia | No. (%) severe anaemia | No. (%) anaemic with malaria |
| Male | 168 | 79 (47.0) | 14 (8.3) | 12 (7.1) | 36 (21.4) | 17 (10.1) | 65 (38.7) |
| Female | 142 | 78 (54.9) | 15 (10.6) | 10 (7.0) | 35 (24.6) | 18 (12.7) | 63 (44.4) |
| Total | 310 | 157 (50.6) | 29 (9.4) | 22 (7.1) | 71 (22.9) | 35 (11.3) | 128 (41.3) |

Table 2 present the prevalence of malaria infection and malaria anaemia according to gender. The result revealed that females were more infected with malaria than the male counterparts with the prevalence rate of 54.9% and 47.0% respectively. This was statistically not significant ($p>0.05$). Equally female children (44.4%) that were anaemic with malaria infection had the highest prevalence rate than their male (41.3%) counterparts. The result shows no significant difference between gender and malaria anaemia ($p>0.05$).

**Table 3: Prevalence of Malaria Infection and Malaria Anaemia with Age of Children**

| Age group | No. examined | No. (%) infected with malaria | Malaria anaemia | | | | |
|---|---|---|---|---|---|---|---|
| | | | No. (%) non anaemia | No. (%) mild anaemia | No. (%) moderate Anaemia | No. (%) severe anaemia | No. (%) anaemic with malaria |
| 6 mnths-4 yrs | 134 | 67 (50.0) | 18 (13.4) | 4 (3.0) | 30 (22.4) | 15 (11.2) | 49 (36.7) |
| 5-9 yrs | 84 | 49 (58.3) | 2 (2.4) | 7 (8.3) | 24 (28.6) | 16 (19.0) | 47 (56.0) |
| 10-14 yrs | 81 | 38 (46.9) | 8 (9.9) | 10 (12.3) | 16 (19.8) | 4 (4.9) | 30 (37.0) |
| ≤15 yrs | 11 | 3 (27.3) | 1 (9.1) | 1 (9.1) | 1 (9.1) | 0 (0.0) | 2 (10.0) |
| Total | 310 | 157 (50.6) | 29 (9.4) | 22 (7.1) | 71 (22.9) | 35 (11.3) | 128 (41.3) |

Table 3 Highlight the prevalence of malaria infection and malaria anaemia in relation to age group. Children of age-group 5-9 years (58.3%) had the highest prevalence of malaria infection while the least was among ≤15 years (27.3%). There was no significant difference between age group and malaria infection. Similarly, children age-group 5-9 years (56.0%) that were anaemic with malaria infection ha higher prevalence rate with 8.3%, 28.6% and 19.0 as mild, moderate and severe anaemia respectively and the least recorded within ≤15 (10.0%) with only 9.1% and 9.1% as mild and moderate anaemia respectively. There was significant difference between age-group and malaria anaemia ($p<0.05$).

**Table 4: Prevalence of Malaria Infection and Malaria Anaemia according to Parents/Guardians Occupation**

| Parents/guardians occupation | No. examined | No. (%) infected with malaria | Malaria anaemia | | | | |
|---|---|---|---|---|---|---|---|
| | | | No. (%) non anaemia | No. (%) mild anaemia | No. (%) moderate anaemia | No. (%) severe anaemia | No. (%) anaemic with malaria |
| Civil servant | 88 | 46 (52.3) | 7 (8.0) | 10 (11.4) | 25 (28.4) | 4 (4.5) | 39 (44.3) |
| Business/trading | 99 | 43 (43.4) | 9 (9.1) | 4 (4.0) | 20 (20.2) | 10 (10.1) | 34 (34.3) |
| Farming | 63 | 35 (55.6) | 5 (7.9) | 4 (6.3) | 13 (20.6) | 13 (20.6) | 30 (47.6) |
| Unemployed | 30 | 15 (50.0) | 5 (16.7) | 0 (0.0) | 6 (20.0) | 4 (13.3) | 10 (33.3) |
| Others | 30 | 18 (60.0) | 3 (10.0) | 4 (13.3) | 7 (23.3) | 4 (13.3) | 15 (50.0) |
| Total | 310 | 157 (50.6) | 29 (9.4) | 22 (7.1) | 71 (22.9) | 35 (11.3) | 128 (41.3) |

Table 4 highlights the prevalence of malaria infection and malaria anaemia according to parents/guardians occupation. Children parents/guardians with other profession (60.0%) were most infected with malaria parasite and the least malaria infection was among business/trading (43.4%). There was no significant difference between parents/guardians occupation and malaria infection ($p>0.05$). In relation to malaria anaemia,parents/guardians

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occupation with regard to those that were anaemic with malaria infection was higher among chilren's parents/guardians that had other profession (50.0%) while unemployed (33.3%) had the least prevalence rate with only moderate (20.0%) and severe anaemia (13.3%). Analysis indicates significant difference between parents/guardians occupation and malaria anaemia ($p<0.05$).

**Table 5: Prevalence of Malaria Infection and Malaria Anaemia in according to Parents/Guardians Educational Qualification**

| Parents/guardians educational qualification | No. examined | No. (%) infected with malaria | Malaria anaemia | | | | |
|---|---|---|---|---|---|---|---|
| | | | No. (%) non anaemia | No. (%) mild anaemia | No. (%) moderate anaemia | No. (%) severe anaemia | No. (%) anaemic with malaria |
| Tertiary | 104 | 53 (51.0) | 13 (12.5) | 12 (11.5) | 22 (21.2) | 6 (5.8) | 40 (38.5) |
| Secondary | 73 | 39 (53.4) | 9 (12.3) | 2 (2.7) | 19 (26.0) | 9 (12.3) | 30 (41.1) |
| Primary | 46 | 20 (43.5) | 3 (6.5) | 4 (8.7) | 9 (19.6) | 4 (8.7) | 17 (37.0) |
| Non formal | 86 | 45 (51.7) | 4 (4.6) | 4 (4.6) | 21 (24.1) | 16 (18.4) | 41 (47.1) |
| Total | 310 | 157 (50.6) | 29 (9.4) | 22 (7.1) | 71 (22.9) | 35 (11.3) | 128 (41.3) |

Prevalence of malaria infection and anaemia in relation to parents/guardians educational qualification is shown in Table 5. The result depicted those parents/guardians with secondary education their children had highest malaria infection of 53.4 % and the least malaria infection was among primary education (43.5%). This was statistically insignificant ($p>0.05$). In relation to malaria anaemia, children that were anaemic with malaria infection and their parents/guardians that undergo non formal education had the highest prevalence of 47.1% with mild (4.6%), moderate (24.1%) and severe anaemia (18.4%) while the parents/guardians that attended primary education and their children were anaemic with malaria infection had the least prevalence rate of 37.0% with 8.7%, 19.6% and 8.7% as mild, moderate and severe anaemia respectively. This difference in prevalence of malaria anaemia with parents/guardians educational qualification was statistically significant ($p<0.05$).

**Table 6: Prevalence of Malaria Infection and Malaria Anaemia according to Place of Residence**

| Place of residence | No. examined | No. (%) infected with malaria | Malaria anaemia | | | | |
|---|---|---|---|---|---|---|---|
| | | | No. (%) non anaemia | No. (%) mild anaemia | No. (%) moderate anaemia | No. (%) severe anaemia | No. (%) anaemic with malaria |
| Housing estate | 13 | 5 (38.5) | 0 (0.0) | 1 (7.7) | 3 (23.1) | 1 (7.7) | 5 (38.5) |
| Quarters | 33 | 18 (54.5) | 3 (9.1) | 2 (6.1) | 9 (27.3) | 4 (12.1) | 15 (45.5) |
| City/Town setting | 185 | 95 (51.4) | 20 (10.8) | 12 (6.5) | 40 (21.6) | 23 (12.4) | 75 (40.5) |
| Village setting | 79 | 39 (49.4) | 6 (7.6) | 7 (8.9) | 19 (24.1) | 7 (8.9) | 33 (41.8) |
| Total | 310 | 157 (50.6) | 29 (9.4) | 22 (7.1) | 71 (22.9) | 35 (11.3) | 128 (41.3) |

Table 6 highlight the prevalence of malaria infection and malaria anaemia according to place of residence. Children residing in quarter (54.5%) had the highest prevalence rate of malaria infection while the least malaria infection was among those children residing in housing estate (38.5%). Equally, those children that were anaemic with malaria infection that reside in quarters (45.5%) with mild (6.1%), moderate (27.3%) and severe anaemia (12.1%) the prevalence rate was significantly higher while those residing in housing estate (38.5%) had the least with mild (7.7%), moderate (23.1%) and severe anaemia (7.7%). This was statistically insignificant ($p>0.05$).

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## DISCUSSION

The sub-Saharan Africa region has the greatest number of people expose to malaria transmission and the highest malaria morbidity and mortality rates in the world (WHO, 2005). The burden of malaria anaemia may be under estimated in malaria endemic regions in developing countries were access to appropriate health care facilities is wanting (Sumbele *et al*., 2015).

This study documented a high prevalence of malaria infection and malaria anaemia with the prevalence rate of 50.6% and 41.3% respectively among the Out-Patient children. The overall prevalence of malaria was consistent with Kiggundu *et al*. (2013) reported 54.6% among Hospitalized children in Rakai, Uganda and Obonyo *et al*. (2007) reported 82.5% in Western Kenya. The differences in environmental factors, existing malaria intervention and prevention strategies, and the class of children examined, may be responsible for observed variation (Oladeinde *et al*., 2012). This prevalence rate of malaria infection in this study was due to fact that the study wasconducted during raining season. Also the number of malaria cases detected was high in the month of October and November indicating malaria transmission was elevated as a result of blockage of water due to the poor drainage and inadequate waste disposal and sanitation in Yola among other factors. According to Yusuf, as long as there are stagnant gutters and swamps in our environment where mosquitoes breed in millions, there shall be no respite to the malaria scourge and its attendant effect on the health and socio-economic life of Nigeria and extension Africans (Yusuf, 2007). The malaria specie detected in this study was *Plasmodium falciparum*, similar with the findings of Ani (2004) in Ebonyi State Nigeria. Ani also reported that *P. falciparum* causes complicated form of malaria especially in young children. Hence this prevalence rate of malaria anaemia in this study.

The relationship between malaria infection and malaria anaemia was statistically not significant ($p>0.05$). The overall prevalence of children that were anaemic with malaria infection was 41.3%, this was lower when compared with the report of Jambo *et al*. (2010), that children with malaria parasite in their blood of which 85.9% of them were anaemic in Markurdi City, North Central Nigeria. Children infected with malaria and had mild, moderate and severe anaemia was 44.9%, 52.2% and 47.9% respectively. In similar study, prevalence of mild and severe forms of anaemia among children diagnosed with *P. falciparum* malaria reported by Alumanah and Nwangums (2007). Malaria is still the single most common cause of fever and anaemia among children in Nigeria and other parts of sub-Saharan Africa (Davis *et al*., 2006; Githeko, *et al*., 2006; Deressa, 2007). Severe anaemia can lead to malnutrition since malaria parasite destroyed red blood cell, hence deficient in iron. In mild and moderate anaemia the used of haematinics should be recommended in addition to anti-malaria drugs while maintain balance diet and in case of severe malaria blood transfusion is highly recommended.

Prevalence of malaria infection was higher in females than the males although this was not significant ($p>0.05$). This finding was similar with the reports of Okonko *et al*. (2009) and Olasunkami *et al*. (2013) where they both recorded high malaria infection among female than their male counterparts in Abeokuta Nigeria. However other finding reveals that prevalence of malaria infection was higher in males than females (Etusium *et al*., 2013). These differences could exist and not far from the fact that malaria is no respecter of persons, transmission depends on the exposure to infectious bite of mosquito, and the individual susceptibility to malaria infection. In relation to malaria anaemia, female children were more anaemic with malaria infection than their male counterparts and this was not statistically significant ($p>0.05$). However, anaemia in females may also results either some female children reach puberty at an early stage and starts to menstruate which could be among other factors, though it was not assess in the study. Studies conducted on anaemia mostly shows prevalence of anaemia was significantly higher in girls when compared to boys (Basu *et al*., 2005; Jai Probhakar and Gangadhor, 2009; Jain and Mangal, 2012).

The analysis showed insignificant difference between age group and rate of malaria infection ($p>0.05$). Age goup 5-9 years (58.3%) recorded the highest prevalence rate of infection. This was consistent with Ani (2004) findings, that the age class 5-7 years (47.0%) had the highest prevalence rate in Ebonyi State, Nigeria and Ezeigbo *et al.* (2014) children aged 5 years were most infected with prevalence rate of 73.8% among 1-5 years in Aba South Eastern Nigeria. This high infection rate among age group 5-9 years might be that those children were expose more to mosquito bites or due to low immunity of these young children in fighting malaria. The least prevalence as in the

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case of 6 month-4 years might be as a result of parents' habit in protecting their children through possible preventives measures. However, the infection rate decreases in older children as seen in 10-14 years and ≤15 years indicating that the malaria infection decreases with increasing age. Therefore, older children are less susceptible to malaria attack because it seems they have developed their own active immunity against malaria (Angyo *et al*, 1996). In this study it was observed decreased prevalence of malaria anaemia with age. Since older children that were anaemic with malaria infection age ≤15 years had least prevalence rate with only mild (9.1%) and moderate anaemia (9.1%). This difference in prevalence was statistically significant ($p<0.05$). This agrees with observation that the speed of acquired anti-disease immunity depends on the frequency of parasite exposure from birth (Doolan *et al*., 2009). Also, decreased prevalence of malaria parasite, the Geometric Mean Parasite Density (GMPB)/µl, anaemia and malaria anaemia with an increase in age group is not unusual as age been associated with a decrease in disease severity (Doolan *et al*., 2009).

Higher prevalence of malaria infection was recorded among children whose parents/guardians with other professions (60.0%). Though, this was not statistically significant ($p>0.05$). This high prevalence rate of malaria might be that their income is below the average and might not be sufficient to carter for those basic needs in their daily life orto acquire those preventive measures against malaria parasite. In relation to malaria anaemia, those that were anaemic with malaria infection recorded high among children whos parents/guardians had other professions (50.0%) with mild (13.3%), moderate (23.3%) and severe anaemia (13.3%). However, this was lower among business/trading which could be as a result of improvement in their living standard. Lower income may be important determinant of this anaemia. Sumbele *et al*. (2015) reported that malaria anaemia decreased with improve socioeconomic status in children living in urban areas accentuating the need for a regulated growth in urban areas. The difference was statistically ($p<0.05$). Father's working status was found to be an important correlate of anaemia in children (Bassam, 2009; Assefa *et al*., 2014).
Parents/guardians level of education was not statistically significant ($p>0.05$). Though, children whose parents/guardians had secondary education recorded a high prevalence of malaria infection of 53.4%. This high infection rate could attribute to the fact that they lack knowledge on the causative agent of malaria parasite, its preventive measures and/or due to poverty. Malaria anaemia was found to be equally significantly higher among children that were anaemic with malaria among children whose parents/guardians do not attend formal education. Also they might have history of previously malaria attack which could have profound effects on malaria anaemia or lacking good balance diet. Analysis indicate there was significant difference between educational qualification and malaria anaemia ($p<0.05$).

Findings from this study revealed that children living in quarters (54.5) were most infected with malaria infection and similarly, according to malaria anaemia, those children that were anaemic with malaria infection had the highest prevalence rate of 45.5% among children living in quarters. This high prevalence of malaria infection and malaria anaemia among children living in quarters may be in line with the reports of other studies that malaria transmission in urban areas varies according to location, land use human movement pattern, socioeconomic factors, waste management and local malaria intervention programme (De Silva and Marshall, 2012). While, the selection of new housing sites away from vector habitats, and improved as well as properly maintained housing, are important elements of environmental management for vector control (Ault, 1994) may be the observed low prevalence among those living in housing estate. The presence of 'pockets' of bushy areas in different parts of the town around houses, couple with urban agriculture may provide optimal conditions for vector breeding, leading to a high risk of malaria transmission in the vicinity (Sumbele *et al*., 2015), hence the prevalence rate of this malaria infection and malaria anaemia among children live in quarters.

## CONCLUSION

The finding of this study reveals that malaria infection and malaria anaemia today is still a public health problem among children which are the vulnerable group. Factors associated with malaria anaemia include children age, occupation and educational qualification of parents/guardians. To advert the effects of *Plasmodium falciparum* and the likely attacks on more children, efforts need to be undertaken on the control and prevention of mosquito vector

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and malaria *Plasmodium* and should be routinely done by the state stakeholders and to encourage individuals and communities participation.

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## REFERENCES

1. *Adamawa State Ministry of Information (1994). Adamawa State Diary. Adamawa Press Limited, Yola, Adamawa State. 1-13.*
2. *Adebayo, A. A. and Tukur, A. L. (1999). Adamawa State in maps. ISBN 97835157-0-5.*
3. *Akosim, C., Tella, I. O. and Jatau, D. F. (1999). Vegetation and Forest Resources In: Adamawa State in Maos. Paraclate Publishers, Yola, Nigeria, 32-35.*
4. *Alumanah, E. O. and Nwanguma, B. C. (2007). Severity of Anaemia in Nigerian Children Diagnosed with Plasmodium falciparum Malaria in the first year of Life. Journal of Rural and tropical public health, 6: 11-15.*
5. *Angyo, L. A., Pam, C. D. and Szlachetba, R. (1996). Clinical Patterns and outcome in Children with Acute Severe Plasmodium falciparum Malaria at Jos University Teaching Hospital Nigeria. East Africa Medical Journal, 73(12): 823-826.*
6. *Ani, O. C. (2004). Endemicity of Malaria among Primary School Children in Ebonyi State, Nigeria. Animal Research International, 1(3): 155-159.*
7. *Assefa, S., Mossie, A. and Hamza, L. (2014). Prevalence and severity of anemia among school children in Jimma town, Southwest Ethiopia. Biomed Central Hematology, 1-18. Doi: 10.1186/2052-1839-14-3.*
8. *Ault, S. K. (1994). Environmental management: A re-emerging vector control strategy. American Journal of Tropical Medicine and Hygiene, 50 (Suppl. 6): 35-49.*
9. *Bassam, F. (2009). AL-ZAIN: Impact of Socioenomic conditions and Parasitic Infection on Hemoglobin level among Children in Um-unnaser village, Geza Strip. Turkish Journal of Medical Science, 39(1): 53-58.*
10. *Basu, S., Hazarika, R. and Parmar, V. (2005). Prevalence of anaemia among school adoleslescent of Chandigarh. Indian Paediatric, 42: 593-7*
11. *Bouyou-Akotet, M. K., Dzeing-Ella, A., Kendjo, E., Etoughe, D., Ngoungou, E., Planche, T., Koko, J. and Kombila, M. (2009). Impact of moderate to severe anaemia in children below 10 years of age in Gabon. BioMed Central. doi: 10.1186/1475-2875-8-166.*
12. *Chapp-Jambo,A. U. N. (2004)Topten diseasesseenatthechildren outpatient of ayoungNigerian TeachingHospital.The ABSUTHexperience.Journalof MedicalInvestigationand Practice, 5: 4-7.*
13. *Cheesbrough, M. (2006). District laboratory practice in tropical countries. Second edition, part 2. Cambridge low price edition. 275-313.*
14. *Davis, J. C., Clark, T. D., Kemble, S. K., Talemwa, N., Njama-Meya, D., Staedke, S. C. and Dorsey, G. (2006). Longitudinal Study of Urban Malaria in a Cohort of Uganda Children: Description of Study Site, Census and Recruitment. Malaria Journal, 5: e18.*
*De Silva, P. M. and Marshall, J. M. (2012). Factors contributing to urban malaria transmission in Sub-Saharan Africa. Journal of Tropical Medicine. ID 819563, doi: doi.org/10.1155/2012/819563 [PubMed free article] [PubMed]*
15. *Deressa, W. (2007). Treatment Seeking Behaviour for Febrile Illness in an area of seasonal Malaria Transmission in Rural Ethiopia. Malaria Journal, 6: s49.*
16. *Doolan, D. L., Dobano, C. and Baird, J. K. (2009). Acquired Immunity to Malaria. Clin Microbiol Rev, 22: 13-36. Doi:10.1128/CMR.00025-08 [PMC free article] [PubMed]*
17. *Etusim, P. E., Kalu, C., Nduka, F. O., Kalu, E. C., Melariri, P. E., Nwoke, M. and Aduaka, A. C. (2013). Studies on the Prevalence of Malaria Parasite among Children with Splenomegaly in Aba Metropolis, Abia State, Nigeria. Journal of Medical and Applied Biosciences, 5(1): 56-66.*

Volume 3 (Issue 11) : November 2016 ISSN: 2394-9414
DOI: 10.5281/zenodo.165287 Impact Factor- 3.109

18. *Ezeigbo, O. R., Osuagwu, M. C., Ezike, M. N., Ibegbulem, Z. O. and Kalu, S. (2014). Malaria Parasitaemia in Children Aged 1-5 Years in Aba, South Eastern Nigeria. US Open General Microbiology Journal, 1(1): 1-6.*
19. *Fernando, S. D., Gunawardena, D. M., Bandara, M. R., De Silva, D., Carter, R., Mendis, K. N. et al. (2003). The impact of repeated malaria attacks on the school performance of children. American Journal Tropical Medical Hygiene, 269: 582-588 [PubMed]*
20. *Githeko, A. K., Agisi, J. M., Odada, P. K., Atieli, F. K., Ndenga, B. A., Githure, J. I. and Yon, G. (2006). Topography and Malaria Transmission Heterogeneity in Western Kenya Highlands; Prospects for local Vector Control. Malaria Journal, 5: e107.*
21. *Iloh,G. U. P., Amadi,A.N.,Nwankwo,B. O. and Ugwu,V. C. (2011). Common under-fivemorbidity insouth-EasternNigeria:astudy ofits patterninarural MissionGeneralHospitalinImostate. NigeriaJournal ofMedicine,20: 99-104.*
22. *Iloh, G. U. P.,Ofoedu,J. N.,Njoku,P. U.,Amadi,A. N. andGodswill-Uko, E. U. (2012).Themagnitude ofunder-fiveemergenciesinaresource-poorenvironmentof arural hospitalinEastern,Nigeria: Implicationsforstrengthening the house-holdand community integratedmanagementof childhoodillnesses. NorthAmericaJournal ofMedicalSciences,4: 344-349.*
23. *Jai Probhakar, S. C. and Gangadhar, M. R. (2009). Prevalence of anaemia in Jenukuruba Primitive Tribal Children of Mysore District, Karnataka. Anthropologist, 11: 49-51.*
24. *Jain, N. and Mangal, V. (2012). Prevalence of anaemia in school children, Rishikesh, Uttrakhand, India. Medical Practice and Review, 3(1).*
25. *Jombo, G. T. A., Mbaawuaga, E. M., Anongu, S. T. Egah, D. Z., Enenebeaku, M. N. O., Peters, E. J., Utsalo, S. J., Okwori, E. E., Odey, F. (2010). The Burden of Malaria among under 5 Children: Finding from Makurdi City, North Central Nigeria. Reviews in Infection, 1(3): 140-144.*
26. *Kagu, M. B., Kawuwa, M. B. and Gadzama, G. B. (2007). Anaemia in pregnancy: a cross-sectional study of pregnant women in a Sahelian tertiary hospital in Northeastern Nigeria. Journal of Obstetrics and Gynaecology, 27: 676-679.*
27. *Kiggundu, V. L., O'Meara, W. P., Musoke, R., Nalugoda, F. K., Kigozi, G., Baghendaghe, E., Lutalo, T., Achienge, M. K., Reynolds. S. J., Makumbi, F., Serwaddda, D. andGray, R. H. (2013). High Prevalence of Malaria Parasitemia and Anaemia among Hospitalized Children in Rakai, Uganda. PLOS ONE, 1-7.*
28. *Menendez, C., Fleming, A. F. and Alonso, P. L. (2000). Malaria-related anaemia. Parasitology Today, 16: 469-476. doS0169-4758(00)01774-9.*
29. *Molineaux, L. (1997). Malaria mortality: some epidemiological considerations. Annals of Tropical Medicine and Parasitology, 91(7): 811-825.*
30. *Nwolisa,C. E.,Erinugha,A. U. andOfoleta,S. I. (2005). Patternof morbidity among preschoolchildren attending the children's outpatientclinicofFederalMedicalCentre,Owerri,Nigeria. NigeriaJournal ofMedicine,14 (4):378-380.*
31. *Obonyo, C. O., Vulule, J., Akhwale, W. S. and Grobbee, D. E. (2007). In-hospital morbidity and mortality due to severe malaria anaemia in Western Kenya. American Journal of Tropical Medicine Hygiene, 77: 23-28.*
32. *Okonko, I. O., Soleye, F. A., Amusan, T. A., Ogun, A. A., Udeze, A. O., Nkang, A. O., Ejembi, J. and Falaye, T. O. C. (2009). Prevalence of Malaria Plasmodium in Abeokuta, Nigeria. Malasian Journal of Microbiology, 5(2): 113-118.*
33. *Olasehinde, G. I., Ajayi, A. A., Taiwo, S. O., Adekeye, B. T. and Adeyeba, O. A. (2010). Prevalence of falciparum Malaria among Infant and Children in Ota, Ogun State, South Western Nigeria. African Journal of Clinical and Experimental Microbiology, 11(3): 159-163.*
34. *Olasunkanmi, O. I., Akingbade, O. A., Akinjinmi, A. A., Okerentugba, P. O., Onajobi, I. B. and Okonko, I. O. (2013). Prevalence of Malaria Plasmodium among Children in Abeokuta, Nigeria. Academic Arena, 5(10): 44-47.*
35. *Salako,I. A. (2002)Nationalmalariaday,malariaawarenesswalk. Textofanaddressgivenonthe occasionofthemalaria awarenesswalkheld inAbuja.Journal of Malaria inAfricanTropic,1: 6-7.*

Volume 3 (Issue 11) : November 2016 ISSN: 2394-9414
DOI: 10.5281/zenodo.165287 Impact Factor- 3.109

36. *Sule,S. S. (2003). Childhoodmorbidity andtreatmentpatternatthe multipurposehealth centre,Ilesa,Nigeria.NigeriaJournal ofMedicine,12:145-149.*
37. *Sumbele, I. U. N., Kimbi, H. K., Ndamukong-Nyanga, J. L. Nweboh, M., Anchang-Kimbi, J. K., Lum, E., Nana, Y., Ndamukong, K. K. J. and Lehman, L. G. (2015). Malaria Anaemia and Anaemia Severity in Apparently Healthy Primary School Children in Urban and Rural Settings in the Mount Camaeroon Area: Cross Sectional Survey, PLOS ONE, 10(4): 1-14. e0123549.*
38. *Vitor-Silva, S., Reyes-Lecca, R. C., Pinheiro, T. R. A., Lacerda, M. V. G. (2009). Malaria is associated with poor school performance in an endemic area of the Brazillian Amazon. Malaria journal, 8: 230. doi: 10.1186/1475-2875-8-230 [PCM free article] [PubMed]*
39. *WorldHealthOrganization (2012). World malaria report Geneva, Switzerland: World Health Organization. www.who.int/malaria/publications/world_malaria_report_2012/en/*
40. *WorldHealthOrganization (2000). Malaria diagnosis, New Perspectives. Geneva, World Health Organization. WHO/CDS/RBM/2000.14, WHO/MAL/2000.1091.*
41. *WorldHealthOrganization(2005).WorldHealthOrganization,Geneva. WHOWorldMalariaReport.*
42. *World Health Organization (2008). World Malaria Report. World Health Organization, Switzerland. 99-101.*
43. *World Health Organization (2011). Haemoglobin concentrations for the Diagnosis of Anaemia and Asseement of Severity. Vitamin and Mineral Nutrition Information System. Geneva World Health Organization. WHO/NMH/NHD/MNM/11.1/*
44. *Yusuf, M. (2007). African Malaria Day should Focus on ridding Africa of Mosquitoes. Pharma News, 29: 1-64.*