The International Journal Of Engineering And Science (IJES)
|| Volume || 5 || Issue || 7 || Pages || PP -08-14 || 2016 ||
ISSN (e): 2319 – 1813 ISSN (p): 2319 – 1805

Prevalence of Malaria Infection and Malaria Anaemia among Children Attending Federal Medical Centre Yola, Adamawa State, Nigeria

*Kunihya, I. Z.[1], Samaila, A. B.[2], Pukuma, M. S.[3]and Qadeer, M. A.[3]
[1]*Department Of Integrated Science, Adamawa State College Of Education, Hong, P.M.B 2237 Yola, Adamawa State, Nigeria.*
[2]*Department of Biological Sciences, Abubakar Tafawa Balewa University, Bauchi, P.M.B 0248, Bauchi State, Nigeria.*
[3]*Department of Zoology, Modibbo Adama University Of Technology, P.M.B 2076, Yola, Adamawa State, Nigeria.*

----------ABSTRACT----------
Malaria associated anaemia represent a major public health problem. Thestudy considered Out-Patient children at Emergency Paediatric Unit, Federal Medical Centre, Yola aged 6 months-15 years from June to November 2015. Questionnaires were used to collect information relating to gender, age and parents/guardians sociodemographic characteristics. Microscopic examination of Thick and Thin blood films a technique was employed, Pack Cell Volumewas used to screen for anaemia. Of the 168 children sampled, the prevalence of malaria infection and malaria anaemia was 29.2% and 26.2% respectively and it was associated with P. falciparum. Malaria infection in relation to anaemia, children with mild anaemia (47.6%) had the highest infection rate. It was observed that malaria infection was higher among males (32.2%) than the females (25.6%), age group 5-9 years (34.2%) had the highest malaria infection and least was ≥15 years (20.0%) but these were statistically insignificant within gender and age of the children and malaria infection ($p>0.05$). Higher malaria infection among children whose parents/guardians were unemployed (38.5%), attended primary education (52.6%) and reside in village setting (31.4%). Malaria anaemia in relation to children epidemiological data, males (31.6%), 5-9 years (31.6%) recorded with high prevalence rate while sociodemographic characteristics of parents/guardians, children whose parents/guardians were civil servant (18.9%), attended tertiary education (13.8%) and live in quarters (11.1%) had the least prevalence rate of malaria anaemia. Children gender, parents/guardians occupation and educational qualification were significantly associated with malaria anaemia ($p<0.05$). Therefore, parents/guardians sociodemographic factors such as better occupation, higher educational qualification and well layout and refined area of residence reduces the prevalence of malaria infection and malaria anaemia in children. There is need to sensitized public on the importance of management of malaria and the possible effects of malaria anaemia on children in order to circumvent the menace.

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

Date of Submission: 17 May 2016 Date of Accepted: 05 July 2016

I. INTRODUCTION

Malaria is a public health importance usually attributed by plasmodium species. There are 300-500 million annual clinical cases and nearly one million deaths from malaria in children globally, 90% which occurs in sub-Saharan (Snow *et al*., 2005; WHO, 2011). Malaria associated anaemia represent a major public health problem in sub-Saharan Africa (Bjorkman, 2002). Malaria infection in human 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).

Severe malaria is associated with development of anaemia in endemic areas, the morphology may be influence by the nutritional status of the subject and some helminthiasis, resulting in an associated microcytic (iron defiency) and macrocytic (folic acid defiency) component (Calis*et al*., 2008). The pathogenesis of malarial anaemia is multifactorial, involving the immune- and non-immune mediate haemolysis of parasitized and non-parasitized erythrocytes (Chang and Stevenson, 2004; Ghosh, 2007). *P. falciparum* is resistance to wide range of antimalarial drugs, age, socio-demographic factors, HIV, couples with parasitic and bacterial infections may influence the prevalence and outcomes of malaria anaemia (Ekvall, 2003; Ong'eche *et al*., 2006).

This present study associate sex, age, parents/guardians sociodemographic characteristics(occupation, educational qualification and place of residence) in relation to malaria infection and malaria anaemia.

II. MATERIALS AND METHODS

Study Area

This study was carried out at Federal Medical Centre (FMC), Yola.FMC, Yola is referral hospital located in Yola Adamawa State. The area has a tropical climate, marked by dry and rainy seasons, with the rainy season commencing from April through October, with an average rainfall of about 79mm in the north and 190mm in the south. The dry season starts in November and ends in April with an average recorded temperature of about 35-42^{o}C. Most indigenes of Yola are civil servants and farmers, producing crops like guinea corn, millet, beans and kola-nut. Cattle rearing are the major occupation in the South.

Study Design and Population

One hundred and sixty eight (168) Out-patient children who came to the Emergency Paediatric Unit (EPU), Federal Medical Centre Yola, who were referred to the Laboratory for confirmatory malaria diagnosis aged 6 months-15 years were used in the study.The consent of parents/guardians of the children were sort, along with questionnaires was issued before collection of blood sample from the subjects.

Sample Collection

Blood sampleswere collected with the assistance of Medical doctors attached to EPU. The method of sample collection employed was finger prick and venipuncture techniques alternatively (Cheesbrough, 2006). Each blood sample was labelled and correctly tallies with the subjects number on the questionnaire to avoid any mix up.

Parasitological Examination

The sample collected was processed at Federal Medical Centre Yola Laboratory (Parasitological Unit). Thick and Thin blood film were prepared as described by Cheesbrough (2006). Thin films were fixed with methanol and all films were stained with 10% Giemsa stain pH 7.2 for 10 minutes as recommended by WHO (2000). Blood films were examined microscopically using x100 (oil immersion) objective as described by Cheesbrough (2006).

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).

Research Ethics

Before the research commenced, introductory letter was obtained from the Department of Zoology, Modibbo Adama University of Technology Yola to the Ethical Committee Federal Medical Centre Yola where they issued Ethical Clearance for the research. Informed consent from accompanying parents/guardians of the children was obtained as evidence of their consent.

Data Analysis

The statistical analysis was done using IBM Statistically Package for Social Sciences (SPSS) version 20 (SPSS, Inc., Chicago, IL, USA). Chi-square (χ^2) test to account for the association between different variable was used.

III. RESULTS

Table 1: Prevalence of Malaria Infection andAnaemia

Anaemia	No. Examined	No. (%) infected with malaria
Non anaemia	56	5 (8.9)
Mild anaemia	21	10 (47.6)
Moderate anaemia	57	24 (42.1)
Severe anaemia	34	10 (29.4)
Total	168	49 (29.2)

Table 1 shows the prevalence of malaria infection among children in relation to anaemia. Children infected with malaria parasite and had mild anaemia 10(47.6%) had the highest prevalence rate. This was followed by children infected with malaria and had moderate anaemia, severe anaemia were 24(42.1%) and 10(29.4%) respectively. While those infected with malaria and have non anaemia 5(8.9%) had the least prevalence rate. This was statistically significant ($p<0.05$).

Table 2: Prevalence of Malaria Infection and Malaria Infection with 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	90	29 (32.2)	1 (1.1)	6 (6.7)	15 (16.7)	7 (7.8)	28 (31.1)
Female	78	20 (25.6)	4 (5.1)	4 (5.1)	9 (11.5)	3 (3.8)	16 (20.5)
Total	168	49 (29.2)	5 (3.0)	10 (6.0)	24 (14.3)	3 (3.8)	44 (26.2)

The gender-related prevalence of malaria infection and malaria anaemia is shown in Table 2. The result revealed that males were more infected with malaria infection than the females counterparts with the prevalence rate of 32.2% and 25.6% respectively. The analysis indicates no significant difference between gender and malaria infection ($p>0.05$). In relation to malaria anaemia, male children that were anaemic with malaria infection had the highest prevalence rate of 31.1% than the females with 20.5%. There was 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	90	26 (28.9)	3 (3.3)	6 (6.7)	12 (13.3)	5 (5.6)	23 (25.6)
5-9 yrs	38	13 (34.2)	1 (2.6)	1 (2.6)	7 (18.4)	4 (10.5)	12 (31.6)
10-14 yrs	35	9 (25.7)	1 (2.9)	3 (8.6)	4 (11.4)	1 (2.9)	8 (22.9)
≥15 yrs	5	1 (20.0)	0 (0.0)	0 (0.0)	1 (20.0)	0 (0.0)	1 (20.0)
Total	168	49 (29.2)	5 (3.0)	10 (6.0)	24 (14.3)	10 (6.0)	44 (26.2)

Table 3 highlight the prevalence of malaria infection and malaria anaemia in relation to the age group. The result revealed that children age group 5-9 year (34.2%) had the highest malaria infection followed by age group 6 months-4 years (28.9%), 10-14 years (25.7%) and the least was among ≤15 years (20.0%). There was no significant difference between age-group and malaria infection ($p>0.05$). Children age group 5-9 years (31.6%) that were anaemic with malaria recorded the highest prevalence rate with mild (2.6%), moderate (18.4%) and severe anamia (10.5%). While the least was among age ≥15 years with only moderate anaemia (20.0%). Analysis reveals that there was no significant difference between age-group and malaria anaemia ($p>0.05$).

Table 4: Prevalence of Malaria Infection and Malaria Anaemia in relation 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	53	12 (22.6)	2 (3.8)	4 (7.5)	4 (7.5)	2 (3.8)	10 (18.9)
Business/trading	49	18 (36.7)	1 (2.0)	0 (0.0)	11 (22.4)	6 (12.2)	17 (34.7)
Farming	36	11 (30.6)	2 (5.6)	2 (5.6)	6 (16.7)	1 (2.8)	9 (25.0)
Unemployment	13	5 (38.5)	0 (0.0)	3 (23.1)	1 (7.7)	1 (7.7)	5 (38.5)
Others	17	3 (17.6)	0 (0.0)	1 (5.9)	2 (11.8)	0 (0.0)	3 (17.6)
Total	168	49 (29.2)	5 (3.0)	10 (6.0)	24 (14.3)	10 (6.0)	44 (26.2)

Prevalence of malaria infection and malaria anaemia in relation to children parents/guardians is shown in Table 4. The result highlighted that unemployed (38.5%) had the highest malaria infection. These was followed by business/trading (36.7%), farming (30.6%), civil servant (22.6%), while the least malaria infection was among others profession (17.6%). The analysis shows no significant difference between parents/guardians occupation and malaria infection ($p>0.05$). Equally, with regard to malaria anaemia, those that were anaemic with malaria infection present with highest prevalence of 38.5% was among children whose parents/guardians were unemployment with mild (23.1%), moderate (7.7%) and severe anaemia (7.7%) and the least was among children whose parents/guardians had other profession (17.6%) with only mild (5.9%) and moderate anaemia (11.8%). There was no significant difference between parents/guardians occupation and malaria anaemia ($p<0.05$).

Table 5: Prevalence of Malaria Infection and Malaria Anaemia in relation 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	58	12 (20.7)	4 (6.9)	3 (5.2)	3 (5.2)	2 (3.4)	8 (13.8)
Secondary	38	10 (26.3)	1 (2.6)	3 (7.9)	5 (13.2)	1 (2.6)	9 (23.7)
Primary	19	10 (52.6)	0 (0.0)	2 (10.5)	5 (26.3)	3 (15.8)	10 (52.6)
Non formal	53	17 (32.1)	0 (0.0)	2 (3.8)	11 (20.8)	4 (7.5)	17 (32.1)
Total	168	49 (29.2)	5 (3.0)	10 (6.0)	24 (14.3)	10 (6.0)	44 (26.2)

Table 5 revealed the prevalence of malaria infection and malaria anaemia in relation to parents/guardians educational qualification. The result depicted those with primary education (52.6%) recorded highest with malaria infection followed by non formal education (32.1%), secondary education (26.3%) and the least malaria infection were among those with tertiary education (20.5%). Analysis revealed no significant difference between parents/guardians educational qualification and malaria infection ($p>0.05$). Similarly, according to malaria anaemia, children that were anaemic with malaria incection and their parents/guardians attended primary education had the highest prevalence of 52.6% with mild (10.5), moderate (26.3) and severe anaemia (15.8%) and the least was among those children whose parents/guardians attended tertiary education (13.8%) with mild (5.2%), moderate (5.2%) and severe anaemia (3.4%). The analysis shows there was significant difference between parents/guardians educational qualification and malaria anaemia ($p<0.05$).

Table 6: Prevalence of Malaria Infection and Malaria Anaemia in relation 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	1	0.(0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Quarters	9	1 (11.1)	0 (0.0)	1 (11.1)	0 (0.0)	0 (0.0)	1 (11.1)
City/town setting	123	37 (30.1)	5 (4.1)	6 (4.9)	19 (15.4)	7 (5.7)	32 (26.0)
Village setting	35	11 (31.4)	0 (0.0)	3 (8.6)	5 (14.3)	3 (8.6)	11 (31.4)
Total	168	49 (29.2)	5 (3.0)	10 (6.0)	24 (14.3)	10 (6.0)	44 (26.2)

Table 6 depicts the prevalence of malaria infection and malaria anaemia according to place of residence. Children living in village setting had the highest malaria infection rate with 31.4%. This was followed by city/town setting (30.1%) and the least rate of malaria infection was among those living in quarters (11.1%). There was no significant difference between place of residence and malaria infection ($p>0.05$). In relation to malaria anaemia, highest prevalence rate was among children that were anaemic with malaria infection residing in village setting (31.4%), followed by city/town setting (26.0%) while the least recorded among those children living in quarters (11.1%). This was statistically insignificant ($p>0.05$).

IV. DISCUSSION

Plasmodium falciparum was the specie of malaria found among the infected subjects. Out of One Hundred and Sixty Eight subjects, 29.2% were present with malaria infection and 26.2% having the prevalence of malaria anaemia. This prevalence rate (29.2%) was higher compared with 27.0% reported byAdemowo (1995) and 24.3% reported by Kuadzi *et al* (2011) among children in Ghana. But this present findings was lower compared to the 30.0% reported by Okonko *et al*. (2012) among children in Ibadan, 31.6% reported by Olasunkanmi *et al*. (2013) among children in Abeokuta, Nigeria, and 36.4% reported by Okafor and Oko-ose (2012) among children aged 6 months-11 years in tertiary institution in Benin City, Nigeria.

Prevalence rate of anaemia among children infected with malaria parasites was 26.2% with mild anaemia (47.6%), moderate anaemia (42.1%) and severe anaemia (29.4%) and the relationship between malaria infection and anaemia was statistically significant ($p<0.05$). Similar studies reported prevalence rate of anaemia among children was 47.3% and malaria was significantly associated with anaemia and also opined that, the improvement in haemoglobin level may be associated with significant reduction of mosquito contact with the children using the malaria prevention tool (Oladeinde *et al*., 2012). Higher prevalence of anaemia (68.7%) in children with malaria parasites reported by Kiggundu *et al*. (2013) and 86% were anaemic and 21% had severe anaemia by Obonyo *et al*. (2007). This study confirms that malaria still the most common cause of anaemia which may results to other complication.

This study reveals that more males were infected (32.2%) than females (25.6%). This was statistically insignificant between gender and malaria infection ($p>0.05$). The present result confirms with the findings of Etusim *et al*. (2013), Obi *et al*. (2012), Ani (2004), Mbanugo and Ejim (2000). Mbanugo and Ejim (2000) reported that sex did not affect the prevalence of malaria among children. Olasunkanmi *et al*. (2013) assert that malaria affects all ages and both sexes. However, Zuk *et al*. (1996) stated that females have better immunity to parasitic disease which is attributable to genetic and hormonal factors while Okafor and Oko-ose (2012) pointed out that this issue is highly contestable because at this age of children, hormonal influence is not marked among children age 6 months-11 years in tertiary institution, Benin City, Nigeria.

Prevalence of malaria infection was found to be high among children aged 5-8 years. Finding of this study reveals that the rate of malaria infection increases among younger children by age as seen in age group 6 months-4 years (28.9%) and 5-9 years (34.2%) while it decreases in older children as their age increases as in age group 10-14 years (25.7%) and ≥15 years (20.0%). The infection rate among age group 6 months-4 years could be in line with WHO's suggestion that, in parts of the world were endemicity of *P. falciparum* malaria is stable severe malaria is mainly a disease of children from the first few month of life to the age of 5 years, because of the acquisition of partial immunity (Idro, 2001; Chiabi *et al*., 2009), and may also be that more care are given to this children and parents' habits in protecting their children through possible preventive measures. Other reasons as outline by Ezeigbo *et al*. (2014) may include environmental factors and parents' habit in adhering to preventive measures. While the decrease in prevalence of malaria infection in older children could be in accordance with Ani (2004) that prevalence of malaria infection has been found to reduce by age. This could be that they are less susceptible due to partial immunity as a result of previous exposure to the infection. While the susceptibility of these age-group 5-9 years with the previous exposure may result to this high prevalent of malaria anaemia. Kiggundu *et al*. (2013) opined that many children are likely to be anaemic at the time of their next malaria infection.

Observation of high prevalence of malaria infection and malaria anaemia recorded among parents/guardians who were unemployed with the prevalence rate of 38.5% and 38.5% respectively. This high prevalence agrees with Simbauranga *et al*. (2015) that unemployment and low level of education might lead to poor socio-economic status and further suggest that better socio-demographic conditions increases access to better nutrition and health care and lower the risk of anaemia. Hence, this lower prevalence rate of malaria anaemia among children whose parents/guardians were civil servant (18.9%) and other profession (17.6%). It is possible that this children are from well to do home where they may be well protected from mosquito bite and feed appropriately with better nutrition as required. Thus, significant reduction of malaria anaemia can be achieved as a result of an improvement in the quality of life.

In this study, there was no significant association between parents/guardians educational qualification and malaria infection ($p>0.05$). High prevalence of malaria infection was among those children whose parents

attended primary education (52.6%). This may likely associated with poverty, magnitude of awareness on the effect of malaria parasite that may result to neglegence toward protection of mosquito vector among others. In relation to malaria anaemia, parents/guardians level of education plays a significant role in determining the level of anaemia as observed in this study. Analysis indicates there was significant difference between parents/guardians educational qualification and malaria anaemia ($p<0.05$). Children whose parents/guardians attended tertiary education are found to be less anaemic with malaria infection with the mild (5.2%), moderate (5.2%) and severe anaemia (3.4%) may be they are conscious of child nutrition, prevention of mosquito bites by using any possible means of preventionand/or they are well informed about malaria because they are enlightened. Simbauranga *et al*. (2015) assert that the relationship between education and anaemia may be due to the capacity of caretakers to grasp the knowledge needed for adequate healthcare and nutrition for children. While the high prevalence of malaria anaemia among children whose parents/guardians attended primary education could be in line with Bassam (2009) reported that mothers' educational level and low family income were found important determinants of anaemia. Also lack of awareness among the mothers about the problem couple with their low educational status (Alaofe *et al*., 2009), poor nutritional practices and unhealthy food habits (Kikafunda *et al*., 2009), low iron bioavailability of the diet (Hashizume *et al*., 2004), malaria and parasitic infestations are additional factors associated with low hemoglobin (Hb) level in children (Ramalingaswami *et al*., 1997).

The high prevalence rate of malaria infection and malaria anaemia recorded in this study among children living in village setting and the least was among those living in quarters. This indicates location of persons, way of life, compliance to preventive measures if any, habit toward dusk and dawn, their belief, poverty, knowledge towards health care and nutrition would have a significant effects on malaria infection and malaria anaemia as seen in accordance to those children living in village setting, city/town setting and quarters. This also agrees with Hay *et al*. (2005) reports that, despite the fact that many Africa's health problems are common to both urban and rural environments, the epidemiology of some diseases and the challenges to prevention and control can differ.

V. CONCLUSION

Younger children are more prompt to malaria infection and malaria anaemia due to their partial immunity. A parents/guardians sociodemographic characteristics such as better occupation, higher educational qualification and well layout and refined area of residence reduces the prevalence of malaria infection and malaria anaemia in children. Furthermore, malaria infection is significantly associated with anaemia while malaria anaemia was also significantly associated with children's parents/guardians occupation and educational qualification. There is need to sensitized public on the importance of management of malaria and the possible effects of malaria anaemia on children in order to circumvent the menace.

VI. ACKNOWLEDGEMENTS

We wish to acknowledge the management of Federal Medical Centre for permission to carry out the research and Dr. Buba Usman Ahmadu (Consultant Paediatrician, Head of Department Paediatrics), staff of Emergency Paediatric Unit (EPU), Mr. Joseph M. Medugu (Medical Lab. Scientist), Federal Medical Centre, Yola for their support, coorperation in sample collection and laboratory analysis of this work. We also thank the children and parents/guardians for participating in the study.

REFERENCES

[1]. Ademowo, O. G., Falusi, A. G. and Mewoyeka, O. O. (1995). Prevalence of Asymptomatic Parasitaemia in an urban and rural community in south-western Nigeria. Central African journal of Medicine,41: 18-21.

[2]. Alaofe, H., Zee, J., Dossa, R. and O'Brien, H. T. (2009). Education and improved iron intakes for treatment of mild iron-deficiency anaemia in adolescent girls in Southern Benin. Food and Nutrition Bullutin, 30: 24-36.

[3]. Ani, O. C. (2004). Endemicity of Malaria among Primary School Children in Ebonyi State, Nigeria. Animal Research International, 1(3): 155-159.

[4]. 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.

[5]. Bjorkman, A. (2002). Malaria associated anaemia, drug resistance and antimalarial combination therapy. International Journal for Parasitology, 32: 1637-1643. [PubMed]

[6]. Calis, J. C., Phiri, K. S., Faragher, E. B., Brabin, B. J., Bates, I., Cuevas, L. E., et al. (2008). Severe anaemia in Malawian children. TheNew England Journal of Medicine,358: 888–899.

[7]. Chang, K. H. and Stevenson, M. M. (2004). Malaria anaemia: Mechanisms and implications of insufficient erythropoiesis during blood-stage malaria. International Journal for Parasitology., 34: 1501-1516. [PubMed].

[8]. Cheesbrough, M. (2006). District laboratory practice in tropical countries. Second edition, part 2. Cambridge low price edition. 275-313.

[9]. Chiabi,A.,V.Takou,P.F.,Tchokoteu,S.NgoUmand L.Essoh, (2009).Initial treatmentofseveremalaria inchildrenisinadequate-astudyfrom aReferral HospitalinCameroon.South AfricanJournal ofChildHealth,3(1): 9-11.

[10]. Ekvall, H. (2003). Malaria and anemia. Current Opinion in Hematology, 10: 108-114. [PubMed]

[11]. 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.

[12]. 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.

[13]. Ghosh, K. (2007). Pathogenesis of anemia in malaria: a concise review. Parasito Res., 101: 1463-1469. [PubMed]

[14]. Hashizume, M., Shimode, T., Sasaki, S., Kunii, O., Caypil, W., Dauletbaev, D. (2004). Anaemia in relation to low bioavailability of dietary iron among school-age children in the Arel Sea region, Kazakhstan. International Journal of Food Sciences and Nutrition, 55: 37-43. 10.1080/09637480310001642466.

[15]. Hay, S. I., Guerra, C. A., Tatem, A. J., Atkinson, P. M. and Snow, R. W. (2005). Urbanization, malaria transmission and disease burden in Africa. Nature Reviews of Microbiology, 3: 81-90. [PMC free article] [PubMed].

[16]. Idro, R. I. (2001). Clinical presentation, immediate outcome and prognostic factors of malaria in children admitted to Mulago hospital. Child Health and Development Centre, Publications and Reports.

[17]. 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.

[18]. Kikafunda, J. K., Lukwago, F. B., Turyashemererwa, F. (2009). Anaemia and associated factors among under-fives and their mothers in Bushenyi District, Western Ugaba. Public Health Nutrition, 12: 2302-2308. doi: 10.1017/S13690009005333.

[19]. Kuadzi, J. T., Ankra-Badu, G. and Addae, M. M. (2011). Plasmodium falciparum malaria in children at a tertiary teaching hospital: AOB blood group is a risk factor. The Pan African Medication Journal, 10: 2.

[20]. Mbanugo, J. I. and Ejim, D. O. (2000). Plasmodium Infections in Children Aged 0-5 years in Akwa Metropolis, Anambra State, Nigeria. Nigeria Journal of Parasitology, 21: 55-59.

[21]. Menendez, C., Fleming, A. F. and Alonso, P. L. (200). Malaria-related anaemia. Parasitology Today, 16: 469-476. doS0169-4758(00)01774-9.

[22]. Obi, R. K., Nwanebu, P. E., Okangba, C. C. and Nwanebu, C. K. (2012). Malaria Prevalence in Children under 5 years and Pregnant Women attending selected Hospital in Ihitte Ubaoma LGA, Imo State, Nigeria. Nigeria Journal of Parasitology, 33(1): 73-76.

[23]. Obonyo, C. O., Vulule, J., Akhwale, W. S. and Grobbee, D. E. (2007). In-hospital morbidity and mortality due to severe malarial anemia in western Kenya. American Journal of Tropical Medicine and Hygiene, 77: 23-28.

[24]. Okafor, F. U. and Oko-Ose, J. N. (2012). Prevalence of malaria infections among children aged six months to eleven years (6 months-11 years) in a tertiary institute in Benin City, Nigeria. Global Advanced Research Journal of Medicine Sciences, 1: 273-279.

[25]. Okonko, I. O., Adejuwon, A. O., Okerentungba, P. O., Frank-Peterside, N. (2012). Plasmodium falciparum and HIV 1/2 Coinfection among children presenting at the Out-Patient clinic of Oni Memorial Children Hospital in Ibadan, Southwestern Nigeria. Nature and Science,10(8): 94-100.

[26]. Oladeinde, B. H., Omoregia, R., Olley, M., Anunibe, J. A., Onifade, A. A. and Oladeinde, O. B.(2012). Malaria and Anaemia among Children in a Low Resource Setting in Nigeria. Iranian Journal of Parasitology, 7(3):31-37.

[27]. 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.

[28]. Ong'echa, J. M., Keller, C. C., Were, T., Ouma, C., Otieno, R. O., Landis-Lewis, Z. et al. (2006). Parasitiemia, anaemia, and malaria anaemia in infants and young children in Rural holoendemic Plasmodium falciparum transmission area. American Journal of Tropical Medicine and Hygiene, 74: 376-385. [PubMed]

[29]. Ramaligaswami, V., Jo'nsson, U., Rhode, J. (1997). Malnutrition: a south Asian enigma. Malnutrition in South Asia: a regional profile. Edited by: Gillespie, S. R. 1997, Kalhmandu: Rosa Publication, 11-22.

[30]. Simbauranga, R. H., Kamugisha, E., Hokororo, A., Kidenya, B. R. and Makani, J. (2015). Prevalence and factors associated with severe anaemia amongst under-five children hospitalized at Bugando Medical Centre, Mwanza, Tanzania. Biomed Central Hematology, 15: 13. Doi: 10.1186/s1287-015-0033-5.

[31]. Snow, R. W., Guerra, C. A., Noor, A. M., Myint, H. Y. and Hay, S. I. (2005). The global distribution of clinical episodes of plasmodium falciparum malaria. Nature, 434: 214-217. Doi: 10:1038/nature03342.

[32]. WHO (2011). World Malaria Report 2011.

[33]. World Health Organization (2000). Malaria diagnosis, New Perspectives. Geneva, World Health Organization. WHO/CDS/RBM/2000.14, WHO/MAL/2000.1091.

[34]. 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/

[35]. Zuk, M. and McKean, K. A. (1996). Sex differences in parasite infections: patterns and processes. International Journal of Parasitology, 26: 1009-1023.