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Analysis of Malaria Parasite and Anemia Prevalence in Children of Age 0-12 Year Admitted to General Hospital Oyo for the Period of 2000-2009, Oyo State, Nigeria

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Abstract:
The highest prevalence of malaria and anemia exist in the developing world where its causes are multifactorial. The objective of this study was therefore to investigate if the prevalence of malaria and anemia in children ages 0-12 years are sex and age dependent.

The investigation was carried out in children ward, Oyo State General Hospital, Owode, Oyo State, Nigeria. Data was collected at the registry in the children ward of ages 0-12 years admitted for malaria and anemia within ten years (2000-2009). The data used was extracted from the disease diagnostic index card for years 2000-2009 of Oyo State Hospital, Owode – Oyo. The method of analysis used was Product Moment Correlation Method. The study showed that the prevalence of malaria and anemia were sex dependent ($p<0.05$) with high prevalence in male, but not age dependent ($p>0.05$). It is therefore concluded that male children are more susceptible to malaria and anemia than female children. Therefore, there is the need for prompt and adequate diagnosis and treatment of the disease if any sign of the symptom is noticed. Parents are advised to report promptly to the clinic on time in case they notice any strange signs and symptoms in their children.

Keywords: *Anemia, Children, Infection, Malaria, Symptom*

1. Introduction

Malaria has been and still is the cause of much human morbidity and mortality in the tropical region. Although, the disease has been eradicated in most temperate zones, it continues to be endemic throughout much of the tropic and sub-topic zones of the world. Epidemics have resulted in the devastation of many populations. It has also resulted to a serious barrier to economic progress in many developing countries in which Nigeria is a part.D'AleTssandro and Butteins cited by Elbadr, Saif, Mahmoud, Osman, and Elmatary (2011) added that the burden of malaria in tropical world is estimated to involve 300-500 million episodes of acute illness and more than million deaths per year, mainly in African children.

And, anemia is one of the commonest and most intractable public healthproblems in Africa (Crawley, 2004). Malaria, anemia, and malnutrition contribute substantially to childhood morbidity in sub-Saharan Africa, but their respective roles and interactions in conferring disease are complex (Ehrhardt, Burchard and Mantel, 2006). Age and transmission intensity are known to influence the manifestation of severe falciparum malaria in African children (Idris, Aloyo, Mayende, Bitarakwat, 2006). A study indicated strong relation of severe anemia in falciparum malaric children to age < 5 years andthere was

strong relation between younger ages and low level of Hb ($p<0.05$) (Elbadr, Saif, Mahmoud, Osman, and Elmatary, 2011).

Several factors contribute to anemia in children in African countries but malaria remains the number one risk factor (Fowowe, n.a). Fowowe reported from his study that male sex have higher risk of malaria parasitemia and male sex was also found to have higher risk factor for anemia

Males had a significantly higher risk of malaria infection (odds ratio, OR, 1.399; 95% confidence interval, CI, 1.087–1.801, $p< 0.009$), while females had a significantly higher risk of anemia (OR, 2.711; 95% CI, 1.872–3.929; $p< 0.001$). Generally, age did not affect the prevalence of malaria—except among males, where children between 2-3 years old had a significantly ($p = 0.006$) higher prevalence. Generally and among males, age affected the prevalence of anemia with children 4–5 years old having significantly ($p< 0.001$) lower prevalence of anemia. Malaria was a risk factor for acquiring anemia (OR, 2.289; 95% CI, 1.630–3.214; $p< 0.001$). Overall prevalences of 75.77% and 87.32% for malaria and anemia, respectively, were observed. While malaria parasitemia was higher among males, anemia was higher in females. Malaria and anemia were affected by age only in males (Akinboab, Omoregiec, Mordia and Christopher, 2009).

From the study conducted in 2006, anemia (hemoglobin level, <11 g/dL) was seen in 64% of children and was, in multivariate analysis, associated with young age, season, residence, parasitemia, P. malariaecoinfection, and malnutrition (odds ratio [OR], 1.68 [95% confidence interval [CI], 1.38-2.04]). In addition, malnutrition was independently associated with fever (axillary temperature, > or = 37.5 degrees C; OR, 1.59 [95% CI, 1.13-2.23]) and clinical malaria (OR, 1.67 [95% CI, 1.10-2.50]). Malnutrition is a fundamental factor contributing to malaria-associated morbidity and anemia, even if the latter exhibits multifactorial patterns (Ehrhardt, Burchard and Mantel, 2006).

The most common cause of anemia is an iron deficiency; however, the condition may also be caused by deficiencies in folate, vitamin B_{12} and protein. Some anemia is not caused by nutritional factors, but by congenial factors and parasitic diseases such as malaria (Osazuwa and Ayo, 2010).Babies who are exposed to malaria before birth develop a tolerant phenotype that increases their susceptibility to malaria and anemia in childhood, they studied 586 newborns residing in a malaria-holoendemic area of Kenya to age three, assessing their malaria infection, malaria-specific immune responses, and anemia, and classifying them into three groups: "sensitized" babies in which cord blood cells made activating cytokines in response to malaria antigens; "exposed, not-sensitized" babies in which cord blood cells did not make activating cytokines but made an inhibitory cytokine (IL-10); and "not-exposed" babies born to uninfected mothers. The authors report that in the first 3 years of life, the exposed, not-sensitized newborns had a 60% greater risk of malaria infection than the unexposed group and a slightly higher risk of malaria infection than the sensitized group. They also had lower hemoglobulin levels, a sign of anemia, than the other babies. At 6 months, the T-cells of exposed, not-sensitized children were less likely to make activating cytokines in response to malaria antigens but made more IL-10 than the T-cells of the other children; malaria-specific antibody levels were similar in the three groups (King, 2009).This study therefore sought to analyze prevalence of malaria and anemia in children of ages 0-12 year admitted to General Hospital Oyo for the periodsof 1999-2009, Oyo State, Nigeria.And two null hypotheses were drawn for this study:

1. Malaria and anemia in children are not significantly sex dependent.
2. Malaria and anemia in children are not significantly age dependent.

2. Data and Method of Analysis

The investigation was carried out in children ward, Oyo State General Hospital, Owode, Oyo Statef, Nigeria. Data was collected at the registry in the children ward on children of ages 0-12 years admitted for malaria and anemia within a period of ten years (2000-2009). The data used in this study was extracted from the disease diagnostic index card for years 2000-2009 of Oyo State Hospital, Owode –

Oyo (Tables 1a, 2a & 3). The methods of analysis used are Product Moment Correlation Method and fatality rate.

3. Results and discussion

Table 1a: Prevalence of malaria parasite and anemia in children according to gender

Year	Male	Female	Total
2000	88	70	158
2001	89	82	171
2002	114	89	203
2003	80	73	153
2004	102	82	184
2005	88	98	186
2006	91	75	166
2007	42	36	78
2008	70	55	125
2009	99	87	186
Total	1527	1142	2669

Table 1b: Correlations of prevalence of malaria parasite and anemia between male and female

Correlations

		values for male	values for female
values for male	Pearson Correlation	1	.918**
	Sig. (2-tailed)		.000
	N	11	11
values for female	Pearson Correlation	.918**	1
	Sig. (2-tailed)	.000	
	N	11	11

**. Correlation is significant at the 0.01 level (2-tailed).

Results indicate that male has a higher mean (M = 146.09, SD = 43.769) than female (M = 110.18, SD = 31.138). Also, the correlationis high and positive (r=0.918, p=0.000) (Table 1b), which indicates that malaria and anemia is sex dependent, more males are affected than female. Therefore hypothesis one which says that malaria and anemia in children are not significantly sex dependent is rejected. This finding is confirmed by (Akinboab et al, 2009) reports that, males had a significantly higher risk of malaria infection (odds ratio, OR, 1.399; 95% confidence interval, CI, 1.087–1.801, p< 0.009), while females had a significantly higher risk of anemia (OR, 2.711; 95% CI, 1.872–3.929; p< 0.001). Overall prevalences of 75.77% and 87.32% for malaria and anemia, respectively, were observed. While malaria parasitemia was higher among males, anemia was higher in females.

Table 2a: Prevalence of malaria parasite and anemia according to age range

Year	Age 0-6 years	Age 7-12 years
2000	141	17
2001	158	13
2002	173	30
2003	136	17
2004	167	17
2005	179	07
2006	150	16
2007	69	09
2008	111	14
2009	154	32

Table 2b: Correlations of prevalence of malaria parasite and anemia between 0-6 and 7-12 years

		0-6 years	7-12 years
0-6 years	Pearson Correlation	1	.342
	Sig. (2-tailed)		.333
	N	10	10
7-12 years	Pearson Correlation	.342	1
	Sig. (2-tailed)	.333	
	N	10	10

Results indicate that children between 0-6 years of age has a significant higher mean (M = 143.80, SD = 32.853) than children between 7-12 years of age (M = 17.20, SD = 8.053).The correlation is very low and positive (r=0.342; p=0.333) (Table 2b) which means that malaria and anemia in children is not age dependent. Therefore, the hypothesis which says malaria and anemia in children are not significantly age dependent is accepted. However, Elbadr, Saif, Mahmoud, Osman, and Elmatary (2011) reported from their finding that children age <5 years are more exposed to severe malaria and anemia. The report of Elbadr et al (2011) was also confirmed by Price, Simpson, Nosten, Terkuile and White (2001)who also added that children age <5 years were more likely than older to become anemic.

Table 3: Mortality rate

Year	Total number of children	Total number of Death	%
2000	344	40	11.63
2001	307	38	12.38
2002	326	35	10.74
2003	314	35	11.15
2004	185	22	11.89
2005	226	34	15.04
2006	245	25	10.20
2007	202	12	5.95
2008	215	21	9.77
2009	315	6	1.91
Total	**2,820**	**304**	

The highest mortality rate was observed in the year 2005 with 15.04% (34 of 226) while the least was also noticed in the year 2009 with 1.91% (6 of 315) (Table 3). The overall mortality was 11% (304 of 2,820). The mortality rate for malaria and anemia in children varies and it depends on the severity of the infection. This finding was consistent with previous studies (Obonyo, Vulule ,Akhwale and Grobbee, 2007) who reported from their findings that 23% of children died from severe malaria-related anemia. Also, 12.2% of children died from severe malaria in developing countries (Faye, Ndao andCamara, 1999).

4. Conclusion and Recommendation

Malaria in children usually leads to anemia if prompt and adequate treatment is not done. Since all the children admitted for malaria during the period under study had anemia. This may be due to self medication of the parent of the infected children.

Also, malaria and anemia in children were not age dependent; all age ranges of children are prone to malaria and the consequent anemia. Although children between 0-6 years of age had higher prevalence of the disease. Malaria and anemia in children are sex dependent since males are more affected than the females. The mortality rate of malaria and anemia within the period is still high, which revealed the extent to which the disease needed to be monitored and controlled. Therefore, there is the need for prompt and adequate diagnosis and treatment of the disease if any sign of the symptom is noticed. Parents are advised to report to the clinic on time in case they notice any strange signs and symptoms.

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Authors' Contributions

We declare that this work was done by the Deborah O. Okunlola and Abiodun I. Oyinlola and all liabilities pertaining to claims relating to the content of this article will be borne by the authors. Deborah O. Okunlola conceived the study, participated in the study design, supervised the data collection, drafted and edited the manuscript. Abiodun I. Oyinlola (PhD) analyzed the data, participated in the study design, drafted and edited the manuscript. All authors read and approved the final manuscript. James K. Fakeye (a doctoral student) also participated in the study design and edited the manuscript.