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Anaemia and Malaria in Children attending two Selected Paediatric Clinics in Kano Metropolis, Northern Nigeria

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ABSTRACT: This study was aimed at assessing the extent of correlation between anaemia and malaria amongst paediatric patients attending Paediatric clinics of Murtala Muhammed Specialist Hospital (MMSH), and Hasiya Bayero Paediatric Hospital (HBPH). Two age groups (0-5 and 6-12 years old) were studied (both male and female). Three hundred samples of blood were examined for Malarial Parasites (MP). Two hundred and forty six samples that were positive, underwent Haematocrit and Haemoglobin Estimation. Higher prevalence of anaemia was recorded amongst 0-5 years age group: 153(83.2%) out of 184, with prevalence in the total population of 199(80.9%) out of 246. Correlation was significant between malaria and anaemia: $\tau=0.800$, $P<0.050$ (2-tailed), positive correlation was obtained between PCV and Hb in the whole age groups: $\tau=0.900$, $P=0.010$; (2-tailed). There was no significant difference between age group and sex of the subjects: $T=0.77$, $P=0.4729$; (2-tailed). This study has shown that malaria is one of the common causes of anaemia among children in malaria-endemic areas, Kano inclusive.

Keywords: Paediatric Clinics, Packed cell volume, Malaria, Anaemia, Haematocrit, Haemoglobin.

Introduction

Malaria is an infection caused by a parasite of the genus *Plasmodium* which is a protozoan, malaria and anaemia as one of its clinical manifestations have remained serious public health problems due to their profound impact on the Disability Adjusted Life Years (DALYs) of the populace (WHO,2003). WHO forecast a 16% rise in malaria cases annually. One child dies of malaria or its complication (severe anaemia and/or cerebral malaria) every 29 seconds in Africa (WHO,2003).

Malaria outbreak increases threefold within 2004-2005, with about 5000 contracting malaria weekly (Marchesini and Crawley,2004). Children with haematocrit of <15% should be transfused with blood because the very low value limits physical exertion and increases metabolic acidosis, thus, leading to anaemia (WHO,2003). In a study conducted in Zimbabwe the result showed that maternal anaemia and low birth weight (<2.5kg) are correlated (Marchesini and Crawley,2004). Of the 242 paediatric patients with malaria in Hasiya Bayero Paediatric Hospital, Kano, 192 (79.34%) were anaemic ranging from mild to severe (HBPH,2000).

Early erythrocyte surface markers were found to be different in severely anaemic children with malaria, and many of the complement lyses may play a role in the anaemia of malaria (Waitumbi and Stoute,2000). In a survey conducted in one health centre in Ogun State, Nigeria, showed 95% of the children with malaria

(mostly below 5 years) were anaemic (Johnson,2003). Sequestration of malarial parasites in the placenta, a consequence of infection with *P.falcifarum* during pregnancy is associated with infant anaemia (Van Eijk *et al.*,2002) As the child grows after passing through dangerous stage ,where he loses the passive immunity obtained from the mother without developing his own (usually under five years of age), the impact of malaria-induced anaemia reduces .i.e. the prevalence of mild anaemia is higher than that of severe anaemia, the rationale was obtained from the work of Meydani *et al.*(1997), where oxidants produced by the phagocytes as immune response in killing the MPs were found to be toxic to normal uninfected erythrocytes together with the infected ones which tantamount to anaemia although it is mild. Also result from the work of Igbeneghu (2005) on children attending diagnostic laboratory in Ibadan buttressed the fact that mild anaemia 139 subjects as compared with 11 subjects out of 242, With Mean Hb range of 10-11.4 g/dl. In a study conducted at four selected hospitals in Kano, 66.3% of pediatric subjects were anemic due to malarial infection (Imam and Indabawa, 2007).

This study was aimed at assessing the extent of correlation between anaemia and malaria amongst paediatric patients attending Murtala Muhammed Specialist Hospital (MMSH), and Hasiya Bayero Paediatric Hospital (HBPH) in Kano metropolis.

Materials and Methods

Study Area and Target groups

Two tertiary hospitals in Kano metropolis (Location: between latitude $12^{\circ} 17'N$, and longitude $8^{\circ} 36'E$), were selected for the study, they comprise: Murtala Muhammed Specialist Hospital (MMSH), and Hasiya Bayero Paediatric Hospital (HBPH). The target groups for the study were three hundred (300) children with age ranges from 0-12 years old, comprising both male and female subjects. Consent was obtained from the parents/guardians of the children who participated in this study.

Sample Collection and Handling

Capillary blood samples were collected from three hundred (300) subjects for Malaria parasites(MP) examination as described by Gilles (1993), where thick blood films stained with Giemsa stain for presence of MP was conducted. Parasites estimation in thick blood films was performed by thoroughly counting asexual forms of MPs against 200 WBC on the assumption that there was WBC count of $8000/\mu l$ (Trape *et al.*,1985). Haemoglobin and haematocrit estimation were conducted on two hundred and fourty six samples that were MP positive as described by Dacie and Lewis (1995).

Anaemia as defined according to WHO as described by Forfar and Arneil (1984): Hb <11 g/dl and PCV <33%. Anaemic subjects were further divided into two groups: Mild anaemia (between Hb <10.7-7g/dl and PCV <38- 25%), and Severe anaemia (Hb <7g/dl and PCV <25%). Age and sex of each subject were recorded.

Statistical Analysis

SPSS Statistical Software (ver.11.5) was used for the descriptive and correlation analysis of the data obtained, including sum (N), percentage, range and mean. Kendall's tau-b rank correlation and T-test were employed for the analysis of the obtained data respectively.

Results

The results of the study on anaemia in paediatric patients with malarial infections attending MMSH, and HBPH in Kano is presented in Table 1: 0-5 year age group males: 76.0%; and females:89.6%; 6-12 year age group male:73.0% and female : 75.0%. Table 2 provides prevalence of mild and severe malaria-induced anaemia and parasite density range in the two study areas. Figures 1 and 2 show mean

haematological indices of MP positive subjects. Correlation was positive between anaemia and malarial infection: $\tau=0.800$, $P<0.05$ (2-tailed), there was no significant difference between age groups and sex of the subjects: $T=0.77$, $P<0.4729$ (2-tailed).

Table 1: Mean Haematological Indices and Prevalence of Anaemia among MP Positive Children in Kano.

Variables	Sex	Age group (years)		Total 0-12 (246)
		0-5 (184)	6-12 (62)	
Haemoglobin (g/dl)	M	10.78	9.33	10.05
	F	9.67	9.02	9.4
PCV (%)	M	32.92	29.21	30.34
	F	29.58	22.69	26.3
Prevalence (%)	M	76.0*	73.0*	75.5*
	F	89.6*	75.0*	85.3*

*No significant difference between age groups and sex of subjects at $P<0.4729$ (2-tailed); Numbers in parenthesis denote number of subjects.

Key:

M=Male

F=Female

Table 2: Prevalence of Mild and Severe Anaemia and Parasite Density ranges in 0-5 and 6-12 Year Age groups of MP Positive Subjects in Kano.

Age Group (Years)	Mild Prevalence	Anaemia (%)	Severe Prevalence	Anaemia (%)	Total Prevalence (%)
0-5	66	(101)	34	(52)	83.2(153)
6-12	80.4	(37)	19.6	(9)	74.2(46)
N	69.4	(138)	30.6	(61)	80.9(199)
Parasite Density Range (/μl)	<1000-	9,999	10,000-	≥100,000	<1000-≥100,000

*There was positive correlation between anaemia and malaria at $P\leq 0.05$ (2-tailed). Numbers in parentheses are number of subjects.

Key:

N= Total number of subjects

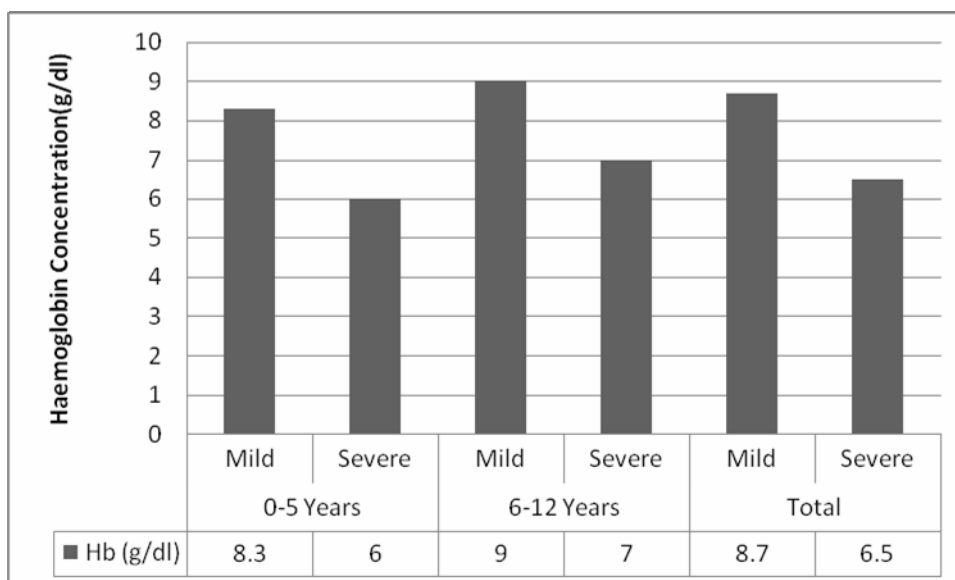


Figure 1: Mean Haemoglobin Concentration of MP Positive Children with Mild and Severe Anaemia in Kano.

Key:

Normal range: Hb \geq 11g/dl

Mild Anaemia: Hb <11-7g/dl

Severe Anaemia Hb <7g/dl

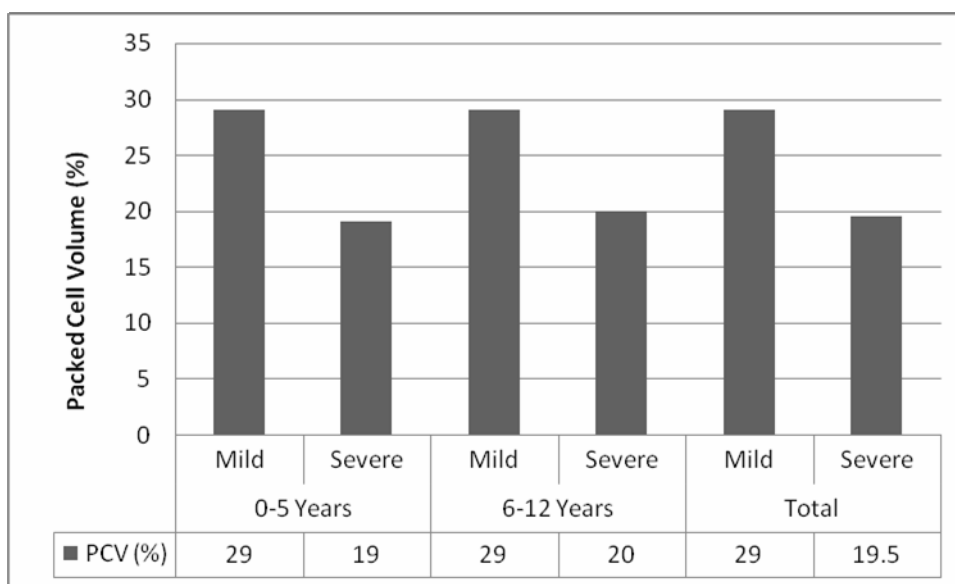


Figure 2: Mean Packed Cell Volume of MP Positive Children with Mild and Severe Anaemia in Kano.

Key:

Normal Range: PCV \geq 33%

Mild Anaemia: PCV <33-25%

Severe Anaemia: PCV <25%

Discussion

This study has shown positive correlation between malaria and anaemia as depicted in Tables 1, and 2. The results correspond with the work of Johnson (2003), where 95% of the children with malaria were anaemic. Highest anaemia prevalence 86(89.6%) out of 96 was obtained from female subjects in the 0-5 year age group, while the lowest prevalence of anaemia was recorded from the male subjects of 6-12 year age group: 16(73.0%) out of 22. This disparity could be as a result of sequestration of malarial parasites in the placenta, a consequence of infection with *P.falcifarum* during pregnancy which is associated with infant anaemia (Van Eijk *et al.*,2002). It could also be as a result of deficiency of conferred immunity by the below 5 year old infants (Collier *et al.*, 1998).

The result obtained as presented in Table 2 showed prevalence of 199(80.9%) out of 246 of the sampled population corresponds with the findings in a cohort study conducted in areas of stable, perennial malaria transmission in Tanzania, Kenya, and Malawi which showed that rate of malarial infection correlates with decline in haemoglobin concentration of less than 8g/dl (Schellenberg *et al.*,2003). It is noteworthy that mild anaemia in this study has higher prevalence,138(69.4%) out of 199 than severe anaemia, 61(30.6%) out of 199 as presented in Table 2. This is owing to the malaria transmission pattern of the study area(Kano) which is stable, and perennial, and greater number of the children might have acquired immunity albeit insufficient to eradicate the MPs (Collier *et al.*, 1998). This corresponds with the work of Meydani *et al.* (1997), who demonstrates that oxidants produced by the phagocytes in immune response in killing the MPs were found to be toxic to normal uninfected erythrocytes together with the infected ones which tantamount to anemia. Imam and Indabawa (2007), also reported the prevalence of malarial anemia among the pediatrics within 0-12 years of age to be 66.3%. the generally low mean haemoglobin range of 9-10.8 g/dl and mean PCV range of 23-32.9% as depicted in Figures 1 and 2 is in agreement with the result of the study of Igbeneghu (2005) conducted in Ibadan, south-western Nigeria. It also in line with the work of Mustapha and Aliyu (2004) where children uner 5 showed a relatively higher malaria prevalence than among those children in above 5 year age group.

Conclusion

The current study has shown positive correlation between malaria and anaemia among the subjects studied, although prevalence of severe anaemia is lower than that of mild anaemia in the total population in the study, the high prevalence of malaria-induced anaemia more especially among under 5 years old children underscores the need for intervention, considering the subjects age groups. This showed that it is a proven scourge in malaria-endemic areas (of which study area Kano is included). Anaemia was related to parasite density, with direct relationship between severity of anaemia and higher parasite density. Despite the fact that anaemia and malaria control are cost-effective with substantial public health benefits, it is often overlooked until it becomes life threatening severe anaemia which increases morbidity, and mortality of children.

Recommendations

Awareness campaign on malaria-induced anaemia in the community should be conducted highlighting signs of its onset, quick referral and early intervention.

Clinicians should be alerted so as to enable them include haematological tests in their baseline assessment of children with diagnosed malarial infection.

Roll back malarial campaign should be accessible, and affordable to the entire populace, although Artemissin -based Combined Therapy is cost effective it is out reach of the masses.

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