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THE EFFECT OF MALARIA PARASITEMIA ON THE SERUM LEVELS OF VITAMIN A AND ZINC OF CHILDREN IN THE MALARIA ENDEMIC AREA

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INTRODUCTION

KEY POINT

MALARIA: Malaria is a prevalent disease in tropical and subtropical areas affecting about 300 - 500 million people a year (Hoffman et al., 2002). It is estimated that one to three million deaths occurs worldwide, involving children under the age of five. Malaria in human is caused by protozoa of the genus plasmodium. It has 4 subspecies viz: *P. Falciparum, P. Vivax, Malariae and Ovale. P. falciparum* causes the greatest illness and death in Africa (WHO, 1996).

Malaria pathogenesis is based mainly on extensive changes in biochemical (micronutrient) and heamatological parameters [Bidaki and Dalimi,2003]. The world health organization [WHO] criteria acknowledges that some biochemical (micronutrient) and hematological features should raise the suspicion of severe malaria [WHO,2000]. There are scientific publications on biochemical (micronutrient) and hematological changes in acute falciparum malaria in different parts of the world including

Symptoms: Fever, shivering, joint pain, vomiting, anemia, retinal damage and convulsions.

Severe malaria leads to cerebral malaria

- **Reduction:** Malaria transmission can be reduced by preventing bites by using mosquito nets, insecticides, draining of stagnant waters.

- **Treatment**: It can be treated with administrating quinine or the artesunate.

MICRONUTRIENTS

These are nutrients required by humans and other living things throughout life in small quantities to orchestrate whole range of physiological functions, but which the organism itself cannot produce.(UNICEF , (2006) e.g.

- **ZINC**: it is a micronutrients that occur in cells growths, cell differentiation and immune function.

It is also a cofactor for several enzymes notably these that regulate storage and metabolism of vitamin A

- **CALCIUM**: Is an essential nutrient required during the earlier storage of life for strengthening of bones and teeth.

It plays a vital role in the maintenance of health and nutritional wellbeing at all stages cycle, it plays parallel roles in impulse transmission, catalytic activation of protein, blood coagulation, optimal functioning of the neuromuscular and this intracellular system where it intervenes as a secondary messenger.

- **VITAMIN A:** It is an essential micronutrient for vision cell growth, normal immune function, hematopoietic system and reproduction

MARTERIALS AND METHODS

The study group comprised 84 children (52girls and 32 boys) aged 1-5years (with mean age 2.6+1.6). They were recruited from the outpatient and emergency wards of the University Teaching Hospital, Okolobiri, Bayelsa State.

The group was made up of 60 (30boys and 30 girls) malaria free children matched for age, sex and socio-economic status with the study group from the nursery and primary school in the same town where the hospital is located

COLLECTION OF BLOOD SAMPLE

- ✓ 6ml of venous blood was collected from children at the wards or parasitological laboratory and parameters such as their names, age, and gender were recorded.
- ✓ The serum was obtained by centrifugation at 3000rev/min for 5min using clinical centrifuge and the were stored in 3 portions.
- ✓ The first two portions were used their same day for the quantification of calcium and zinc, while the 3rd was stored frozen at - 20◦c to be used later for Analysis of vitamin A by HPLC (High Performance liquid chromatography

DAGNOSIS OF MALARIA

This was done by thick smear and thin smear respectively according to this steps:

i. Spreading of blood on the blade
ii. Coloration with Giemsa stained
iii. Washing reading and using a microscope

Quantification of parasites in the blood was done by relating the number of parasites in the blood to that of white blood cell or red blood cells and adjusting the value to millimeter cube of blood (Moretti and Mandoul, 1997)

RESULTS

The Range and mean values of results obtained for the sample population base on the clinical state of the subjects is summarized in the tables below

	1. Control			2. Malaria cases			|t|	P
	Min.	Max.	Mean± SD	Min.	Max.	Mean ± SD		
Age (years)	0.41	5.00	2.2 ± 1.3	0.33	5.00	2.6 ± 1.6	1.338	0.168
$[Zn^{2+}]$ (µmol/I)	1.00	36.64	14.5 ± 7.5	2.00	32.01	13.7 ± 8.4	0.485	0.629
Vitamin A (µmol/l)	0.24	3.21	1.1 ± 0.6	0.21	2.06	0.8 ± 0.4	2.461	0.016
Parasitemia (TPF/mm^3)	-	-	-	50.00	145000.0	10701.4 ± 31599.9	-	-

Table 1: The Range and mean values of results obtained for the sample population base on the clinical state of the male subjects

	1. Control			2. Malaria cases			|t|	P
	Min.	**Max.**	**Mean± SD**	**Min.**	**Max.**	**Mean±SD**		
Age (years)	0.41	5.00	2.3 ± 1.4	0.66	5.00	2.3 ± 1.5	1.322	0.193
$[Zn^{2+}]$ (µmol/I)	1.00	36.64	15.2 ± 9.2	2.01	32.01	13.6±8.7	0.543	0.590
Vitamin A (µmol/I)	0.37	2.15	1.2 ± 0.6	0.21	1.80	0.8 ± 0.4	2.123	0.040
Parasitemia (TPF/mm^3)	-	-	-	100	145000	12372.9±36798.1	-	-

	CONTROL			MALARIA CASES			T-test	P-value
	Min	max	Mean± SD	Min	Max	Mean± SD		
Age (years)	0.41	4.00	2.1±1.3	0.66	5.00	2.3 ± 1.5	0.573	0.569
[Zn^{2+}] (µmol/I)	2.00	24.42	13.9 ± 5.9	2.01	32.01	13.6 ± 8.7	0.138	0.891
Vitamin A (µmol/l)	0.24	3.20	1.0 ± 0.6	0.21	1.80	0.8 ± 0.4	1.404	0.166
Parasitemia (TPF/mm^3)	-	-	-	50.00	120000	9175.2 ± 26751.1	-	-

Table 2. Frequency distribution of parameters analyzed

Parameters	Subjects	Controls (n = 60)			Fishers Test	
		N	%	N	%	
Age	Less than 1 year	13	20.96	11	20.37	P = 1.0000
	between 1 and 5 years	49	79.03	43	79.62	
	High (more than1 04 mg/ml)	22	35.48	10	18.51	
[Zn2+]	Deficient (less than 7.6 µmol/l)	10	16.12	15	27.27	P = 0.3525
	Normal (between 7.6 and 15.3 µmol/l)	21	33.87	15	27.27	
	High (more than15.6 µmol/l)	31	50.00	24	44.44	
Vitamin A	Deficient (less than 0.70 µmol/l)	19	30.64	28	51.85	P = 0.0388
	Normal (more than or equal to 0.70 µmol/l)	43	69.35	26	48.14	

DISCUSSION

From the result; the proportions of malaria patient difficult in Vitamin A (51.85%) were significantly higher than that of their corresponding control – This may suggest the negative effect of malaria on the levels of this micronutrient. Infact, micronutrient deficiencies have been associated with increased morbidity and mortality from malaria, and malaria, in turn may contribute to poor nutritional status, reflecting the classic, vicious cycle of malnutrition and infection (Scrimshaw et al., 1968). This is justified by the fact that in the course of infection, nutrients move from the circulation to the tissues causing a reduction in their circulation (Keusch, 1998).

Also from the result, for Zinc; no difference on the means of blood zinc levels were observed ($_{P\text{-}0.90}$) between the malaria and the control cases. These results are in conformity with those of Brown et al. (1993), where infection did not affect the serum zinc levels. But, according to Shankar (2000), during the acute phase response, zinc is redistributed from plasma to lymphocytes and to the liver, causing decreased zinc plasma concentrations

– For vitamin A; the low level of vitamin A observed in malaria patients is probably due to the fact that vitamin A is an anti-infective vitamin, which plays an important role in immunity to infectious diseases.

During malaria infection, vitamin A may enhance both antibody – mediated immunity and cell mediated immunity. (Thurnham and Singkamani, 1991).

CONCLUSION

Malaria has been shown to significantly alter some micronutrients in the body. Hence, those altered micronutrients associated with malaria could be estimated in addition to malaria parasite identification. This will enhance the determination of the severity of malaria disease at diagnosis and as well reduce delay in medical intervention required to avoid mortality arising from malaria.

LIMITATION

Getting the parents of the children to educate them on blood extraction from their children was a difficult task.

RECOMMENDATION

It is therefore recommended that parents should do a routine malaria checkup for their children and adequate preventive measures like the use of mosquito nets and insecticides should be put in place to avoid malaria infection.

Parents should know the nutritional status of their children to avoid severe cases of malaria, knowing that malaria is associated with poor nutritional status and micronutrient deficiency