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The Impact of Malaria Infection on Serum Vitamin A and Zinc Levels in Children in Malaria-Endemic Regions.

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ARTICLE INFO	ABSTRACT

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Background: Malaria and micronutrient deficiencies are significant public healt concerns in tropical regions, particularly among children.

Objective: To investigate the effect of malaria infection on serum vitamin A and zin levels in children living in malaria-endemic areas.

Methods: A cross-sectional study was conducted among 84 children (52 girls an 32 boys) aged 15 years (mean age 2.6±1.6). Blood samples were collected, an serum vitamin A and zinc levels were quantified using HPLC and atomic absorptio spectrophotometry, respectively.

Results: Malaria patients had significantly lower serum vitamin A levels (p=0.038 but similar zinc levels (p=0.90) compared to healthy controls.

Conclusion: Malaria infection is associated with reduced serum vitamin A levels i children, highlighting the need for integrated approaches to address both malari and micronutrient deficiencies in these regions.

INTRODUCTION:

Malaria, a prevalent disease in tropical and subtropical areas, affects approximately 300-500 million people annually (Hoffman et al., 2002). It causes an estimated one to three million deaths worldwide, mainly involving children under five. Malaria is caused by protozoa of the genus Plasmodium, with P. falciparum being the most severe and deadly species in Africa (WHO, 1996). Malaria pathogenesis is characterized by extensive changes in biochemical (micronutrient) and hematological parameters (Bidaki & Dalimi, 2003).

Malaria's impact extends beyond morbidity and mortality, as it also has significant economic and social consequences. The disease can lead to anemia, cognitive impairment, and malnutrition, which can further exacerbate its severity (Menendez et al., 2000). Moreover, malaria can have long-term effects on children's growth and development, even after treatment (Korenromp et al., 2004).

Vitamin A and zinc are essential micronutrients that play critical roles in maintaining immune function, growth, and development. Deficiencies in these micronutrients can impair immune function, increasing the risk of infections, including malaria (Scrimshaw et al., 1968). Conversely, malaria can also lead to reduced levels of vitamin A and zinc, perpetuating a cycle of malnutrition and infection (Keusch et al., 1998).

This study aims to investigate the impact of malaria infection on serum vitamin A and zinc levels in children living in malaria-endemic regions. Understanding the relationship between malaria and micronutrient deficiencies can inform strategies for malaria prevention and treatment, ultimately improving the health and well-being of children in these regions.

METHODS:

The study included 84 children (52 girls and 32 boys) aged 15 years (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 consisted of 60 malaria-free children matched for age, sex, and socio-economic status. Blood samples were collected, and serum was obtained by centrifugation. Vitamin A and zinc levels were quantified using High-Performance Liquid Chromatography (HPLC) and atomic absorption spectrophotometry, respectively.

RESULTS:

The study included 84 children (52 girls and 32 boys) aged 15 years (mean age 2.6±1.6). The results showed that:

- Vitamin A levels were significantly lower in malaria patients (mean ± SD: 0.8 ± 0.4 μmol/L) compared to healthy controls (mean ± SD: 1.1 ± 0.6 μmol/L) ($p = 0.0388$).

- Zinc levels did not differ significantly between malaria patients (mean ± SD: 13.7 ± 8.4 μmol/L) and healthy controls (mean ± SD: 14.5 ± 7.5 μmol/L) ($p = 0.90$).

- The prevalence of vitamin A deficiency (<0.7 μmol/L) was higher in malaria patients (51.85%) compared to healthy controls (30.64%) ($p = 0.0388$).

- The prevalence of zinc deficiency (<7.6 μmol/L) did not differ significantly between malaria patients (27.27%) and healthy controls (16.12%) ($p = 0.3525$).

These results indicate that malaria infection is associated with reduced vitamin A levels and a higher prevalence of vitamin A deficiency in children. In contrast, zinc levels and the prevalence of zinc deficiency did not differ significantly between malaria patients and healthy controls.

Table 1: comparing of demographic and Biochemical Parameters

	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/l)	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 2: The Range and mean values of results obtained for the sample population base on the clinical state of the male subjects

parameter	1. Control			2. Malaria cases			|t|	P
	Min.	**Max.**	**Mean ± SD**	**Min.**	**Max.**	**Mean ± SD**		
Age (years)	0.41	5.00	2.6 ± 1.6	0.66	5.00	2.3 ± 1.4	1.322	0.193
$[Zn^{2+}]$ (µmol/l)	1.00	36.64	14.5.2 ± 7,5	2.01	32.01	13.7±8.4	0.543	0.900
Vitamin A (µmol/l)	0.37	2.15	1.1 ± 0.6	0.21	1.80	0.8 ± 0.4	2.123	0.0388
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/l)	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 3. Frequency distribution of parameters analyzed

Parameters	Subjects	Controls (n = 60)			Fishers Test	
		N	%	N	%	
Age	Less than 1 year		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 0.7(µmol/l)	43	69.35	26	48.14	

DISCUSSION:

The study's findings suggest that malaria infection significantly alters vitamin A levels but not zinc levels in children. This is consistent with previous research demonstrating the association between malaria and micronutrient deficiencies (Scrimshaw et al., 1968). The reduced vitamin A levels in malaria patients may be attributed to several factors, including:

- Increased vitamin A metabolism during inflammation (Thurnham & Singkamani, 1991)
- Impaired vitamin A absorption due to malaria-induced gastrointestinal damage (Menendez et al., 2000)
- Enhanced vitamin A catabolism by inflammatory cytokines (Korenromp et al., 2004)

The lack of significant difference in zinc levels between malaria patients and controls may indicate that zinc homeostasis is maintained despite malaria infection. However, this requires further investigation, as zinc deficiency can still occur due to inadequate dietary intake or malabsorption (Shankar, 2000).

These findings have important implications for public health strategies in malaria-endemic regions. Vitamin A supplementation programs may need to be integrated into malaria treatment and prevention initiatives, particularly for children. Moreover, promoting adequate nutrition and addressing micronutrient deficiencies can enhance immune function and reduce malaria severity (Keusch et al., 1998).

The study's limitations include the challenges of blood sample extraction from children and the need for larger sample sizes to confirm these findings. Future research should investigate the longitudinal effects of malaria on micronutrient levels and explore the potential benefits of micronutrient supplementation in malaria treatment.

CONCLUSION:

In conclusion, this study demonstrates that malaria infection significantly decreases serum vitamin A levels in children, while zinc levels remain unaffected. These findings highlight the importance of considering micronutrient deficiencies in the management and prevention of malaria, particularly in regions where vitamin A deficiency is prevalent.

The study's results underscore the need for integrated approaches to address both malaria and micronutrient deficiencies. Vitamin A supplementation programs may be necessary to mitigate the impact of malaria on vitamin A levels, especially in children. Moreover, promoting adequate nutrition and addressing micronutrient deficiencies can enhance immune function and reduce malaria severity.

The findings of this study contribute to the existing body of knowledge on the relationship between malaria and micronutrient deficiencies. Future research should investigate the longitudinal effects of malaria on micronutrient levels and explore the potential benefits of micronutrient supplementation in malaria treatment.

Ultimately, this study emphasizes the importance of a comprehensive approach to addressing malaria and micronutrient deficiencies in children, with the goal of improving health outcomes and reducing the burden of these conditions in malaria-endemic regions.

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Conflict of Interest

There are no conflict of interest

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