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Malaria and the Effect of Malaria Parasitaemia on Albumin Level Among HIV/AIDS-Patients in Jos, Nigeria

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From September to November 2006, blood samples from 200 HIV/AIDS individual who are attending the Plateau State specialist Hospital, Jos were screened for malaria parasites, level of malaria parasitaemia and albumin level response to the infection. Twenty healthy volunteers albumin levels were measured and used as the normal range values. Of the 200 HIV/AIDS patients examined, 64 (32.0%) had *Plasmodium* parasites, while 136 (68.0%) who had no *Plasmodium* parasite were used as controls. The prevalence of malaria parasites in the age grouping revealed a significant difference, while a no significant difference was observed in the degree of parasitaemia among the age grouping. Of the 200 HIV/AIDS examined, 78 (39.0%) of them are farmers and this group also has a high rate of *Plasmodium* parasitic infection 30 (15%). Only *P. falciparum* (30%) and *P. malariae* (0.5%) with a mixed infection of *P. falciparum* and *P. malariae* (1.5%) were seen. There was a significant difference in the albumin level between the infected and the control. In conclusion, albumin level in the malaria-HIV/AIDS positive individuals is lower than in the HIV/AIDS positive. Albumin level can be used as a prognostic marker for disease severity and progression in HIV/AIDS.

Key words: Malaria, HIV/AIDS, prevalence, parasitaemia, albumin, Jos, Nigeria

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INTRODUCTION

HIV pandemic, spreading from person to person by sexual contact in an increasing mobile world, while malaria is endemic, dependent on a local symbiosis between infected anopheline mosquitoes and humans. While in malaria, its severe symptoms appear within days and brings death to about 15-25% of those stricken when great quantities of infected red blood cells are destroyed in a single burst, HIV on the hand is a slow, insidious process that can take years to deplete immunologically crucial white blood cells; resulting in death of all nearly untreated persons (Huff, 2000). Both diseases can be transmitted by contaminated blood (Bastos *et al*., 1999).

With shared geography and demographics, co-infection is common, yet surprisingly few obvious clinical associations between HIV and malaria are reported. Studies are contradictory about the frequency and severity of malaria in HIV-infected people (Huff, 2000).

Mcgregor *et al*. (1970) and Cohen *et al*. (1961) both stated that malaria is a powerful stimulator of the immune system. Subjects exposed frequently to malaria have enhanced serum levels of immunoglobulins and an accelerated rate of IgG turnover. Whittle *et al*. (1984, 1990) also reported that malaria infection might have an adverse effect on HIV infection both by stimulating T-cell turnover and by impairing T-cell cytotoxic function.

This study aims to determine the prevalence of malaria parasites in HIV/AIDS patients, to determine (if any) relationship between parasitaemia and age/sex, to correlate the albumin levels with parasitaemia and to determine the influence of protection against natural transmission on the prevalence of the disease.

MATERIALS AND METHODS

Study area: The study was conducted at the Plateau State Human Virology Research Laboratory (PLASVIREC), Robert Gallo House, in Plateau State Specialist Hospital, Jos (located on latitude 10° and longitude 9.45°) from September through November, 2006. The area has two seasons, the dry season (November-March) and the rainy season (April-October). Malaria transmission is usually high towards, the end of the rainy season. Other geographical indices of the area are given in Ajakpo and Okonkwo (1984).

Ethical clearance: The Ethical clearance committee of the Plateau State Specialist Hospital, Jos approved the study (Ref. PSSH/ADM/454/IX). Informed consent was obtained from all study participants according to the guidelines of the Plateau State Specialist Hospital, Jos, Plateau State, Nigeria.

Subject selection and sample collection: The study population were 200 patients confirmed to be HIV-seropositive by standard laboratory techniques and in addition, presenting with clinical signs and symptoms of malaria. HIV patients that had no malarial parasite, served as control. Twenty healthy volunteers whose albumin levels were measured were used as the normal range values.

The following criteria were used for the selection of the study participants: patients must have not received any anti-malaria drugs for a past two-months period; patients must have clinical signs of malaria; patients must be within 10-above 50 years of age; patients must have been screened as positive for HIV using $HIV^{1/2}$ STAT-PAK™ (Manufactured by CHEMBIO 3661 Horseblock road, NY USA) and further confirmed by Determine $HIV^{1/2}$ (Manufactured by Abbott Laboratory, Minato-Ku, Tokyo, Japan); patients must have been screened not to have Hepatitis B or any liver disease previously.

A 5 mL blood sample was obtained by venu-puncture from each of these patients into bottles containing Ethylene Diamine Tetr-Acetic Acid (EDTA) anticoagulant.

The following information's were also collected from patients: age, sex and occupation.

Examination of samples: Thick and thin films were prepared from each subject's blood sample. The thin films were fixed with absolute methanol and both thick and thin films were stained with 10%Giemsa after which they were examined microscopically with oil immersion (x100) objective. The parasite counting was done using the thick blood films while the thin blood films were used for species identification. Malaria parasites were counted according to the method described above (WHO, 2003, 1996, 1995). The parasite count in relation to the leucocytes count were converted to parasite per microliter of blood using mathematical formula

$$\text{Parasitaemia } (\mu L^{-1}) = \frac{\text{No. of asexual parasite}}{\text{No. of leucocytes}} \times 8000$$

Where:
8000 = Putative means of leucocytes

The number of asexual parasites was counted against 200 leucocytes using laboratory counter (N.B. Once started a field is always counted to the end. Therefore it is usual that the final leucocyte count will be over 200).

The albumin levels estimation was then carried out as described by standard protocol (Tietz, 1987) using Bromocresol green method. The albumin-BCG-complex absorbs maximally at 578 nm. The absorbance being

directly proportional to the concentration of albumin in the sample and read against a reagent blank using the commercial BCG kit.

Statistical analysis: All data's were analysed statistically using Chi-square, regression and t-test for comparison between the infected and uninfected.

RESULTS AND DISCUSSION

Prevalence of malaria parasite with respect to sex and age is as shown in Table 1. 64(32.0%) of the 200 patients examined had malaria parasites. Of the the 64 infected individuals, 41(37.96%) are females and 23(25.0%) are males. The highest percentage of malaria infection 35(17.5%) was among the age group of 21-30 years. A significant difference occurred among the sexes ($\chi^2 = 3.84$; df = 1; $p<0.05$) and between the age groups ($\chi^2 = 12.18$; df = 4; $p<0.05$). Prevalence of malaria parasites with respect to occupation showed that the highest prevalence of 30(15.0) was among the farmers who are mostly rural dwellers (Table 2).

Regarding the parasite density shown in Table 3. 13(20.31%) of those with parasite density >5000 μL^{-1} are females while only 4(6.25%) are males. 11(17.19%) of the age group 21-30 years had parasite density >5000 μL^{-1}, while 1(1.56%) in the age group >50 years had >5000 μL^{-1}. Statistical analysis showed there was no significant difference among the sexes ($\chi^2 = 2.71$; df = 1; $p>0.05$) and age groupings ($\chi^2 = 2.71$; df = 1; $p>0.05$). Collective parasite intensity of the infected patients was 228.24×10^3 μL^{-1}. Of this intensity, the age group of 21-30 years had the highest with 135.92×10^3 μL^{-1} (59.55%), while the least was in the age group 41-50 years with 1.4×10^3 μL^{-1} (0.61%) as shown in Table 4.

Figure 1 showed the regression plot, albumin level was observed to be closely associated with the presence of malaria parasitaemia ($Y = 32.972-0.001X$; $R^2 = 0.288$; $p<0.001$). A significant difference (p-value = 0; $p<0.05$) was observed between the infected and uninfected as shown in Table 5. The mean total albumin for the infected was 28.95 g L^{-1} and uninfected 35.46 g L^{-1}.

These findings indicate that malaria is highly prevalent in HIV/AIDS seropositive individuals and the degree of parasitaemia of the malaria parasite could seriously aid in the rheologic changes of HIV/AIDS patients. The results also showed that high decrease in albumin concentration is seen in those with malaria-HIV/AIDS seropositive as compared to the malaria-HIV/AIDS seronegative. These agree with Fieldman *et al.* (2000) who in his studies on women showed that serum albumin can predict disease progression and this also

Table 1: Prevalence of *Plasmodium* species malaria with respect to sex and age

Parameters	No. of examined (%)	No. with malaria infection (%)	p-value
Sex			
Male	92 (46.00)	23 (25.00)	
Female	108 (54.00)	41 (37.96)	<0.05
Total	200 (100.00)	64 (32.00)	
Age (year)			
<20	30 (15.00)	11(5.50)	
21-30	82 (41.00)	35 (17.50)	
31-40	46 (23.00)	12 (6.00)	
41-50	22 (11.00)	2 (1.00)	
>50	20 (10.00)	4 (2.00)	<0.05
Total	200 (100.00)	64 (2.00)	

Age grouping: ($\chi^2 = 12.18$; df = 4; $p<0.05$); Sex: ($\chi^2 = 3.84$; df = 1; $p<0.05$)

Table 2: Prevalence of malaria parasite with respect to occupation

Occupation	No. of examined (%)	No. of positive (%)
Commercial Sex Workers (CSW)	30 (15.00)	7 (3.50)
Civil servants	60 (30.00)	17 (8.50)
Farmers	78 (39.00)	30 (15.00)
Others (students)	32 (16.00)	10 (5.00)
Total	200 (100.00)	64 (32.00)

Table 3: Levels of parasitaemia with respect to sex and age grouping

	Distribution: parasite densities (parasite μL^{-1})			
Parameters	<1000	1000-5000	>5000	Total
Sex				
Male	13 (20.31)	6 (9.38)	4 (6.25)	23 (35.94)
Female	17 (26.56)	11 (17.19)	13 (20.31)	41 (64.06)
Total	30 (46.88)	17 (26.56)	17 (26.56)	64 (100.00)
Age				
≤20	5 (7.81)	3 (4.69)	3 (4.69)	11 (17.19)
21-30	14 (21.88)	10 (15.62)	11 (17.19)	35 (54.69)
31-40	6 (9.38)	4 (6.25)	2 (3.12)	12 (18.75)
41-50	2 (3.25)	0 (0.00)	0 (0.00)	2 (3.13)
>50	3 (4.69)	0 (0.00)	1 (1.56)	4 (6.25)
Total	30 (46.88)	17 (26.56)	17 (26.56)	64 (100.00)

Age grouping: ($\chi^2 = 5.38$; df = 4; $p>0.05$) Sex: ($\chi^2 = 2.71$; df = 1; $p>0.05$)

associated with increased mortality in individuals with certain chronic conditions. They stated further that women who are HIV positive and with reduced serum albumin had a risk of death three times greater than women with higher albumin levels.

The mean total albumin levels in the infected was 28.94 g L^{-1} while it was 35.46 g L^{-1} in the uninfected. Onwuliri (2004) in her findings reported that the mean total albumin was 36.7 g L^{-1} in the non-HIV subjects as compared to 36.4 g L^{-1} in the HIV infected subjects.

Since serum protein gets depleted by HIV infection and more depleted by malaria-HIV infection, there will be lower levels of albumin available for transport of bilirubin; consequently there will be a high amount of accumulated bilirubin that is untransported. Albumin also gets suppressed as a result of the suppressive effect of HIV because of the increased catabolism from cell damage.

A final deduction from this study is the appreciation of the increasing prevalence of malaria parasite and

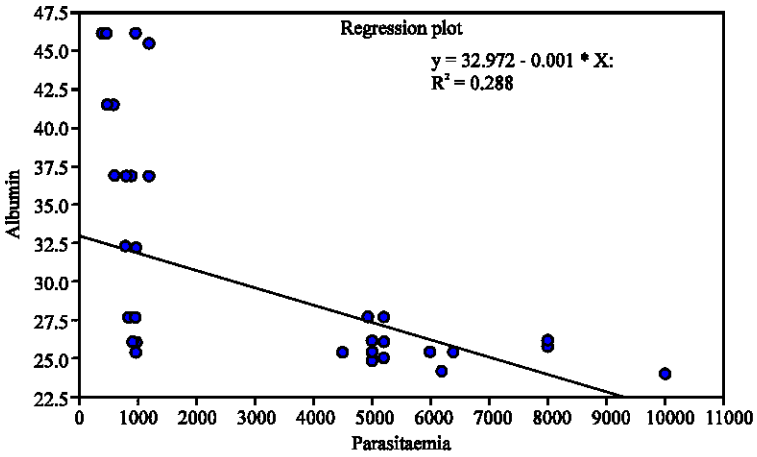

Fig. 1: Regression plot for parasitaemia and albumin

Table 4: Parasite density index (parasite μL^{-1}) of patients with respect to sex and age

	Distribution: parasite intensities (parasite μL^{-1})						
	<1000		1000-5000		>5000		
Age	Males	Females	Males	Females	Males	Females	Total
10-20	1.92×10^3	1.88×10^3	5.00×10^3	10.0×10^3	18.0×10^3	6.4×10^3	43.20×10^3
21-30	4.56×10^3	7.76×10^3	11.20×10^3	21.2×10^3	0.0×10^3	91.2×10^3	135.92×10^3
31-40	2.72×10^3	2.36×10^3	14.92×10^3	0.0×10^3	5.2×10^3	15.0×10^3	40.20×10^3
41-50	1.40×10^3	0.00×10^3	0.00×10^3	0.0×10^3	0.0×10^3	0.0×10^3	1.40×10^3
>50	1.36×10^3	0.96×10^3	0.00×10^3	0.0×10^3	0.0×10^3	5.2×10^3	7.52×10^3
Total	11.96×10^3	12.96×10^3	31.12×10^3	21.2×10^3	23.2×10^3	117.8×10^3	228.24×10^3

Table 5: t-test for infected and non infected subjects albumin levels

	Group statistics				
	Status	N	Mean	SD	SEM
Content	Infected	64	28.9363	6.41679	0.80210
	Non Infected	136	35.4546	4.83145	0.41429

Independent samples test

		Levene's test for equality of variances		t-test for equality of means						
									95% confidence interval of the difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference	Lower	Upper
Content	Equal variances assumed	1.634	0.203	-7.983	198.00	0	-6.51838	0.81655	-8.12862	-4.90814
	Equal variances not assumed			-7.220	97.849	0	-6.51838	0.90277	-8.30994	-4.72682

most patients have reduced albumin levels indicative of subclinical infections, suggesting that this parasite could be a serious hazard to HIV/AIDS. There is the need therefore to make malaria chemotherapy and Insecticides Treated Net (ITN) an utmost priority for those infected with HIV/AIDS as a way of curbing disease progression.

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