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PARASITE DENSITIES INFLUENCE ON THE WHITE BLOOD CELLS DISRIBUTION IN PLASMODIUM FALCIPARUM TREATED CHILDREN

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ABSTRACT
This study was conducted on a sample size of 313 children enrolled, all suffered from uncomplicated *Plasmodium falciparum* malaria and treated with either Artesunate + Sulphadoxine - Pyrimethamine (AT+SP) and Amodiaquine + Sulphadoxine - Pyrimethamine (AQ+SP), the result assessed the influence of parasite densities on WBC distribution in children (6-59 months) treated over 28 days. The protocol on therapeutic efficacies of anti - malarial drugs was adopted. This shows a reduction in WBC with parasite depletion, the influence of parasitaemia on WBC was 92.92% for AT + SP compared to 87.66% for AQ + SP. The result further shows that for each µl of blood parasite clearance, there was a recovery in WBC by 0.5299 $x10^9$/µl for AT + SP compared to 0.4597 $x10^9$/µl for AQ + SP patients.

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Key words: influence , malaria, parasitaemia, WBC, *Plasmodium falciparum*, efficacy, thrombocytes

1.0.INTRODUCTION

Malaria is one of the most important infectious diseases in the world and a leading cause of death in children in Tropical Africa [6]. It remains the most important parasitic disease that afflicting 2.2 billion people globally [27] ranked the second leading health problem in Sub-Saharan Africa after HIV/AIDS [17] and constitutes 10% of Africa's overall disease burden [27], 40% of public health expenditure [19], 30 - 50% of inpatient admissions [13] with up to 50% outpatient visits in areas with high malaria transmission [28],[28]. Most malaria deaths in children are due to *Plasmodium falciparum* infection [20].

The white blood cells play a pivotal role in the defense against *Plasmodium* infections [21] identified as a strong determinant of antimalarial

drugs safety and efficacy [25], [16], [24], [30], [14]. Changes in white blood cell counts are in response to parasite densities during follow-up periods in treated children in *Plasmodium falciparum* infections but varies [2] as a result of either level of acuteness of infections [9], parasitaemia [15] or host immunity[12]. The total white blood cell count in children with acute *Plasmodium falciparum* infection are usually within normal ranges in healthy individuals, but there may be a slight decrease (leucopenia)/ or upsurge (leucocytosis)/ from the normal reference range [18].

2.0. MATERIALS AND METHODS

2.1. Study Site: The study was conducted in the malaria holo-endemic settlements around Lake-Alau, Borno State, Nigeria (Lat: 12^0N and 13^0N; Long: 11^0E and 13^0E). The peri-urban outpatient primary Health Center at Lake-Alau, Kayamla village in Konduga Local Government Area of Borno State, Nigeria, it caters for 63 village settlements with a combined population of 114,224 heads (National Population Commission, 2006).

2.2. Recruitment Procedures

2.2.1. Ethical clearance: Prior to the commencement of the field work, ethical clearance was obtained from the Borno State Ministry of Health, Maiduguri, Nigeria. Similarly, a letter of consent and acceptance was obtained from the Konduga Local Government Authorities addressed to the respective village heads and also informed consent from parents/ guardia was obtained[27].

2.2.2. Inclusion and exclusion criteria

The criteria for the assessment of antimalarial drugs [27] was strictly followed, for example, a clinically apparent uncomplicated malaria, mono-infection and absence of severe malaria or malnutrition and with measured axillary temperature of ≥ 37.5 °C, parasite density in the range of 2,000 - 200,000 /µl with packed cell volume > 15% were accepted for the study.

2.3. Experimental Procedure

2.3.1. Parasite density count (per µl): Thick blood films were prepared for each patient on days 0, 1, 2, 3, 4,7,14 and 28[27]. Slides were stained for 30 - 45 minutes with 3% Giemsa for parasite count x100 magnification using a research microscope. When the parasite count was < 10 parasites/200 leukocytes, counting was continued per 500 leucocytes. The density of the parasites were expressed as the number of asexual

parasites per µl of blood by assuming a mean normal leukocyte count of 8000/µl of blood [10].

2.3.2. White blood cell count ($x10^9$/µl): Micropipette was used to measure out 20 µl of EDTA anticoagulated blood sample, and then diluted in 0.38 ml which hemolyzes the red blood cell leaving only the stained white blood cells and was counted microscopically under the x10 objectives using hand tally counter in haemotocytometer ('Neubauer" ruled counting chamber). The total number of white blood cells was then divided by 2 and the figure was again divided by 10 to arrive at the WBC $x10^9$/µl of blood [7].

2.4. Drug Administration: Drugs were obtained from the pharmacy department of the university of Maiduguri teaching hospital, Maiduguri.

2.4.1. Group 1 – Artesunate + Sulphadoxine-Pyrimethamine (AT+SP): Each of the children orally received 4 mg⁄kg body weight Artesunate daily for three days orally.

2.4.2. Group 2 – Amodiaquine + Sulphadoxine-Pyrimethamine (AQ+SP): Administered orally at the dose of 10 mg⁄kg body weights of amodiaquine daily for three days orally

Both groups received a combined 25 mg⁄kg body weight Sulphadoxine and 1.25 mg⁄kg body weight Pyrimethamine as single dose on the first day of treatment.

2.5. Data management and analysis

Data collected was subjected to descriptive statistics (means, percentages and standard deviation) using the analytical software Staistix Version 8.0 (Microsoft, 2007). Charts were drawn using Microsoft Excel (2007) and the regression analysis was conducted between parasite densities clearance and white blood cells count was conducted.

3.0. Results

3.1. Baseline Characteristics of Patients at Enrollment

Table I – Shows the distribution of ages of the children as highly dispersed between 8 to 59 months with the mean of 43.3 $\pm$ 14.4 months. The parasite count on admission was equally highly dispersed (2304 - 36800⁄µl) from the mean of 20820 $\pm$ 5277.7⁄µl. In a similar vein, the mean WBC count was 8.47 $\pm$ 1.82 $x10^9$/l, ranging from 2.9 $\pm$ 15.0 $x10^9$/

Table 1 Baseline characteristics of patients at enrollment

Parameter	Baseline data
1. No. enrolled (N)	313
2. Gender (No. /%)	
Male	149 (47.6)
Female	164 (52.4)
3. Age (months)	
Mean $\pm$ SD	43.3 $\pm$ 14.4
Range	8 - 59
4. WBC($x10^9$/µl)	
Mean $\pm$ SD	8.47 $\pm$ 1.82
Range($x10^9$/µl)	2.9 - 15.0
5. Parasite count (µl)	

Mean ± SD	20820 ± 5277.7
Range	2304 - 36800

3.2. Influence of parasite density (per µl) on white blood cell (x109/l):

Figures 1 and 2 showed that almost similar WBC count of 8.8958 x10^9/µl in AQ+SP and 8.202 x10^9/µl in AT+SP patients at inception The results indicated that AT+SP and AQ+SP cleared 99.9% and 99.7% of the parasite density compared to the recoveries of 87.66% versus 92.92% for WBC with AT + SP and AQ + SP, respectively over 28 days follow-up. The results on the mean daily recoveries of WBC counts in relation to parasite densities shows that for each µl of parasite cleared, there was a recovery in WBC by 0.5299 x10^9/µl for AT + SP(fig 1) compared to 0.4597 x10^9/µl for AQ + SP(fig 2) patients.

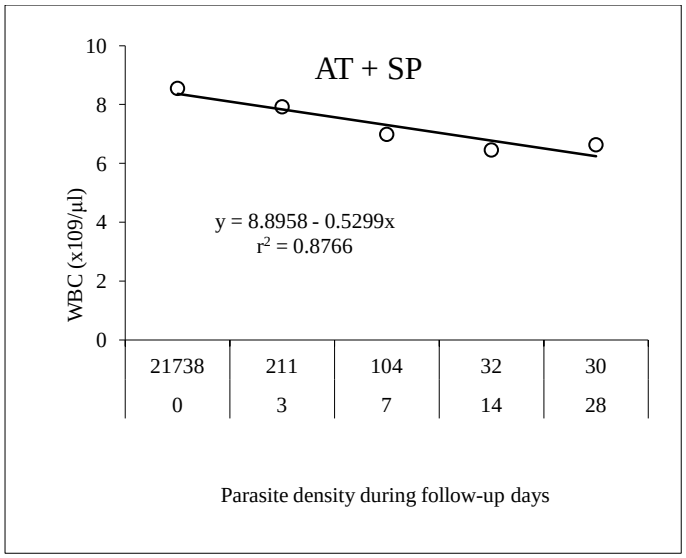

Fig 1 influence of parasitamia on white blood cells count in *P. falcifarum* infected children treated with AT+SP during follow-up period

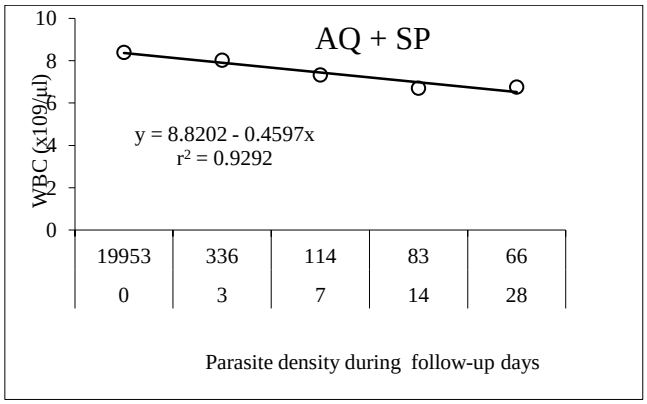

Fig 2 influence of parasitamia on white blood cells count in *P. falcifarum* infected children treated with AQ+SP during follow-up period

4.0. Discussion

White Blood Cell counts are implicated as reliable indicators for the recoveries from malaria parasitaemia[26]. This is because the phagocytotic response by leucocytes is symbolic in the recovery from malaria patients[2]. The results shows a highly significant (P=0.01) parasite clearance over time in *Plasmodium falciparum* treated children in both AT+SP and AQ+SP treated groups. The results of the present study consistently indicated that, both drugs had an inverse relationship between parasite densities and WBC counts over 28 days follow-up (fig 1 and 2), which tallies with [8]. This relationship between parasitaemia and WBC count could serve a strong diagnostic tool in malaria treated patients [22], [23]. The regression coefficient (r^2) expressed the mean daily influence

of parasite densities on WBC counts, gave for each µl of parasite cleared there was a recovery in WBC by 0.5299 $x10^9/l$ for AT + SP compared to 0.4597 $x10^9/l$ for AQ + SP patients, showing a slightly higher recovery in AT+SP compared AQ+SP patients. Even though both drug combinations had similar recovery trends in WBC counts, AT+SP had slight edge (0.0702 $x10^9/l$) over AQ+SP treated group[1], [5], [3], [4]. Artesunate based combination therapies are relatively faster in the recoveries of hematological abnormalities due to malaria infections in children but reducing parasitaemia could stongly solicit for a radical cure from *Plasmodium falciparum* infection and gives a normalized WBC counts within referral range in children malaria [2].

5.0. Conclusion: The present results depicted very high relationship between clearance and recoveries in White blood cell counts over 28 days follow-up in the two respective drugs however, both drugs showed faster parasite clearance and normalized WBC count levels over time but AT+SP had a slight edge over AQ+SP.

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