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The Biochemical and Hematological Alterations in Patients Infected with Falciparum Malaria Attending General Hospital Barkin/Ladi, Plateau State, Nigeria.

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Abstract:

Objective. *These studies seek to investigate alterations in biochemical and haematologic indices of malaria infected inhabitants of Barkin Ladi.* **Methods**. *Malaria parasite, Biochemical and haematologic changes were estimated by microscopy, reflotron plus dry chemistry analyzer and SYSMEX KX-21N haematology analyze respectively. A total of 97 persons were enrolled for the study out of which 67 persons were malaria positive and 30 persons were malaria negative (control group).* **Result.** *Liver enzymes; Alanine amino transferase (ALT), Aspartate serum transferase (AST) were significantly higher in malaria positive group 31.62 and 36.05 (ụ/L) respectively compared to the control group 7.89 and 2.68 (ụ/L) respectively. Total bilirubin, creatinine, and urea level were significantly higher in malaria infected group 2.68, 1.14 and 21.37 (mg/dL) compared to non infected group 1.44, 0.54 and 12.73 (mg/dL) respectively. Albumin concentration in malaria positive group were lower 3.21 (mg/dL) compared to the control group 4.64 (mg/dL). The haemoglobin concentration (g/dl), PCV (%), RBC x10^6, platelets x10^3 in malaria infected group was significantly lower 10.84 (g/dL), 25.14 (%), 3.69 (/ụL) and 69.26 (/ụL) compared tonon infected group 26.87(g/dL),, 25.95(%), 6.39 (/ụL) and 221.67(/ụL) respectively. WBC and white blood cell components, ESR (mm/h), MCV (fl) and MCH (pg/cell) concentrations were significantly higher in malaria infected individuals 13.85, 28.80 (mm/h), 80.48(fl), and 66.45(pg/cell), compared to non infected group 8.87, 19.11(mm/h), 59.85(fl), and 22.95(pg/cell).* **Conclusion** *This study concluded that the malaria infection has alteration on haematological parameters and immense impact on the liver and kidney function especially among those who were severely infected.*

Keywords. Malaria, Falciparum, Barkin/Ladi, ALT, AST.

1 Introduction

Several species of intracellular protozoa of the genius *plasmodium* causes malaria in humans. They include; *plasmodiumfalciparum*, *plasmodiumvivax*, *plasmodiumovale*, *plasmodiummalariae* [9-10]. *Plasmodium falciparum and plasmodium vivax* cause the most serious forms of the disease[6,9,21].

Primarily, malaria is an infection of the red blood cells, causing recurring fever of sudden onset. Malaria caused by *p. falciparum* is life threatening and can cause multiple organ damage, coma and death. Malaria is spread by female anopheles mosquitoes. The parasite enters the body in mosquito saliva when a person is bitten by an infected mosquito. The parasite first infects the liver where it begins to multiply. After some days, the resulting parasites are released into the blood stream to infect the red blood cells and further infecting others. If they reach high numbers they may cause severe disease or even death. Some of the parasites in the red blood cells developed into the sexual stages (gametocytes). When a mosquito bites an infected person, they develop into the gut of the mosquito for 10-14 days and then enter the salivary glands ready for the next bite.

Malaria poses a threat to public health with 80 to 90% of morbidity and mortality occurring in Africa, afflicting both young and old [1, 7,15]. In addition, reports show that malaria could be transmitted by transfusion of infected blood [2, 18], sharing needles [20] and congenital transmission [4]. Blood is a tissue that circulates in a virtually closed system of blood vessel. It is composed of solid elements; red, white blood cells and platelets suspended liquid medium plasma. Therefore, the plasma is an extracellular fluid confined within the vascular system. The water and electrolyte composition of plasma is particularly the same as that of the intracellular fluid, made up of water, electrolytes, metabolites, nutrients, proteins and hormones.

2 Materials And Methods.

2.1 Study Area

This study was carried out in General Hospital BarkinLadi. BarkinLadi local government area in central Plateau State Nigeria and in collaboration with the Biochemistry Laboratory Plateau State University Bokkos and clinical chemistry laboratory of the national veterinary and research institute (NVRI) Vom.

Barkin/Ladi has an area of 1,032km^2 and a population of 175,267 at the 2006 CENSUS with a tropical climate with much rain in the summer than in winter. Precipitation is highest in august averaging 288mm and lowest in December (0mm). it has a weather of 22^{0}C-26^{0}C with humidity of 74%.

The study was conducted between July/2016 to October/2016. The wet season is within April to October when breeding of *anopheles* mosquito is at its peak and bites are prevalent.

2.2 Sample Collection And Preparation Of Blood Specimen

Blood samples were collected from each subject by vein-puncture of the cubital veins. The site was cleaned thoroughly using 70% isopropyl alcohol in water and allowed to dry taking precautions to avoid contamination of the site. About five millilitres of blood (5.0mL) was collected using a sterile vacutainer needle and EDTA, labelled with the participant's information such as sex, age, time of collection and serial number.

Three millilitres (3.0mL) of the blood samples were transferred into plain bottles to allow coagulation whereas the remaining 2.0mL was left in the logical studies. The

coagulated blood samples were centrifuges at 3000rpm for ten minutes, the serum transferred into Bijou bottle and stored froze until required for biochemical analysis.

2.3 Test Procedure: Malaria Test

Thin blood films were prepared and stained with 10% Giemsa solution (pH 7.2) for ten minutes and examined by light microscopy using X100 objectives. Images of the parasite are then seen under oil immersion [3] and as reported by sumbele [19]. Microscopy was used to differentiate the *plasmodium falciparum* from other species.

2.4 Statistical Analysis: the experiments were designed in a completely randomized method and data collected were analyzed by the analysis of variance (ANOVA)

3 Results

3.1 Estimation Of Prevelance

Percentage prevalence =

Number of subjects positive

_____X 100 (CDC, 2009)

Total number of subjects

That is 67 malaria positive, 30 malaria negative and 97 total number of subjects.

Therefore, 67/97 X 100

= 69.02 %

From the estimation, there is a high prevalence of *Falciparum* Malaria cases in Barkin/Ladin local government area.

Table 1: showed the biochemical indices of falciparum malaria positive and negative subject

Comparison Of Variation In Biochemical Parameters Of The Two Groups

Comparison	Mean Difference	q	P value
ALT +VE vs ALT- VE	23.731	71.223	*** P<0.001
TB+VE vs TB- VE	1.234	3.703	ns P>0.05
C+VE vs C- VE	0.5974	1.793	ns P>0.05
AST+VE vs AST- VE	28.617	85.888	*** P<0.001
AX 10+VE vs AX10- VE	-1.427	4.274	ns P>0.05
U+VE vs U- VE	8.643	25.939	*** P<0.001

Values are expressed as mean difference, q and p values

Liver enzymes ALT and AST in malaria infected group was significantly higher *** p<0.001 in comparism with the non infected group.

Creatinine, total Bilirubin and urea values were p>0.05 compared with the infected and non infected group. Albumin was P>0.05 which is greater in the non infected group compared to the infected group.

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Table 2 Shows The Comparison Of Variation in Haematological Parameters Of The Two Groups

Comparison	Mean Difference	q	P value
HB+VE vs HB- VE	8.035	0.6420	ns P>0.05
PCV+VE vs PCV- VE	0.8187	0.06541	ns P>0.05
WBC+VE vs WBC- VE	4.984	0.3982	ns P>0.05
NX+VE vs NX- VE	6.081	0.4859	ns P>0.05
EX+VE vs EX- VE	1.255	0.1003	ns P>0.05
LX+VE vs LX- VE	-1.318	0.1065	ns P>0.05
MX+VE vs MX- VE	-0.3396	0.02738	ns P>0.05
RBC+VE vs RBC- VE	-2.697	0.2174	ns P>0.05
PX+VE vs PX- VE	-152.41	12.286	*** P<0.001
ESR+VE vs ESR- VE	9.685	0.7807	ns P>0.05
MCV+VE vs MCV- VE	20.624	1.663	ns P>0.05
MCH+VE vs MCH- VE	43.515	3.508	ns P>0.05

Values are expressed as mean difference, q and p Values.

The P – value is < 0.0001, considered extremely significant. Variation among columns means is greater than expected by chance.

4 Discussion

Biochemical and haematological changes associated with falciparum malaria infection are well recognized and have been widely reported [4, 11-13].

Malaria is a major parasitic disease that is responsible for high death rate in children and in the world especially in the tropical region where it is endermic [22]. Almost all the complication and death that occurs as a result of malaria infection are cause by P. falciparum among complications that are associated with falciparum malaria, renal and hepatic dysfunctions are common in all children and in adults. These two organs are very important in the body and their impairment needs to be detected early and managed appropriately.

The present study reported biochemical and haematologic changes associated with malaria infection; this study showed a significant increase in the creatinine and urea levels with malaria infection when compared with control group. The observed increases in creatinine and urea could be a result of sequestration of the parasite into the renal microvasculature bed which may lead to ischemia. This indicates that the group with severe malaria may be more likely to have transient renal dysfunction which could be limited for the period of infection.

The invasion and development of the malaria parasite into the liver during the life cycle maybe responsible for liver dysfunction by causing organ congestion, cellular inflammation and sinusoidal blockage. There is increase in the serum ALT and AST in the severe group when compared with the control group.

This study shows that malaria parasite infection may be responsible for the increase in liver enzymes. The increase in serum ALT and AST in malaria positive individuals could be as the result of leakage of these enzymes from the liver, as a result of damage to liver cells during the liver stage of life cycle of malaria parasite.

The haematological parameters conducted from this research shows a decrease haemoglobin concentration in malaria subjects compare with the non-malarious group which is in agreement to reports conducte by several authors [5, 11-13]. Earlier report had posited that malaria related anaemia is often more severe in areas of intense malaria transmission.

The present study shows a significant reduction in serum levels of albumin in malaria patients in Barkin/Ladi Nigeria than the corresponding non-malaria group thus Serum albumin could be use as the reliable biochemical marker for establishing severe pathological condition such as malnutrition and infection.

Serum bilirubin was found to be higher in malaria subjects in comparism to the control group. This could be as the result of abnormal breaking or disruption of the red blood cells when an individual is parasitized with *falciparum* malaria.

Similarly, the packed cell volume level was lower in malaria group in comparism with the control group. The drop in PCV values in malarious group may be due to;

i. Rapid rate of haemolysis associated with the pathophysiology of the disease condition [5].

ii. Reduce rate of haemoglobin biosynthesis which is often connected to the level of immunity and nutritional status of infected individual [5, 11, 17].

Divergent views have been empress on total white blood cell count, neutrophils, eosinophil, lymphocytes and monocytes count. However, this research shows an increase in the blood parameters in malaria subject compared with the control subject. This finding agrees with works of George [8] but in contrast with researches of Perrin [16]

The current study shows the decrease in the red blood cell of malaria subject in comparism with the non-malaria group, this reduction in the number of red blood cell

could be as the result of parasite target which leads to the sequestration and breaking of the red blood cell.

The blood platelet count was significantly reducing in the infected group in comparism with the non-infected individual while the ESR values where high in the malaria group than the non-malaria group. However, measurement of ESR is often used as a non-specific test for acute illness and may reflect the acute process of the disease.

The MCV and MCH values where significantly higher in the malaria subject than the non-malarious group in this study.

5. Conclusion

This study concluded that the malaria infection has alteration on haematological parameters and immense impact on the liver and kidney function especially among those who were severely infected.

Preventive strategies including regular haemochemo prophylaxes intermittent preventive treatment with anti-malarias, provision of iron supplementation and insecticide treated bed net should be implemented urgently to prevent the negative effect of biochemical and haematological parameters in individuals.

6 Ethical Clearance

An ethical clearance was obtained from General Hospital Barkin/Ladi administration after presenting a proposal for the study with compliance with the declaration on the right of the patients subjects involved signed an informed consent form.

7. Conflict Of Interest

No conflict of interest among researchers

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