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DETERMINATION OF METHAEMOGLOBIN LEVELS IN MALARIA INFECTED PATIENTS IN UNIVERSITY HEALTH SERVICES DEPARTMENT,MICHAEL OKPARA UNIVERSITY OF AGRICULTURE,UMUDIKE, ABIA STATE, NIGERIA

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ABSTRACT

The oxidative stress in malaria infection especially in severe cases are much may be as a result of body's defense mechanism such as release of cytokines which bring about different signs and symptoms with different level of severity.The release of free radicals and the use of drug during malaria infection could affect the reducing capacity of the enzyme system or the glutathione levels in the blood.125 sujects were chosen for the study.80 of the subjects were infected with malaria.20 were severely infected while 60 has uncomplicated malaria infection(mild/moderate malaria) in the University Health Services Department of Michael Okpara University of Agriculture, Umudike,Abia State,Nigeria.40 were apparently healthy individuals who visisted there for other issues.The result was analysed using t-test.The statistical analysis showed no significant difference in the mean methaemoglobin values between the sex ($P>0.05$).There was significant difference in the malaria infected patients and the apparently healthy individuals($P<0.05$).There was significant difference between the mean methaemoglobin levels of the severely infected patients and those who had uncomplicated malaria infections(mild/moderate cases).

KEYWORDS: Malaria, Severe Malaria, Uncomplicated Malaria And Methaemoglobin.

INTRODUCTION

Methaemoglobin is a form of the oxygen-carrying metalloprotein haemoglobin in which the Iron in the haeme group is in the Fe^{3+}(ferric) state,not the Fe^{2+}(ferrous) of normal haemoglobin.Methaemoglobin cannot bind oxygen unlike oxyhaemoglobin.It is bluish chocolate-brown in colour.In human blood a trace amount of methaemoglobin is normally produced spontaneously.But when it is present in excess the blood becomes abnormally dark bluish brown.The NADH-dependent enzyme methaemoglobin reductase(diaphorase 1) is responsible for converting methaemoglobin back to haemoglobin(Bando et al,2004).

Common causes include: (a) reduced cellular defence mechanism-children younger than 4 years exposed to various environmental agents,pregnant women are considered vulnerable to exposure of high levels of nitrates in drinking water(Manaseram et al,2010),cytochrome b5 reductase deficiency,G6PD deficiency,Haemoglobin M disease,Pyruvate Kinase deficiency. (b) various pharmaceutical compounds-local anesthetic agents,especially prilocaine,oral pain relief gels, liquids and lozenges containing benzocaine,Amyl nitrite,chloroquine dapsone, nitrates, nitroglycerine, nitroprusside, phenacetin, phenazopyridine, primaquine, quinones, sulfonamides. (c) environmental agents-aromatic amines, Arsine, Chlorobenzene, Chromate, nitrates/nitite (d) inherited disorders.

Normally,methaemoglobin levels are 1-3%,as measured by the co-oximetry test(Dacie et al,2006).Elevated levels of methaemoglobin in the blood are caused when the mechanisms that defend against oxidative stress with the red blood cell are overwhelmed and the oxygen ferrous ion of the haeme group of the haemoglobin molecule is oxidised to the ferric state.This converts haemoglobin to methaemoglobin,resulting in a reduced ability to release oxygen to tissues and thereby hypoxia.This can give the blood a bluish or chocolate-brown colour.Spontaneously formed enzyme systems and to a lesser extent the ascorbic acid and glutathione enzyme systems.Disruption with these enzymes systems leads to the condition.
Hypoxia occurs due to the decreased oxygen-binding capacity of methaemoglobin,as well as the increased oxygen-binding affinity of other subunits in the same haemoglobin molecule which prevents them from releasing oxygen at normal tissue oxygen levels.

Signs and symptoms of methaemoglobinemia(methaemglobin>1%) include shortness of breath,cynosis is the classic symptom,mental status changes(¬50%),headache,fatigue,exercise

intolerance,dizziness and loss of consciousness.Arterial blood with elevated methaemoglobin levels has a characteristic chocolate-brown colour as compared to normal bright red oxygen-containing arterial blood(eMedicine,2008).

Severe methaemoglobinemia (methaemoglobin>50%) patients have dyrythmiass, seizures, coma and death (>70%).Healthy people may not have many symptoms with methaemoglobin levels<15%.However,patients with co-morbidities such as anaemia,cardiovascular disease,sepsis,or presence of other abnormal haemoglobin species may experience moderate to severe symptoms at much lower(as low as 5-8%).

Malaria is a serious public health chanllenge(Obeagu et al,2013).It is among the leading cause of deaths in the world despite global efforts to control it(Akhigbe et al,2011).WHO estimates that in 2010 there were 219 million cases of malaria resulting in 600,000 deaths.Majority of the cases(65%) occured in children under 15 years old.About 125 million pregnant women are at risks of infection each year(Hedrick,2011,Weatherall,2008 and WHO,2012).Malaria has been associated with high morbidity and mortality through anaemia,cerebral complications and other mechanisms.Malaria is the second leading disease after Acquired Immunideficiency Syndrome[(AIDS)(Murray et al,2012,Nadjm and Behrens,2012,Rowe et al,2009 and Weatheraii,2008)].

Malaria infection interferes with haemoglobin by disruption to methaemoglobin(Uko et al,2003).Malaria infection through its oxidative stress is expected to oxidise ferrous ion of haemoglobin to ferric ion(methaemoglobin) leading to the increase.This inrease reconverts after the infection due the enzyme systems and glutatione in the red blood cells especially in the new red cells as a result of the compensatory mechanism and in a case it persists after the recovery from the infection that means that methaemoglobinemia has ensued by acquired means or inherited.

MATERIALS AND METHODS

Study Area:This was carried out in the University Health Services Department of Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.

Subjects and Methods: Blood samples were collected from 80 malaria infected patients admitted to the University Health Services Department of the University and 40 apparently healthy adults who visited the clinic for other issues.Venous blood samples were collected

into EDTA anticoagulated Containers and the remaining used to make thick and thin blood films for malaria parasite test and stained with Giemsa.Methaemoglobin levels were determined using the Evelyn and Malloy by spectrophotometric analysis and the results obtained analalysed statistically by t-test.Significant P-Value set at P<0.05.The mean methaemoglobin values were presented in percentages.

Ethics.Oral consents were made to the subjects prior to the sample collection.

RESULTS

TABLE1:MEAN METAEMOGLOBIN VALUES OF MALARIA INFECTED BASED ON SEX

SEX	METHAEMOGLOBIN(%)	SD(%)	P-VALUE
MALE(32)	3.9	±0.4	
FEMALE(48)	4.1	±0.6	P>0.05

TABLE2:MEAN METHAEMOGLOBIN VALUES OF MALARIA INFECTED PATIENTS AND HEALTHY INDIVIDUALS

SUBJECTS	METHAEMOGLOBIN(%)	SD(%)	P-VALUE
MALARIA INFECTED PATIENTS	4.0	±0.6	
HEALTHY INDIVIDUALS	0.9	±0.3	P<0.05

TABLE 3:MEAN METHAEMOGLOBIN VALUES IN SEVERE AND UNCOMPLICTED MALARIA INFECTION

SUBJECTS	METHAEMOGLOBIN(%)	SD(%)	P-VALUE
SEVERE MALARIA (20)PATIENTS	5.2	±0.5	
UNCOMPLICATED (60)MALARIA PATIENTS	2.7	±0.3	P<0.05

DISCUSSION

Table 1 showed no significant difference in the mean values of methaemoglobin levels based on sex(P>0.05).Table 2 and table 3 showed significant difference in the levels of

methaemoglobin between malaria infected patients and apparently healthy individual($P<0.05$) as well as between the severely infected patients which is in line with work of Uko et al(2003) where they studied methaemoglobin profile in malaria infected children in UCTH calabar.This significant increase may be as a result of oxidative stress of the malaria infection on the red blood cells which depressed reducing ability of the enzyme and glutathione systems.This converts haemoglobin to methaemoglobin which lowers the ability to release oxygen to the tissues(Uko et al,2003).

CONCLUSION

The study showed significant increase in severe cases of malaria which may reconvert spontaneously after the infection.Methaemoglobin is an indicator of malaria infection in patients.This suggests that methaemoglobin test should be done on those infected with malaria parasites which should in turn guide doctors on the choice of anti-malaria drugs to avoid exacerbation of the condition on the patients.

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