IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 22, Issue 4 Ser.4 (April. 2023), PP 56-64
www.iosrjournals.org

Comparative Assessment of the Plasma Malondialdehyde (MDA) Levels in Parturients on Intermittent Preventive Treatment with Sulphadoxine Pyrimethamine (IPT-SP), and their Controls during Current Confinements.

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Abstract
Background: *The importance of malaria prevention especially in endemic areas during antenatal periods has been greatly emphasized. It is a useful tool for reducing the problems of malaria in pregnancy. Such problems may include anaemia in pregnancy, preterm labours, small for date and low bith weight etc. It has also been noted that optimal antioxidant status like Malondialdehyde is necessary to help pregnant women enjoy uneventful pregnancies as well as avert other problems of pregnancy which may include intrauterine growth retardations (IUGR), preterm births, neonatal anaemias, increased admissions into special care baby units and even neonatal deaths.*
Objectives: *We comparatively assessed the plasma malondialdehyde (MDA) levels in parturients who received intermittent preventive treatment with sulphadoxine pyrimethamine (IPT-SP), and their controls during their Current Confinements.*
Method: *Federal Medical Centre(FMC), Owerri Nigeria was the center for this study. Owerri presents a typical malaria endemic setting in Sub Saharan Africa. Ethical clearance and certification were obtained from the ethics committee of the health facility enabling commencement of a longitudinal recruitment of participants after adequate counseling and informed consent involving both groups. The study involved antenatal clinic recruitment, laboratory assessment of MDA levels and a cross-sectional description of parameters of the 296 participants who clearly satisfied the inclusion criteria for either the study or control groups as allotted. Following recruitment, participants were followed up through out their entire antenatal course till delivery to enable collection of blood samples for Malondialdehyde estimation. This was done using the Colorimetric method of Gutteridge and Wilkins,* ***1982****. The principle's methodology is based on the fact that when Malondialdehyde, a product of lipid peroxidation, is heated with 2-thiobarbituric acid (TBA) under alkaline conditions, it forms a pink-coloured product, which has absorption maximum at 532 nm. The colour intensity generated is directly proportional to the concentration of MDA in the sample.*
Data analysis: *Computation and analysis of the data obtained was done using the computer Software Package for Social Sciences (SPSS) version 20.0 (SPSS, Inc, 2007, Chicago). Descriptive statistics (mean, standard deviation, range, percentages etc) were determined for continuous variables. P-value less than (<0.05) at 95% confidence interval was considered statistically significant.*
Result: *The results of this study showed that the mean serum level of Malondialdehyde (MDA) in the study group was 2.72 nmol/ml while the minimum and maximum serum malondialdehyde levels were 1.12 and 5.21 respectively. For the control group the mean serum level was 3.27 nmol/ml while the minimum and maximum serum malondialdehyde levels were 1.54 and 8.06 respectively. The difference was found to be statistically significant (p= <0.0001) with odds ratio 0.60 (CI of 95% 0.172-0.767).*

Keywords: *Anaemia in pregnancy, antenatal course, Colorimetric method, Malaria endemicity, Malondialdehyde, Sulphadoxine-Pyrimethamine, Thiobarbituric acid (TBA).*

Date of Submission: 02-04-2023 Date of Acceptance: 13-04-2023

I. Introduction

Malaria infection is of major global and public health importance having afflicted humans over the millennia. Its menace is felt more in endemic areas of the world like the Sub-Saharan Africa where it is a significant cause of morbidity and mortality especially among our pregnant women, the fetuses, neonates and young children. The elderly are however not spared. Malaria is known to constitute enormous social and economic burdens.

The most severe form of malaria is caused by Plasmodium falciparum with its variable clinical features including fever, chills, headache, vomiting, muscular aching, cough weakness, diarrhoea and abdominal pain. Other symptoms which may be related to organ failure may later supervene. Such features may include acute renal failure, pulmonary oedema, generalized convulsions, circulatory collapse, followed by coma and death. The initial symptoms which may be mild as well as non specific and may not easily be recognize as being due to malaria (WHO Intnl Travel and Health, 2018). Chukwu and co studied the pattern and respective prevalence of malaria symptoms and signs. Their conclusion on the percentage occurrences of malaria symptoms were as follows: fever 92%; body weakness 90%; headache 85%; malaise 80%; loss of appetite 80%; nausea 72%; vomiting 70%; abdominal pains 50% (Chukwu, Agbasi & Unekwe, 2019). It is important that the possibility of falciparum malaria is considered in all cases of unexplained fever starting at any time between 7 days after the first possible exposure to malaria and 3 months (or, rarely, later) after the last possible exposure. Any individual who experiences a fever in this interval should immediately seek diagnosis and effective treatment, and inform medical personnel of the possible exposure to malaria infection. Falciparum malaria may be fatal if treatment is delayed beyond 24 hours after the onset of clinical symptoms (WHO Intnl Travel and Health, 2018). Among the pregnant women especially in the malaria endemic areas of the world, there is an increased incidence of malaria cases and anaemia in the parturients. For the above reasons a number of preventive measures have continuously been put in place to help reduce the malaria cases and anaemia among the mothers. This is one of the factors prompting this very study. From the past antimalarial chemoprophylaxis was generally recommended to prevent the adverse effects and consequences of malaria in pregnancy. To achieve this in the past, African countries adopted antimalarial prophylaxis using weekly pyrimethamine or chloroquine and this had wide acceptance in the past (WHO Report, 1986; Falade et al., 2007). Unfortunately, the efficacy of these congeners as malaria chemo prophylactic agents has long been undermined by the emergence of multiple drug resistant strains of Plasmodium falciparum and poor compliance (Falade et al., 2007). In 1998 the project Roll back malaria (RBM) initiative came on board. RBM is a global partnership that was initiated by the WHO, UNDP, UNICEF and the World Bank. In this programme initiative, prevention of malaria in pregnancy was not left out. To achieve its aims RBM promoted four main strategies to enable us halve the world's malaria burden by 2010. These strategies were **-evidence based,** (shown to be effective) **-outcome focused** and **-cost effective.** They strategies include: 1. Prompt access to malaria treatment 2. Promoting the use of insecticide treated nets (ITNs) 3. Prevention and control of malaria in pregnant women and 4. Malaria epidemic and emergency responses (WHO [RBM], 2001; WHO [RBM], 2005; FMOH Nigeria, 2011;).

Intermittent preventive treatment (IPT-SP) for malaria in pregnancy was later introduced by World Health Organization (WHO) for the prevention of malaria in pregnancy, which itself is a major public health problem, with substantial risks to the mother, her fetus and the neonate. IPT-SP for malaria in pregnancy is a full therapeutic course of antimalarial regimen for pregnant women prescribed during routine antenatal visits. The component drugs usually in a fixed dose regimen, is meant to be given regardless of whether the recipient is infected with malaria or not (WHO, 2006; WHO, 2012).

Sulfadoxine-pyrimethamine, (IPT-SP) is recommended by WHO in all areas with moderate to high malaria transmission in Africa. By October 2012, WHO recommended that this preventive treatment be given to all pregnant women at antenatal care visit starting as early as possible in the second trimester. Each IPT-SP dose should be given at least 1 month apart from the other. IPT-SP is said to reduce maternal malaria episodes, maternal and fetal anaemia, placental parasitaemia, as well as reduce the incidence of low birth weight, and neonatal mortality (WHO, 2012; WHO, 2017).

Although malaria infection may be relatively uncommon in developed countries, it is seen among travelers on return from endemic regions and remains one of the most prevalent infections of humans worldwide (Kathryn et al, 2004; WHO International Travel and Health, 2018). The mosquito becomes infected by biting an infected person and drawing blood that contains the parasite. When that mosquito bites another uninfected person, that person becomes infected. However, in the United States and other non

malarious regions of the world, people who developed malaria almost always got infected while traveling to parts of the world where malaria is endemic (CDC, 2017). Current efforts to control malaria focuses on reducing attributable morbidity and mortality. While we note the critical roles played by the Centers for Disease Control and Prevention (CDC) in eliminating malaria from the United States over 60 years ago, malaria remain a parasitic infection transmitted by mosquitoes that has afflicted humans over the millennia (Kathryn et al, 2014; CDC and Malaria, 2017)**.** Also, Falciparum malaria infection produces reactive oxygen species (ROS) leading to serum lipid peroxidation. This can overwhelm the body's antioxidant defenses. An imbalance between reactive oxygen species and antioxidant defense mechanisms of a cell leads to **oxidative stresses.** The interplay between these factors and IPT-SP following ingestion of SP for the prevention of malaria in pregnancy (SP) has remained a virgin area for clinical research before this study especially in Owerri, a heavy malaria endemic area (Chukwu Leo Clinton, Ph.D research project, 2019).

It has also been reported that the production of a wide range of reactive oxygen and nitrogen species (ROS and RNS), that are associated with oxidative stress play critical roles in the development of systemic complications seen during malaria infection. This have been suggested by recent studies. It has equally been noted that malaria infection has the capacity to induce the generation of hydroxyl radicals ($OH^{\bullet}$) in the liver hepatocytes. This may be the most important trigger to the induction of oxidative stress and apoptosis (Guha et al., 2006; Sandro et al., 2012).

Malaria itself has been suggested to be able to suppress responses to immunogens while the hidden malaria plasmodium in the placenta can impair antibody transfer from the pregnant mother to her unborn fetus. This alone can potentially reduce the benefits of maternal-uterine immunization and it is worst as well as more severe in first time mothers (Tiyong et al, 2009; Steketee, Nahlen, Praise & Menendez, 2001).

MALARIA, MALODIALDIALDEHYDE (MDA) AND ANTIOXIDATION

Malondialdehyde is one of the two main omega-6 fatty acid lipid peroxidation products, the other one is, 4-hydroxy-2-nonenal (4-HNE). Lipid peroxidation can be described generally as a process under which oxidants such as free radicals attack lipids containing carbon-carbon double bond(s), especially polyunsaturated fatty acids (Antonio, Mario & Sandro, 2014).

Among the aldehydes [Malondialdehyde (MDA), propanal, hexanal, and 4-hydroxynonenal (4-HNE)] that can be formed as secondary products during lipid peroxidation, MDA appears to be the **most mutagenic product** of lipid peroxidation, whereas 4-HNE is the **most toxic** (Esterbauer, Eckl & Ortner, 1990).

Malaria infection has been found to be associated with lipid peroxidation with a consequent reduction in antioxidant capacity of the infected patients. This is especially so with malaria of the Plasmodium falciparum variety (Idonije, Festus, Okhiai & Akpamu, 2011). Patients with malaria parasitaemia had significantly higher levels of lipid peroxidation products (MDA) than the healthy asymptomatic volunteers. This MDA level was significantly higher in primigravidea and also correlates well with malaria parasite density (Tiyong et al., 2009).

In Benin City Nigerian MDA, a biomarker of lipid peroxidation was evaluated in Nigerian adults (18-45 years) with P. falciparum and P. vivax malaria infection. Their lipid peroxidation products (MDA) values estimated spectrophotometrically were compared to that of the control group who were apparently healthy tested malaria negative subjects. Result showed a significant increase ($p<0.05$) in Malondialdehyde level in malaria positive patients ($n = 100$; 7.67 ± 0.42 μM L^{-1}) compared to the control; malaria negative patients ($n = 50$; 4.43 ± 0.32 μM L^{-1}). This increase in Malondialdehyde level was higher in P. vivax malaria patients ($n = 50$; 7.94 ± 0.27 μM L^{-1}) than in P. falciparum malaria ($n = 50$; 7.41 ± 0.38 μM L^{-1}) and increases as the degree of parasitaemia increases (Idonije et al. 2011).

This prooxidant MDA has been shown to increase in parturients during the third trimester, a change which runs parallel with an increase in the amounts of the antioxidants Superoxide Dimutase (SOD) and Catalase during the same period. These changes may be related to the process of pregnancy itself and the placental circulation that plays an important role in oxidative stress during this period (Claudio et al., 2011).

As against healthy asymptomatic volunteers, Malodialdehyde has been found to be significantly higher in patients with parasitaemia. This MDA level was higher in primigravidea and also correlates significantly with malaria parasite density ($p<0.001$). On the other hand, the activity of Catalase did not differ statistically from that of the control. In contrast, SOD activity of patients with malaria was found to be significantly higher than that of controls; mean: 0.7899 ± 0.2777 and 0.4263 ± 0.2629 respectively, $p<0.05$ (Tiyong et al., 2009). The disparities in these prooxidants and oxidants during malaria infection need further elucidation. This is especially so in pregnant women on IPT-SP.

Also, there is dearth of scholarly works assessing Malondialdehyde levels and their interactions with Intermittent Preventive Treatment with Sulphadoxine Pyrimethamine in Parturients who Received Intermittent Preventive Treatment with Sulphadoxine Pyrimethamine in pregnancy. Hence, this study was conducted to ascertain a comparative assessment of the Plasma Malondialdehyde (MDA) Levels in Parturients who Received

Intermittent Preventive Treatment with Sulphadoxine Pyrimethamine (IPT-SP), and their Controls during their Current Confinements. It is believed that the results of this study will guide policy makers and stakeholders in obstetrics and gynecological practice in adopting strategies that will ensure better pregnancy outcomes for our women. The research question is: Does the levels of Malondialdehyde affect pregnancy outcomes in malaria endemic areas of the world?

STUDY SETTING AND STUDY CENTER: The study was carried out at Federal Medical Centre, in Owerri Municipal Local Government Area of Imo State, Nigeria. Owerri is the densely populated state capital of Imo and a malaria endemic area. Majority of the outpatient visits to the hospitals in Imo state are due to malaria infection. Federal Medical Center Owerri, where the study took place is located along Amakohia / Hospital road in Owerri. The hospital is a tertiary health institution located in the Imo state capital. It offers quality health services especially in emergency obstetric care, safe motherhood, comprehensive maternity care and other specialist medical services. These quality services of the hospital attract parturients from far and wide in the state and other towns in neighboring states for medical care.

STUDY DESIGN: The study design was a prospective **Cohort study**, based on the protocol of comparing the Pregnancy outcomes of parturients who received Intermittent Preventive Treatment (IPT) with sulfadoxine-pyrimethamine (IPT-SP) at varying trimesters during their index confinement and those of parturients who did not receive any IPT at all during their current pregnancies.

All the pregnant women in the study group (case) received 2 doses of the recommended antimalarial drug, (SP) preferably at the first and second regularly scheduled antenatal clinic (ANC) visits after 'quickening'. Those in the control arm did not receive any SP.

The study involved home visitations in the form of follow up where necessary. While each dose of SP was given at least 1 month apart from the other, the IPT-SP was administered as directly observed therapy (DOT) and preferably given on an empty stomach where necessary. The drug SP was administered to selected pregnant women as guided by the inclusion criteria below.

IPT-SP was administered at a stat dose of three tablets sulphadoxine-pyrimethamine (each tablet containing 500mg/25mg SP) giving the total required dosage of 1500mg/75mg of SP per study group participant.

STUDY POPULATION AND RECRUITMENT: The study population included pregnant women who attended Federal Medical Center, Owerri for their antenatal care within the stated study period. They were mainly booked antenatal gravid women without any known signs nor symptoms of malaria infection and no parasitological diagnosis of malaria at recruitment.

These pregnant women who come for antenatal care services and satisfied the inclusion criteria were recruited longitudinally and must have witnessed quickening (first fetal movements en-utero) from about 16 weeks up to 28 weeks of gestation. A **Purposive Sampling technique** was used for participant selection. Initially, recruitment was based on those parturients without any symptoms and neither signs of malaria (**clinical diagnosis**) and no laboratory diagnosis of malaria (**parasitological diagnosis**). Follow up visits for the selected pregnant women were meant to coincide with their regularly scheduled antenatal visits to boost compliance. During each visit, adequate interval history was taken and physical examination done to ascertain the state of health of the participant during the period from the last visit. Routine antenatal investigations done included Haemoglobin estimation and Urinalysis.

INCLUSION CRITERIA: For a participant to be recruited into the **study group,** such pregnant women must consent to the study as well as satisfy all the inclusion criteria which were:

a. Pregnant women residing in Owerri town or any of its suburbs who could afford ANC follow up and ready to deliver at FMC, Owerri, (both groups).
b. Booked antenatal patients of the hospital with ancillary body temperature of $< 37.5\ ^{o}C$ and without any symptoms nor signs and no laboratory diagnosis of malaria, (both groups).
c. No ingestion of antimalaria drug at time of presentation (at least $\geq$ 2 weeks) for both the study and control groups. This information relied on our getting a good history.
d. Were ready to take the IPT-SP as DOTS (Directly observed therapy) and no allergies to SP. For only the study (case) group only.

THE CONTROL GROUP: The control group on the other hand, essentially consisted of pregnant women either presenting for delivery **(unbooked)** but meeting other criteria for inclusion or those who presented late for antenatal care **(late booking)** in the last months of pregnancy and also met other criteria for inclusion. Pregnant women with documented **allergies to SP** who met other criteria for inclusion were also considered for recruitment in the control group. For all the control participants essentially, **good history** was also used to exclude ingestion of SP prior to presentation.

EXCLUSION CRITERIA: The following candidates were excluded from the study:

a) Those with symptoms and signs of severe malaria.
b) Women with underlying medical or other diseases (example were known hypertensive, diabetics, or those suffering from nephrosis, congestive heart failure, HIV/AIDS, SCD or other conditions/co-morbidities suspected possibly to affect the results of the study).
c) All Haemoglobin AS women were also excluded from the study.
d) Those who had allergies to any component of the drug combination (SP). These parturient were then included among those who did not receive any IPT-SP (control group) at all during their current pregnancy provided they met other criteria for inclusion.
e) Women who had used any antimalarial drug in the past 2 weeks prior to recruitment.
f) Women who live far away from study base that may discourage effective follow-up.

SAMPLING SIZE DETERMINATION (Araoye, 2004).
Sample size was calculated using the formula: $n = \frac{z^2pq}{d^2}$

Where: n= the desired sample size.
z= the standard normal deviate, usually set at 1.96 (or more simply 2.0).
This corresponds to the 95% confidence level.
p= incidence of malaria in pregnancy in Owerri, reported as **11%** (Ogbusu, Nwoke, Njoku, Anosike, & Uwaezuoke, 2004).
q= 1.0-p
d= degree of accuracy desired, usually set at 0.05 or occasionally 0.02.
(Araoye, 2004).
From: $n = \frac{z^2pq}{d^2}$

$n = \frac{(1.96)^2 (0.11) (1-0.11)}{(0.05)^2}$

= 148. (Araoye, 2004).

Approximated to 150 to account for minimal attrition. A sample size of 150 subjects for each group who meet the inclusion criteria and consented to the study (both verbally and in writing) as well as used the above hospital for antenatal care and delivery were recruited longitudinally using a Purposive Sampling method. Responses were drawn using:

MALONDIALDEHYDE (MDA) ASSAY
MDA level was determined by the Colorimetric method of Gutteridge and Wilkins, 1982.
Principle: Malondialdehyde (MDA) is a product of lipid peroxidation. When heated with 2-thiobarbituric acid (TBA) under alkaline condition, it forms a pink coloured product, which has absorption maximum at 532 nm. The intensity of colour generated is directly proportional to the concentration of Malondialdehyde in the sample.
Procedure:
To 0.1 ml of sample in test tube was added 1 ml of 1% Thiobarbituric acid dissolved in alkaline medium (0.05 M sodium hydroxide). The mixture was mixed thoroughly, and 1 ml of glacial acetic acid was added to the mixture. The reaction mixture was also shaken thoroughly and incubated in boiling water (100 °C) for 15 minutes. It was allowed to cool and the turbidity removed by centrifugation at 3000 rpm for 10 minutes. Thereafter, the supernatant was read off at 532 nm. The same volume of TBA and glacial acetic acid was added to the blank, but 0.1 ml of distilled water was added to the blank instead of plasma.
Calculation:
The level of MDA in the serum is expressed as nmol/ml using the molar extinction coefficient for MDA ($1.56x10^5$ M-1cm-1).
MDA (nmol/ml) = (OD X 1000000)/ E_{532}
Where:
E_{532} = Molar extinction coefficient for MDA ($1.56x10^5$ $M^{-1}cm^{-1}$)
1000000 = conversion of mMol to nMol (Gutteridge and Wilkins, 1982).
STATISTICAL ANALYSIS: The results obtained from this study have been presented as mean ± std. deviation. The results after computation were analyzed using the computer software Package for Social Science (SPSS) version 20.0. (SPSS, Inc, 2007, Chicago). Descriptive statistics (mean, standard deviation, range, percentages etc) were determined for continuous variables. Independent Sample t-test was used to compare the means of continuous variables for the two groups (subjects & control). Student's t-test and one-way analysis of variance (ANOVA) was used for comparing mean values of both study and control groups. The results obtained

were presented as tables, bar charts, histograms and box plots in the next section. P-value less than **(<0.05) at 95%** confidence interval was considered statistically significant.

RESULTS

A total of 456 antenatal women were assessed for eligibility, 56 women were excluded from the study while 400 questionnaires were administered. A total of 296 finally completed the study comprising equal numbers (148) each of study (case) and control groups.

The Influence of MDA on the study (case) and control groups

The mean Malondaldehyde was found to be higher in the control group compared to the value obtained from the study group. The above box plot showed that two outlier observations are contained on each data for the case and the control groups. The outlier observations indicate skewness as observed on the histogram shown. The mean values are (2.72 nmol/ml for case and 3.27nmol/ml for control and the difference was statistically significant with p= < 0.0001; 95% CI =0.172 – 0.767 (see table 4.15).

II. DISCUSSION

The results of this study showed that the mean serum level of Malondialdehyde (MDA) in the study group was 2.72 nmol/ml while that of the control was 3.27. The difference was found to be statistically significant (p= <0.0001) with odds ratio 0.60 (CI of 95% 0.172-0.767). The reduced serum Malondialdehyde (MDA) level among the study participants may have resulted from the use of IPT-SP, which itself may have the capacity to decrease the intensity of lipid peroxidation in IPT-SP treated cohorts. In another study on pregnant women during delivery, the level of lipid peroxide product Malondialdehyde (MDA) was found to be significantly higher in the malaria infected subjects (p= 0.0047) and anaemic (p= 0.024) women (Megnekou et al., 2015*).* Their study result somewhat compared with the findings of this very study since, IPT-SP have been found to reduce the rate of anaemia in pregnancy as reported in some studies. Intermittent preventive treatment with Sulphadoxine pyramithamine has also been reported to reduce the incidences of anaemia and malaria in pregnancy in malaria endemic areas of the world (Chukwu et, al 2019). In the course of this study, it was also recorded that levels of MDA correlated positively with malaria parasitaemia (p= 0.0024) but negatively with haemoglobin levels (p= 0.002). Further histological studies revealed that the level of MDA associated positively and significantly with placental malaria infection and the presence of malaria pigments (Megnekou et al., 2015). Dhananjay and colleagues studied the serum Malondialdehyde levels as a marker of oxidative stress in pregnant women with Pregnancy-induced Hypertension (PIH) and their controls. They found out that higher O_2 free radical production existed, evidenced by increased levels of MDA in hypertensive pregnant women. This demonstrated that there is significant difference between PIH and normal pregnancy regarding serum MDA. The rise in MDA could be due to increased generation of ROS from to the excessive oxidative damage generated in the hypertensive patients. The lipid peroxides and free radicals may have been important in pathogenesis of PIH (Dhananjay, Manjusha, Roshan & Ashlesha, 2014). Megnekou and co in their study concluded that placental P. falciparum infection may causes oxidative stress of the placental tissue with MDA as a potential biomarker of placental malaria, which alongside other oxidants could lead to poor pregnancy outcomes (anaemia and low birth weight etc). This finding might contribute to the understanding of the pathophysiology of P. falciparum placental malaria infection in pregnant women (Megnekou, et al., 2015). In another study also, plasma malondialdehyde levels in the third trimester was (3.13±0.61umol/l) in pre-eclamptic mothers and was higher than it was in the second trimester (3.00±1.21umol/l). Plasma malondialdehyde in the third trimester of normal pregnancy (2.03±0.71umol/l) was also found to be significantly higher than it was in the second trimester (1.65±0.62umol/ l) with p= <0.0001 (Atiba et al., 2014). This may underscore the need for monitoring of these biomarkers during pregnancy (recommendation of this study).

Recent studies have further suggested that oxidative stress can partake in the pathogenesis of thrombocytopenia associated with malaria. This was evidenced by the fact that the number of platelets and the activities of antioxidant enzymes, SOD and GSH-Px in patients with vivax malaria were reduced while lipid peroxidation of platelets (estimated by measuring the malondialdehyde, MDA), was elevated in infected individuals, suggesting a negative correlation between platelet count and platelet during lipid peroxidation. These results suggested that oxidative stress occupied an important role in the pathogenesis of thrombocytopenia in malaria. This is envisaged to occur through loss of elasticity of membranes and by increasing brittleness which causes dysfunction in receptors, resulting in considerable functional impairment of thrombocytes (Erel, Vural, Aksoy, Aslan & Ulukanligil, 2001; Sandro et al., 2012).

III. CONCLUSION:

From the study also we can deduce that treatment with SP alters the body's enzymatic antioxidant defense profile. The mean MDA values were 2.72 umol/l and 3.27umol/l for the case and control respectively depicts a statistically significant difference (p < 0.0001; 95% CI =0.172 – 0.767). Also from the results of this study and supported by the results from other authors/researchers involved in the IPT-SP

evaluation, it can be concluded that Intermittent Preventive Treatment regime with sulphadoxine-pyrimethamine was still practically effective in optimizing pregnancy outcomes in malaria endemic areas. This is evident from the participants of this study as well as those living in other malaria endemic areas (Falade et al., 2007).

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ACKNOWLEDGMENT: The authors would like to thank the entire management particularly the ethics committee of Federal Medical Centre, Owerri Nigeria for giving us the opportunity to carry out this research after painstakingly going through our research proposal. We equally thank the resident doctors, house officers, nurses and midwives that assisted us during the course of this study. The efforts of the management and staff of Ave Marianso Clinics and Hospitals (AMCH) Owerri, South East Nigeria in helping to ensure a smooth research process is also highly acknowledged.

FUNDING: There is yet no external funding assistence received from the time of Research Conceptualization to this period of article publication. However, the authors will be highly pleased to welcome any Research grants that can help us offset part of our expences as well as carry out further research works.
CONFLICT OF INTERESTS: The authors of this journal article hereby declare that there was no conflicts of interests.
Authors contribution:
AUTHOR CONTRIBUTIONS CLC: contributed to conceptualization, study design, manuscript writing and revision; OCL: data collection; ECJ: data collection & revision OCA: data collection & revision.

CONFLICTS OF INTEREST The authors have no conflicts of interes.
Disclosure statement for publication: All authors approved the final manuscript, and agreed to be accountable for all aspects of the work.

Ethical approval: Application for ethical permission and approval was sent to the ethical committee of Federal Medical Center, Owerri. After due considerations and amendments the same was approved and granted. Following ethical approval, recruitment and laboratory investigation commenced. However, informed consent for assistance was routinely sought from medical colleagues and experienced midwives at the various antenatal clinics and labour ward before the exercise finally commenced. Also the aim of the study and confidentiality of the investigations were explained to the candidates to enable them make their informed consent.
A candidate (participant) was free to withdraw from the study whenever she so desired.
Those pregnant women who withheld consent were not denied quality care.
RESULTS
A total of 456 antenatal women were assessed for eligibility, 56 women were excluded from the study while 400 questionnaires were administered. A total of 296 finally completed the study comprising equal numbers (148) each of study (case) and control groups.

Table 1: The Effects of the serum levels MDA in both the study and control groups

variable	n	min	max	mean	Std.dev	coef	S.e.	p-value	OR	95% C.I.for OR Lower	Upper
Case	148	1.12	5.21	2.72	0.84						
Control	148	1.54	8.06	3.27	1.27	-0.508	0.124	<0.0001	0.60	0.172	0.767

From the table above, the average serum level of Malodyaldehyde (MDA) of the mothers was 2.718 ± 0.84 for the treatment (case) group and 3.270 ± 1.27 for the control.

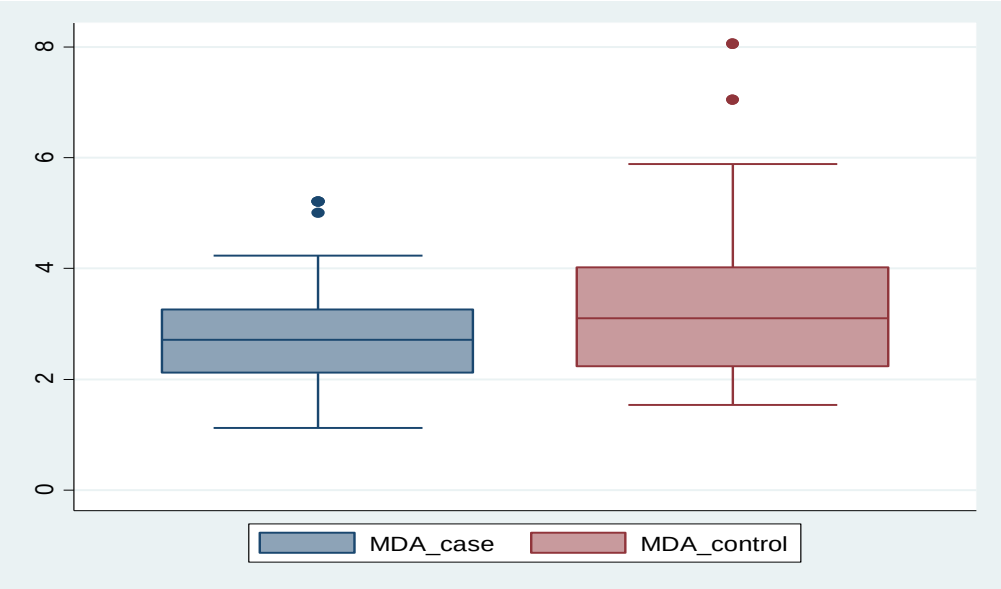

Figure 1 (Box plot 1): Serum levels of Malondaldehyde (MDA) in both the study (treatment) and control groups.

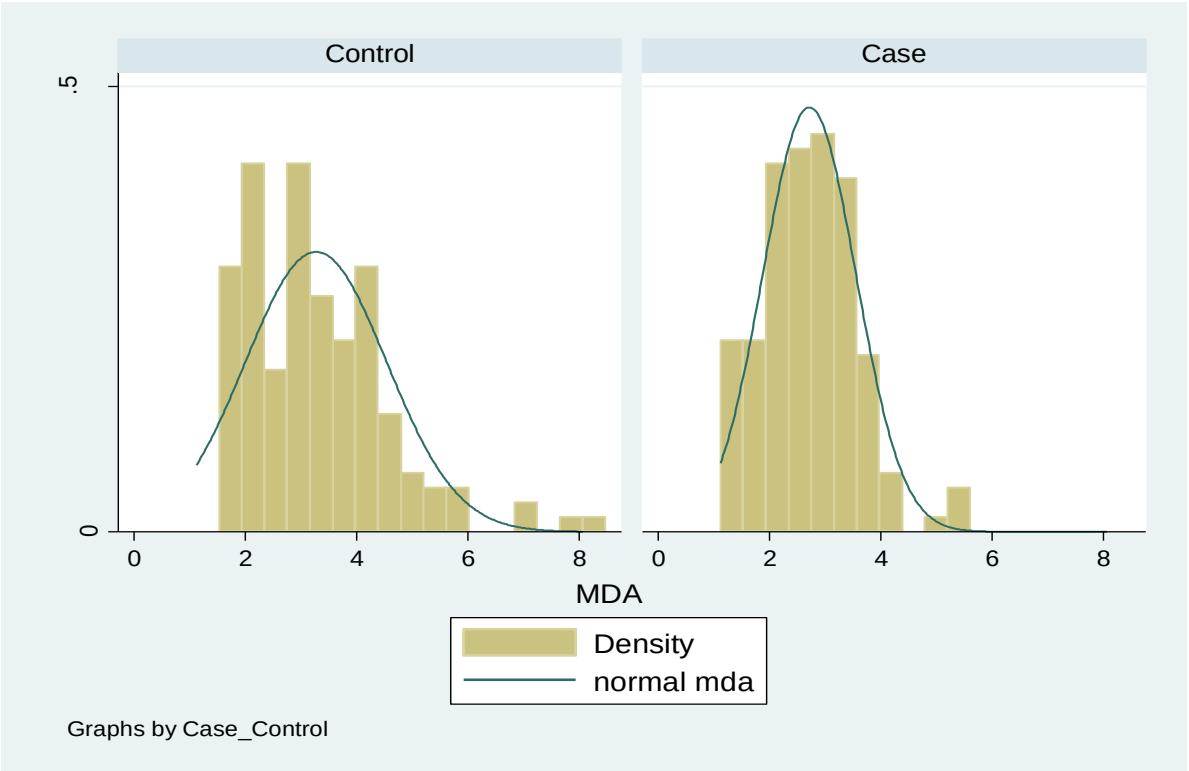

Figure 2 (Histogram 1): shows serum levels of Malondaldehyde (MDA) in both the study/case and control groups.

The Influence of MDA on the study (case) and control groups

The mean Malondaldehyde was found to be higher in the control group compared to the value obtained from the study group. The above box plot showed that two outlier observations are contained on each data for the case and the control groups. The outlier observations indicate skewness as observed on the histogram shown. The mean values are (2.72 nmol/ml for case and 3.27nmol/ml for control and the difference was statistically significant with p= < 0.0001; 95% CI =0.172 – 0.767 (see table 4.15).