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Full Length Research Paper

Effect of malaria infection on oxidative stress and lipid profile in pregnant women

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Abstract

This study assessed the effect of malaria infection on oxidative stress and lipid profiles in pregnant women. One hundred and fourteen pregnant women were enrolled and they were grouped according to their gravidity. Blood samples were collected to determine serum lipid profile status and malaria parasite count of the individuals. The mean parasite density was significantly higher (P<0.05) in primigravidae than multigravidae. Mean low density lipoprotein (LDL) level was significantly higher (p<0.05) in malaria positive than in malaria negative women. Mean high density lipoprotein (HDL) and total cholesterol levels were higher in malaria negative than in malaria positive. There was a significant increase in triglyceride level in malaria positive pregnant women. The mean Total cholesterol level was significantly higher (P<0.05) in malaria positive primigravidae than in multigravidae. There was increase in the mean triglyceride in malaria positive multigravidae as compared to malaria positive secungravidae. While the MDA level was significantly lower in malaria positive multigravidae than in malaria positive primigravidae and secungravidae, there was significant increase in catalase level. This study showed that the increase in LDL and decrease in the HDL levels in malaria positive pregnant women and primigravidae could expose them to atherosclerosis.

Keywords: Malaria, pregnant women, lipid profile, oxidative stress, gravidity.

INTRODUCTION

Malaria parasite has been reported to be a human pathogen for the entire history of the species (Hayakawa et al., 2008). Almost all deaths and severe disease transmitted by mosquito are caused by *P. falciparum* (Talman et al., 2004). Despite the concerted effort by different organization and government, malaria infection still remains one of the most deadly diseases in the world today (Akanbi et al., 2010). The prevalence of malaria infection is higher in the Sahara and sub tropical region of the world (Akanbi et al., 2010). Malaria transmission can be reduced by preventing mosquito bites with mosquito nets and insect repellant or by spraying insecticides inside houses and draining stagnant water where mosquito laid their eggs (Kilama and Ntoumi, 2009). Children and pregnant women have been reported to be more susceptible to infection than other groups (Akanbi et al., 2009). Malaria is a substantial burden affecting pregnant women irrespective of their age or parity. It causes a serious adverse effect on both mother and their baby; this includes maternal anaemia, abortion, low birth weight, feotal loss, premature delivery, intra-uterine growth retardation (Akanbi et al., 2010). Several studies had revealed that primigravidae are more vulnerable to malaria infection than secungravidae and multigravidae (Falade et al., 2008). The reduction in the susceptibility of pregnant women to malaria infection reduces with the increase in the number of pregnancy (Akanbi et al., 2009).

The existence of oxidative stress and changes in lipid profiles during acute malaria infection has been demonstrated in some studies. This includes depletion of antioxidant, increased plasma lipid peroxidation and altered fluidity of erythrocyte membrane (Das et al., 1993; Sibmooh et al., 2000). Although the oxidative stress appears to be a common phenomenon in acute infection, it may cause a specific consequence in malaria pathogenesis (Sibmooh et al., 2004). Hyperlipidemia, which is one of the indicators of malaria infection could results in depletion of natural antioxidants and facilitate the production of reactive oxygen species which is

capable to react with all biological molecules in the body system and exert cytotoxic effects on cellular components (Khovidhunkit et al., 2000; Krishna et al., 2009). Lipoproteins are major lipid component in plasma, and certainly the targets for oxidative stress. Malaria infection produces moderate changes in plasma lipid profile in man, with typical rise in serum triglyceride concentration and decline in HDL concentration (Faucher et al., 2002). These changes in lipid parameters are more pronounced in *Plasmodium falciparum* infection (Sibmooh et al., 2004). These might be as a result of acute phase response to malaria infection (Akanbi et al., 2012). The acute phase response is associated with changes in lipid metabolism including a moderate increase in serum triglyceride and VLDL, but decrease in HDL and LDL (Sibmooh et al., 2004). In low-level malaria infection, the level of total cholesterol, LDL, and HDL are reduced while triglyceride levels are increased (Mohanty et al., 1992).

The increased oxidative stress in malaria which account for the degradation of the lipoproteins may originate from several sources including intracellular of parasitized erythrocytes, extracellular of haemolysed erythrocytes, or host immune responses. Consequently, the product from oxidative stress reactive species will interact with the mediators involved in the pathogenesis of malaria infection. This study assessed the effect of malaria infection on oxidative stress and lipid profiles in pregnant women.

MATERIALS AND METHOD

Study group

One hundred and fourteen pregnant women who came to antenatal clinic at Ikare specialist hospital, Ikare and Iwaro general hospital, Iwaro, Nigeria and who gave informed consent were recruited for this study. History of treatment of malaria during the preceding week with any form of antimalaria chemotherapy and chemo prophylactic agent were obtained from the participants. Variables obtained from the patients included: age, parity, number of still-birth, and last menstrual period were obtained using questionnaire. Gestational age was obtained from the last menstrual period.

Blood collection

Five milliliters of blood was collected by venipuncture from each participating pregnant women. 2ml of blood was immediately transferred into a bottle containing Ethylenediamine tetra acetic acid (EDTA) to determine haematological parameters, while the remaining 3 ml of blood was transferred into a plain bottle to obtain serum. The serum obtained was used to determine MDA, Super oxide dismutase (SOD) and lipid profiles levels. Patients who have been transfused within the last two months before the study were excluded from the study. Those who were malaria positive were treated accordingly. The study was reviewed and approved by the Local Institution Review Board.

Parasitological study

Thick and thin peripheral blood films were prepared from each sample, stained with Giemsa stain and examined for the presence of parasites using routine microscopy to determine the parasitaemia. For the positive slides, the number of parasite counted per 200 white blood cells was recorded and used to calculate parasite density assuming 8000 leucocytes/µl of blood.

Determination of Biochemical parameters

Lipid peroxidation in serum was assessed by measuring the thiobarbituric acid reactive substances and expressed in term of MDA formed per mg protein as described by Vashney and Kale, (1990). Catalase activities were measured by the method described by Misra and Fridovich (1972).

Determination of lipid profiles

Total triglycerides assay

Serum total triglycerides concentrations were measured by Tietze, (1990) as described in the manual of the Randox total triglycerides kit.

Total cholesterol assay

Serum total cholesterol level was measured by the method described by Trinder, (1969) as described in the manual of the Randox total cholesterol kit.

HDL-cholesterol assay

Serum HDL-cholesterol concentration was measured by the method described by NIHCDCS (1992) as described in the manual of the Randox HDL-cholesterol kit.

LDL-cholesterol assay

Serum LDL-cholesterol level was calculated by the method described by Friedwald et al., (1972) as described in the manual of the Randox HDL-cholesterol kit.

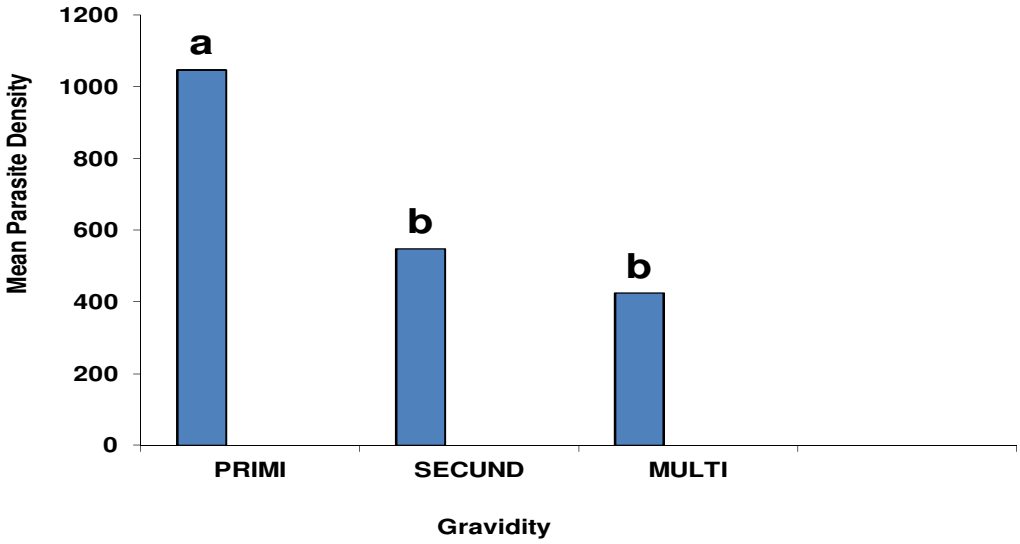

Figure 1. shows the effect of gravidity on malaria parasite density among pregnant women.

Statistical analysis

The differences among the groups were analyzed by the one-way analysis of variance. Inter-group comparisons were done using Duncan's multiple range tests with 95% confidence intervals. The SPSS 15.0, SPSS Inc., Chicago, IL, USA, was used for this analysis. The results were expressed as mean±standard deviation (SD). The level of significance was estimated at $P<0.05$.

RESULT

The mean parasite density was significantly higher ($P<0.05$) in primigravidae than in secungravidae and muligravidae, while it was only slightly higher in secungravidae than in multigravidae as shown in figure 1. Figure 2 shows that the mean LDL level was significantly higher in malaria positive pregnant women than in malaria negative pregnant women. The mean HDL and total cholesterol levels were higher in malaria negative pregnant women than in malaria positive pregnant women but the difference was not significant. The mean triglyceride level was significantly higher in malaria positive pregnant women than in malaria negative pregnant women. The LDL level was slightly higher in malaria positive primigravidae than in malaria positive secungravidae and malaria positive multigravidae. HDL level was slightly higher in malaria positive multigravidae than in every other group. The mean cholesterol level was significantly higher in malaria positive primigravidae than in both malaria positive secungravidae and malaria positive multigravidae. The mean triglyceride was significantly higher in malaria positive multigravidae than in malaria positive secungravidae as shown in figure 3. The mean MDA level was significantly lower in malaria positive multigravidae than in malaria positive primigravidae and secungravidae. There was no significant difference between the mean MDA levels of malaria positive primigravidae and malaria positive secungravidae as indicated in figure 4. The mean catalase level was significantly higher in malaria positive multigravidae than in malaria positive primigravidae, while the mean catalase level was only slightly higher in malaria positive multigravidae than in secungravidae as shown in figure 5.

DISCUSSION

Malaria infection is one of the major challenges facing the tropical region of the world. The adverse effect of malaria infection has become intolerable in every area where it is endemic. Despite the ongoing efforts to curb the incessant spread of malaria, it seems there is no well defined solution to this problem up till this present time. The prevalence of malaria has been reported to be higher among children and pregnant women than any other groups (Falade et al., 2008). Pregnant women especially those in low endemic areas has been reported to be more susceptible than their counterpart living in the same region. Among pregnant women, primigravidae are more prone to the infection than other groups. In this study, the prevalence of malaria infection and the parasite density were significantly higher in primigravidae than secungravidae and multigravidae. The higher parasi-

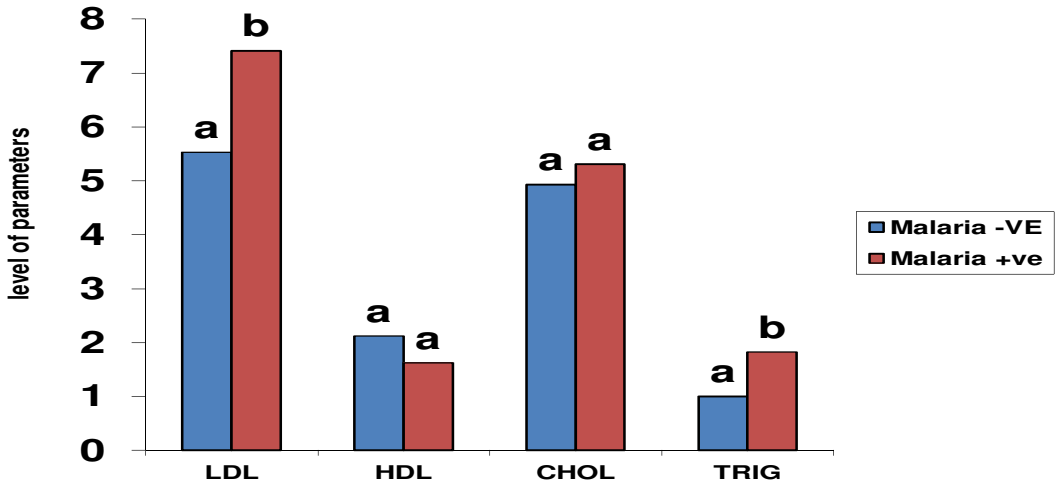

Figure 2. Shows the effect of malaria parasites on the lipid profile in pregnant women

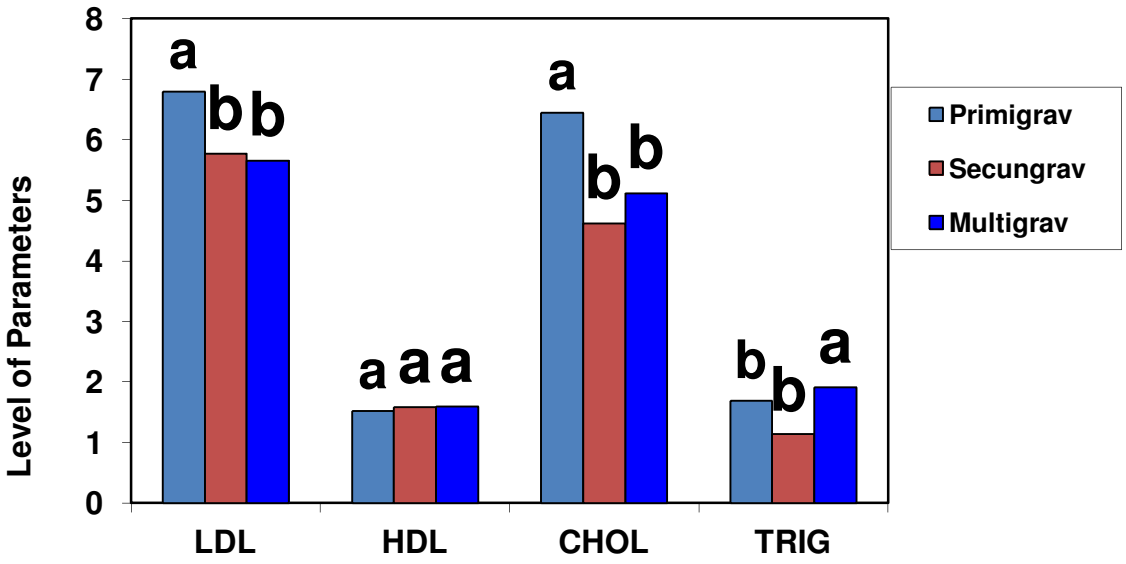

Figure 3. shows the effect of gravidity on lipid profiles in malaria positive pregnant women.

taemia level in primigravidae could be as a result of their novelty to the pregnancy, which could have exposed them to some physiological changes for the first time. It has been reported that during the first pregnancy, there is development of new uteroplancental vasculature which have had no previous exposure to malaria infection and thus immunologically naïve, thereby permitting parasite colonization (Akanbi et al., 2004).

Malaria in pregnancy is associated with a range of deleterious effects in women and their baby. Changes in lipid profiles during malaria infection have been reported to contribute to pathological effect of malaria in pregnant women (Sibmooh et al., 2004). Increase in cholesterol, LDL and triglyceride levels during malaria infection have been reported to contribute to the pathogenesis of malaria and this could be dangerous to human health as it is capable of causing atherosclerosis if necessary treatment is not adopted. Lipoprotein has been reported to represent a major component of serum needed for the growth of the malaria parasite (Nilson-Ehle and Nison-Ehle, 1990). The increase in LDL, cholesterol and triglycerides levels has been reported to be common in

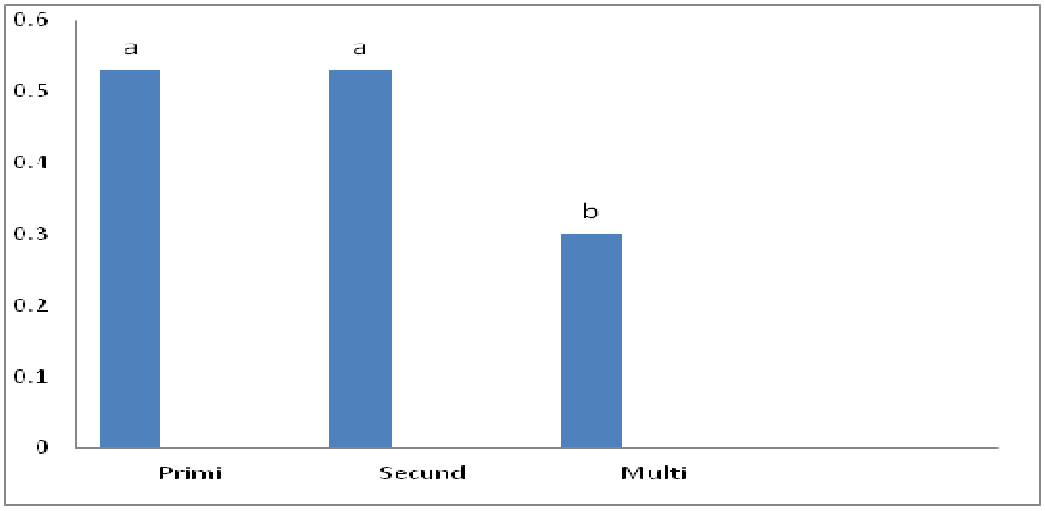

Figure 4. Shows the effect of gravidity on MDA levels in malaria positive pregnant women.

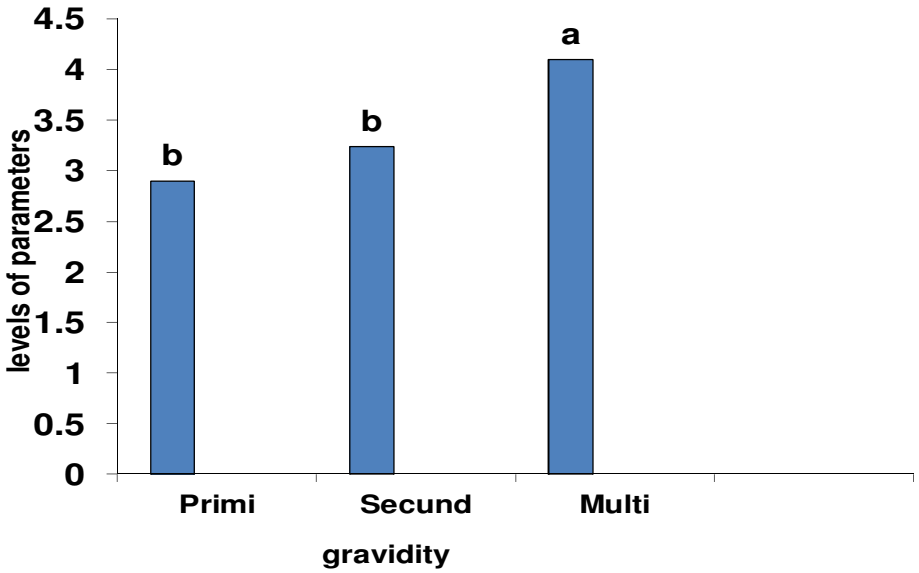

Figure 5. Shows the effect of gravidity on the mean catalase level in malaria positive pregnant women.

malaria positive patients. In this study, the mean LDL and triglyceride were significantly higher in malaria positive pregnant women than in malaria negative pregnant women, while HDL level was higher in malaria negative than malaria positive pregnant women. This agrees with the previous study (Krishna et al., 2009). The effect of gravidity on the lipid profiles in malaria positive pregnant women was also studied. The mean LDL and cholesterol levels were higher in primigravidae than in secungravidae and multigravidae. This shows that primigravidae are at the high risk of having atherosclerosis than other pregnant women. It is possible that this increase could be as a result of the increase in the parasitaemia in the primigravidae than in the secungravidae and multigravidae as it is shown in fig.1. It has been reported that the level of parasitaemia could determine the extent of changes in lipid profiles in malaria positive patients (Akanbi et al., 2012).

The malaria parasite could also be responsible for the upsurge increase in the oxidative stress in malaria positive patients. The parasite enhanced the production of large quantity of reactive oxygen species (ROS)

purposely to kill the parasite (Gavino et al., 1981). This study showed that the mean MDA level was significantly lower in malaria positive multigravidae than in both malaria positive primigravidae and secungravidae while the mean catalase level was significantly higher in malaria positive multigravidae when compared with malaria positive primigravidae and secungravidae. This increase in MDA level and decrease in catalase level in primigravidae and secungravidae indicates that there was an oxidative stress in primigravidae and secungravidae. This could be as a result of the high level of parasitaemia in primigravidae and secungravidae as shown in fig.1. The increase in MDA levels shows that there was increase in the lipid peroxidation in malaria positive primigravidae and this could be responsible for the increase in the cholesterol and LDL in malaria positive primigravidae

It is concluded from this study that primigravidae and secungravidae are highly susceptible to malaria infection and the tendency of having atherosclerosis is higher in malaria positive primigravidae as a result of increased levels of LDL and total cholesterol in them.

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