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EFFECT OF WEIGHT GAINED IN PREGNANCY ON LIPID PEROXIDATION PRODUCT

Adeniran Samuel ATIBA

Department of Chemical Pathology, Ekiti State University Teaching Hospital, Ado-Ekiti, Ekiti State, Nigeria

Temitope Adeola NIRAN-ATIBA

Department of Biomedical Science, Ladoke Akintola University of Technology, Osogbo, Osun State, Nigeria

Rasaq Akintunde AKINDELE

Department of Obstetrics and Gynaecology, Ladoke Akintola University of Technology Teaching Hospital, Osogbo, Osun State, Nigeria

Ahmed Kayode JIMOH

Department of Chemical Pathology, Federal Medical Center, Ido-Ekiti, Nigeria

Dolapo Pius OPARINDE

Department of Chemical Pathology, Ladoke Akintola University of Technology Teaching Hospital, Osogbo, Osun State, Nigeria

Babatunde Moses DUDYEMI

Department of Anatomic Pathology, Ekiti State University Teaching Hospital, Ado-Ekiti, Ekiti State, Nigeria

Murtala Segun GHAZALI

Department of Chemical Pathology, Federal Medical Center, Ido-Ekiti, Nigeria

ABSTRACT

BACKGOUND: Pregnancy is a stressful condition, lipid peroxidation increases as pregnancy advances. This has also been linked to increase body weight in a non pregnancy state. Pregnant women experience weight gained within a short period than non pregnant women. Some pregnant women probably experience increase in lipid peroxidation product (oxidative stress) due to increase body weight

OBJECTIVE: To determine the effect of weight gain during pregnancy on plasma MDA (product of lipid peroxidation) level

METHOD: The study site was antenatal clinic of Ladoke Akintola University of Technology Teaching Hospital, Osogbo, Osun State, Nigeria. Ninety eight normal pregnant women were recruited in their second trimester into the study. Weight, Height and BMI as well as plasma MDA were determined in second and third trimesters. Variables were statistically analyzed using SPSS 16 taking levels of significant to be <0.05

RESULTS: The mean age of the study group was 28.58 years, gestational age in second and third trimesters were 24.10 weeks and 32.20 weeks respectively. Subjects that did not gain weight at all had their mean plasma MDA level to be 0.10 µmol/l. Subjects that gained between 1 to 4 kg had their average plasma MDA to be 1.61 µmol/l. Mean plasma MDA levels for subjects that gained 5-9 kg as well as those that gained more than 10kg were 2.12 and 2.51 µmol/l respectively

CONCLUSSION: Product of lipid peroxidation increases with increase in body weight as pregnancy advances. This may be an additive effect to increasing oxidative stress observed as pregnancy advances

Keywords: *Weight gained malonaldehyde, Lipid proxidation, Body mass index, Gestational age.*

INTRODUCTION

Pregnancy is a stressful physiological condition (Thornburg *et al.*, 2000). It experiences oxidative stress injury (Toescu *et al.*, 2002). It means there is generation of free radical (oxidants) than the protective antioxidants (MacNee, 2000). Free radicals with their attack on polyunsaturated membrane lipid gives peroxyl radical with subsequent production of malonaldehyde (MDA), this is termed lipid peroxidation (Orrenius *et al.*, 1989). Pregnancy is associated with weight gain at various stages as it advances (Thornburg *et al.*, 2000). Also lipid peroxidation has been found to be increasing as pregnancy advances (Toescu *et al.*, 2002; Adiga *et al.*, 2007). Furthermore, weight gain in non pregnancy state has been linked with an increased oxidative stress. In view of this above increased lipid peroxidation found in the third trimester of pregnancy could be due to pregnancy being a stressful condition or as a result of weight gained in pregnancy. There are conflicting reports as to the oxidative stress being a suggested cause to various complications of pregnancy namely; gestational diabetes (Chen and Scholl, 2005; Lappas *et al.*, 2011), pre-eclampsia (Carl, 1999; Maarten *et al.*, 2004). Adiga *et al.* (2007) had reported an increased in lipid peroxidation in patients with pre-eclampsia. However, (Morris *et al.*, 1998) reported no change in lipid peroxidation product in patients with pre-eclampsia when compared with normal pregnant subjects. However, in these studies above there was no reference made to the weight gain by the subject groups. Considering the conflicting reports of oxidative stress injury as a suggested pathogenesis of various complications of pregnancy (Maarten *et al.*, 2004; Chen and Scholl, 2005; Lappas *et al.*, 2011), this study was designed to determined weight, body mass index (BMI) and plasma malonaldehyde (MDA) in normal pregnant subjects in second and third trimesters. It is our hope that this study will throw light on the contribution of weight gained in pregnancy on oxidative stress.

MATERIALS AND METHODS

The study site was antenatal clinic of Ladoke Akintola University of Technology Teaching Hospital, Osogbo, Osun State, Nigeria. Ninety eight pregnant women were recruited in their second trimester into the study. These women were all certified by the gynaecologist of having normal

pregnancy as at the time they were being recruited into in the study. They were not diabetic, not pre-elamptic, none was a known hypertensive and none had multiple gestations. Weight of the study subjects were taken in kilogram using weighing scale and height was taken in metre using standometer as well as body mass index (BMI) calculated by the formula weight(kg)/height(m^2) About 5 mls of venous blood were drawn from anticubital fossa of each subject in their second and third trimesters following normal process of venepuncture. This was dispensed into lithium heparin specimen bottle and subsequently centrifuged at 3000g for 5mins. The plasma supernatant was separated into plain screw cap plain bottle and was kept at -20^oC for about two months before analysis. The plasma malonaldehyde (MDA) was analysed using method of Satoh (1978). This is based on the principle that, trichloroacetic acid (TCA) was used to precipitate protein from the plasma for thiobarbituric acid (TBAR) to react with MDA. This finally gives a red coloured complex that is read spectrophotometrically at 532nm. The deeper the color complex the higher the concentration of MDA. Ethical clearance was taken from ethical committee of Ladoke Akintola University of Technology Teaching Hospital; Osogbo, Nigeria Variables were analysed statistically using SPSS version 16

RESULTS

The mean age of the study group was 28.58 years, expected gestational age from their last menstrual cycle in second and third trimesters were 24.10 weeks and 32.20 weeks respectively. Average weight and BMI gained by pregnant women between second and third trimesters were 7.2kg and 4.0kg/m^2 respectively. Mean plasma MDA increase was found to be 0.6µmol/l. It was observed to be higher correspondingly in the third trimester. These and ranges of these variables are shown in table 1 below Table 2 shows mean values of variables in both second and third trimesters. Weight (kg) of the subjects in the third trimester (79.41±8.80) was found to be higher than in the second trimester (61.59±8.65), $p<0.05$.

Average BMI (kg/m^2) was also found to be higher in the third trimester (27.42±4.38) than in the second trimester (23.42±4.34); $p<0.05$. Mean plasma MDA (µmol/l) level was found to be higher in the third (2.09±0.63) than in the second trimester (1.48±0.51); $p<0.001$. The average height (m) of study group was 1.63±0.08 Table 3 shows different groups of weight gained and their corresponding mean plasma MDA levels. Subjects that did not gain weight at all had their mean plasma MDA level to be 0.10 µmol/l. Subjects that gained between 1 to 4 kg had their average plasma MDA to be 1.61 µmol/l. Mean plasma MDA levels for subjects that gained 5-9 kg as well as those that gained more than 10kg were 2.12 and 2.511 µmol/l respectively Variables were analysed using SPSS version 16 taking level of significant to be less than 0.05

Discussion

This study observed an increased weight in the third trimester than in the second trimester. This is also shown by the increase in body mass index in the third trimester. This is already an established

fact (Thornburg *et al.*, 2000). As pregnancy advances women gain weight accordingly (Thornburg *et al.*, 2000). It has been stated that a woman gains an average of 12.5kg at term (Thornburg *et al.*, 2000). The weight gain in pregnancy could be as a result of several factors like fetal growth, placental growth, increased plasma volume and increased in the size of the breasts. Weight gain has been linked to free radical production resulting to oxidative stress likewise the pregnancy. It was also observed that some patients in our study did not gain weight, this as evidenced by negative lower limit of ranges shown in table 1. Pregnant women lose weight or having their weight the same at a period in pregnancy due to factors like intrauterine growth retardation (IUGR), intrauterine feta death (IUFD) etc. There are reports to suggest that IUFD (Kressig *et al.*, 2008; Mert *et al.*, 2012) and IUGR (Chen and Scholl, 2005; Hracsko *et al.*, 2008) are as a result of oxidative stress despite that their weight was not expectedly increased. This is contrary to the report of our study as shown in table 1 and 3 below. Subjects with no change or those with weight loss had a lower increase in product of lipid peroxidation (MDA). Considering the findings of this study, one would have expected the scenario that IUFD or IUGR would probably cause the pregnant women's body weight to decrease or remains the same with subsequent decrease in lipid peroxidation product. There are reports to explain it contrarily, that product of lipid peroxidation increases in pregnancy with IUFD and IUGR. However, in their studies, weight of the subjects was not taken into consideration

Free radicals are unstable in nature; they appear transiently in the system, thus their assay is difficult. However, before its disappearance, it ensures some degree of damage to cellular organelles. Its tendency to attack membrane polyunsaturated lipid leading to its peroxidation remains the evidence of free radical injury. In the course of this reaction, a product known as malonaldehyde is produced and this is currently being used as an index of free radical injury because it is more stable in the system. Our study observed plasma level of malonaldehyde to be higher in third trimester than in second trimester of normal pregnancy . This is consistent with study of Basbug et al[17.] Weight gained during pregnancy may be due to increased blood lipid (lipidaemia) seen in them (Riedman *et al.*, 1991; Bayhan *et al.*, 2002). This lipidaemia subsequently may lead to increase polyunsaturated membrane lipid autoperoxidation. The destruction of lipid also generates free radicals that further attack membrane lipid. This process continues until when underlined pathology stops or necessary antioxidants are made available.

CONCLUSSION

Product of lipid peroxidation increases with increase in body weight as pregnancy advances. This may be an additive effect to increasing oxidative stress observed as pregnancy advances

Limitation

We would have recruited patients in their first trimester but in our environment, women usually book their pregnancy in second trimester.

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Table-1. Range and Mean Values Gained of Variables

Variables	Mean (n=98)	Range
Age (year)	28.58	16 to 42
Second trimester GA (weeks)	24.10	16 to 28
Third trimester GA (weeks)	32.20	27 to 36
Weight gained (Kg)	7.82	-1 to 16
BMI gained (kg/m^2)	4.0	-4.3 to 8.5
MDA gained (µmol/l)	0.61	-0.18 to 2.31

Table-2. Second and Third Trimesters Mean Values of Variables

Variables	Second Trimester N= 98	Third Trimester N= 98	p- values
Weight	61.59±8.65	79.41±8.80	<0.05
BMI	23.42±4.34	27.42±4.38	<0.05
MDA	1.48±0.51	2.09±0.63	<0.001
Height	1.63±0.08	1.63±0.08	-

Table-3. Different Range of Weight Gained and Corresponding Increase In Mda

Range of Weight gained (Kg)	Mean Plasma MDA (µmol/l)
Subjects gained < 0.00	0.10
Subjects gained 1-4	1.61
Subjects gained 5-9	2.12
Subjects gained > 10	2.51