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# Comparative study of lipid profile of normal pregnant women in the different trimesters

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## ABSTRACT

Pregnancy has been found to be associated with changes in lipid profile and this differs with each trimester. In this study, serum total cholesterol (TC), triglyceride (TG), high density lipoprotein (HDL) and low density lipoprotein (LDL) were estimated in 120 pregnant women during normal gestation (40 in each trimester) and in 40 volunteers, apparently healthy non – pregnant women serving as control. TC, TG and HDL in the first, second and third trimesters when compared with that of the control subjects were significantly high ( $p < 0.05$ ). The change in low density lipoprotein was not significantly high ( $p > 0.05$ ) in the first trimester but became significant ( $p < 0.05$ ) in the second and third trimester when compared with the control. Comparison between first, second and third trimesters showed that TC, TG and LDL in the 2<sup>nd</sup> and 3<sup>rd</sup> trimesters were significantly higher than in the 1<sup>st</sup> trimester. Although, not significant in the 1<sup>st</sup> trimester HDL followed similar trend. Conclusively, increase in susceptibility to the development of coronary heart disease, arteriosclerosis, hypertension and other foetal/maternal diseases associated with dyslipidaemia in the subjects studied may be unlikely since the increase in LDL is accompanied by corresponding increase in the scavenging lipid- HDL. We therefore recommend that lipid panel be part of routine investigation during pregnancy.

**Keyword:** Pregnancy, Lipid profile, Trimester, Cholesterol.

## INTRODUCTION

Pregnancy is accompanied by significant variations in maternal lipid metabolism [1, 2]. In early pregnancy, there is increased body fat accumulation associated with both hyperphagia and increased lipogenesis while in late pregnancy there is an accelerated breakdown of fat depots,

which plays an important role in foetal development [3]. A review of literature has revealed conflicting observations on normal and abnormal pregnancies [4, 5]. Increase in maternal lipid profile during pregnancy differs with trimester. It has been observed that the concentration of serum total cholesterol, serum triglyceride, high density lipoprotein cholesterol and low density lipoprotein cholesterol in normal pregnant women increased with increasing gestational age [6, 7, 8]. Wald and Guckle, [9] observed that the increase in the maternal lipid profile in the third trimester is in response to the maternal switch from carbohydrate to fat metabolism which is an alternative pathway for energy generation due to high energy demand. The present study was undertaken to elucidate any significant variation in the lipid profile during normal pregnancy in the different trimesters, to establish if pregnancy affects the lipid profile and to evaluate the clinical significance of the lipid profile level in pregnancy.

## MATERIALS AND METHODS

### Subjects

A total of one hundred and sixty (160) subjects between the ages of 20 and 45 formed the study population. Group 1; the control comprises of forty (40) healthy non pregnant volunteers of Nigerian origin. Group 2; the test involve one hundred and twenty (120) apparently healthy pregnant Nigerian women, sub-divided into three groups; X, Y and Z, each made of forty (40) subjects distributed into 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> trimester of pregnancy respectively. The test subjects were selected among those attending ante natal clinic at Ujoelen and Iruokpen Primary Health Care Centres in Ekpoma, Esan west Local Government Area of Edo state, Nigeria between March 2009 and February 2010. The study was conducted in compliance with the Declaration on the Right of the Patient [10] after approval by the Ethical Committee of the Health centres in Ekpoma, Edo state, Nigeria. Also, an informed consent was obtained from all subjects enrolled for the study.

Inclusion criteria include; healthy non pregnant and pregnant women of Nigerian origin and are consumers of normal mixed food.

Exclusion criteria include; pregnant women with gestational diabetes mellitus, anemia, hypertension, obesity, smoking, alcoholism, HIV and Women with other chronic diseases that may affect the lipid profile. Adolescents and women over age 45 were excluded because pregnancy in those age groups is considered to be high risk.

### Sample collection and analysis

All subjects were made to fast overnight at least for a minimum of 8hrs. 5ml of fasting venous blood was collected from the antecubital vein under aseptic precaution from each subject into plain bottles. The blood was then centrifugated after clotted blood has retracted at 4000rpm for 5 minutes and the serum removed and stored at 4 °C pending assay for lipid profile.

Serum Triglycerides (TG), Total cholesterol (TC) and HDL cholesterol (HDL) were analyzed by enzymatic methods with the help of Glaxo kits on ERBA Chem-5 semi auto analyzer. Serum LDL cholesterol (LDL) was calculated by Frederickson-Friedwald's formula according to which  $LDL\ cholesterol = Total\ cholesterol - (HDL\ cholesterol + VLDL\ cholesterol)$ . VLDL cholesterol (VLDL) was calculated as 1/5 of Triglycerides.

### Statistical Analysis

Results were presented in mean  $\pm$  S.D and in suitable tables. The paired sample t test was used to test the level of significance and  $P < 0.05$  was considered significant.

## RESULTS

TABLE 1: TC, TG, HDL AND LDL levels (Mean  $\pm$  S.D in mg/dl) of pregnant women in their first, second and third trimesters and control

| PARAMETER (mg/dl) | PREGNANT WOMEN IN FIRST TRIMESTER (n = 40) | PREGNANT WOMEN IN SECOND TRIMESTER (n = 40) | PREGNANT WOMEN IN THIRD TRIMESTER (n = 40) | CONTROL (n = 40) |
|-------------------|--------------------------------------------|---------------------------------------------|--------------------------------------------|------------------|
| TC                | 164.3 $\pm$ 11.5*                          | 191.4 $\pm$ 12.8*                           | 231.4 $\pm$ 9.1*                           | 148.1 $\pm$ 10.3 |
| TG                | 180.9 $\pm$ 21.1*                          | 217.5 $\pm$ 34.5*                           | 211.1 $\pm$ 26.3*                          | 106.9 $\pm$ 15.1 |
| HDL               | 45.6 $\pm$ 4.1*                            | 44.4 $\pm$ 6.4*                             | 47.9 $\pm$ 3.8*                            | 40.3 $\pm$ 8.9   |
| LDL               | 82.4 $\pm$ 12.9                            | 103.5 $\pm$ 16.2*                           | 141.2 $\pm$ 8.6*                           | 86.7 $\pm$ 12.9  |

\* Significantly different from control, n= frequency, TC= Total Cholesterol, TG= Triglycerides, HDL= High density lipoprotein cholesterol, LDL= Low density lipoprotein cholesterol

TABLE 2: TC, TG, HDL and LDL levels (Mean  $\pm$  S.D in mg/dl) of pregnant women in thier first trimester as compared with second trimester

| PARAMETER (mg/dl) | PREGNANT WOMEN IN FIRST TRIMESTER (n=40) | PREGNANT WOMEN IN SECOND TRIMESTER (n=40) |
|-------------------|------------------------------------------|-------------------------------------------|
| TC                | 164.3 $\pm$ 11.5                         | 191.4 $\pm$ 12.8**                        |
| TG                | 180.9 $\pm$ 21.1                         | 217.5 $\pm$ 34.5**                        |
| HDL               | 45.6 $\pm$ 4.1                           | 44.4 $\pm$ 6.4                            |
| LDL               | 82.4 $\pm$ 12.9                          | 103.5 $\pm$ 16.2**                        |

\*\* Significantly different from 1st trimester, n= frequency, TC= Total Cholesterol, TG= Triglycerides, HDL= High density lipoprotein cholesterol, LDL= Low density lipoprotein cholesterol

TABLE 3: TC, TG, HDL and LDL levels (Mean  $\pm$  S.D in mg/dl) of pregnant women in thier first trimester as compared with third trimester

| PARAMETER (mg/dl) | PREGNANT WOMEN IN FIRST TRIMESTER (n=40) | PREGNANT WOMEN IN THIRD TRIMESTER (n=40) |
|-------------------|------------------------------------------|------------------------------------------|
| TC                | 164.3 $\pm$ 11.5                         | 231.4 $\pm$ 9.1***                       |
| TG                | 180.9 $\pm$ 21.1                         | 211.1 $\pm$ 26.3***                      |
| HDL               | 45.6 $\pm$ 4.1                           | 47.9 $\pm$ 3.8***                        |
| LDL               | 82.4 $\pm$ 12.9                          | 141.2 $\pm$ 8.6***                       |

\*\*\* Significantly different from 1st trimester, n= frequency, TC= Total Cholesterol, TG= Triglycerides, HDL= High density lipoprotein cholesterol, LDL= Low density lipoprotein cholesterol

The result analysis shows a significant increase ( $p < 0.05$ ) in the TC, TG and HDL level during the first trimester of pregnancy when compared with control as shown in table 1. There was a significant increase ( $p < 0.05$ ) in the TC, TG, HDL and LDL levels during the second trimester of pregnancy when compared with that of the control subjects. Also, from table 1, the result shows a significant increase ( $p < 0.05$ ) in the TC, TG, HDL and LDL levels during the third trimester of pregnancy when compared with the control subjects.

**TABLE 4: TC, TG, HDL and LDL levels (Mean  $\pm$  S.D in mg/dl) of pregnant women in thier second trimester as compared with third trimester**

| PARAMETER (mg/dl) | PREGNANT WOMEN<br>IN SECOND TRIMESTER<br>(n=40) | PREGNANT WOMEN<br>IN THIRD TRIMESTER<br>(n=40) |
|-------------------|-------------------------------------------------|------------------------------------------------|
| TC                | 191.4 $\pm$ 12.8                                | 231.4 $\pm$ 9.1****                            |
| TG                | 217.5 $\pm$ 34.5                                | 211.1 $\pm$ 26.3****                           |
| HDL               | 44.4 $\pm$ 6.4                                  | 47.9 $\pm$ 3.8****                             |
| LDL               | 103.5 $\pm$ 16.2                                | 141.2 $\pm$ 8.6****                            |

\*\*\*\* Significantly different from 2nd trimester, n= frequency, TC= Total Cholesterol, TG= Triglycerides, HDL= High density lipoprotein cholesterol, LDL= Low density lipoprotein cholesterol

## DISCUSSION

Some previous studies showed that the most dramatic damage in the lipid profile in normal pregnancy is serum hypertriglyceridemia, which may be as high as two to three folds in the third trimester over the levels in non pregnant women [11]. In our study also this observation holds true. In this study, it was observed that the concentration of serum total cholesterol, serum triglyceride, high density lipoprotein cholesterol and low density lipoprotein cholesterol in normal pregnant women increased with increasing gestational age although HDL dropped a little in the 2<sup>nd</sup> trimester with the serum triglyceride concentration showing a very significant increase in the third trimester of normal pregnancy than in the non pregnant women, the mean value being raised almost two folds. Similar observations were reported in studies conducted by Fahraeus *et al* [6], Jimenez *et al.* [7] and Potter and Nestel [8]. The principal modulator of this hypertriglyceridemia is oestrogen as pregnancy is associated with hyperoestrogenaemia. Oestrogen induces hepatic biosynthesis of endogenous triglycerides, which is carried by VLDL [12]. This process may be modulated by hyperinsulinism found in pregnancy [13].

Furthermore, this study showed that total cholesterol, high density lipoprotein and triglyceride levels of the test subjects in the first trimester were higher than that of the control subjects. This is in agreement with those of Klovich and Hallman, [14] in which they observed that, in the first trimester of pregnancy there is formation of zygote in the uterine wall. This accounts for the elevated levels of cholesterol and triglyceride in the first trimester. Total cholesterol, triglyceride, HDL and LDL of the test subjects in the second trimester were observed to be higher than those of the control subjects. This is in line with the findings of Wald and Guckle, [9] who observed that the increase in the maternal lipid profile is in response to the maternal switch from carbohydrate to fat metabolism which is an alternative pathway for energy generation due to high energy demand. Total cholesterol, triglyceride, HDL and LDL levels of the test subjects in the third trimester were higher than those of the control subjects. This is in line with results of Russel and Copper, [15] in which they reported that there is development of foetal organ in the third trimester.

This study also showed a significant increase ( $p < 0.05$ ) in total cholesterol, triglyceride and LDL levels during the first trimester of pregnancy when compared to the second trimester. This is in agreement with Munoz *et al.*, [16] who reported that total cholesterol, triglyceride, and LDL increased progressively throughout pregnancy with significantly higher values after 25<sup>th</sup> week of gestation. We also observed that there were slightly lower values of HDL in the second trimester compared with the first trimester of pregnancy, which is in line with the study of Desoye *et al.* [17] in which they observed that there was a decrease after weeks 22 to 24 in HDL which coincides with the onset of increasing resistance to insulin and the increase in concentration of plasma insulin. This study also showed significant increase ( $p < 0.05$ ) in total cholesterol,

triglyceride, HDL and LDL levels during the third trimester when compared with the first trimester of pregnancy. This agrees with the study conducted by Desoye *et al.* [17] in which they observed that LDL levels peaked at approximately week 36, HDL 2 and 3 levels peaked at approximately 28 weeks and remained unchanged till delivery.

Two consistent manifestations of altered maternal lipid metabolism associated with gestation are the accumulation of lipids in maternal tissues and the development of maternal hyperlipidaemia [3]. This is reflected in the results obtained from this research work. Studies in recent past have incriminated abnormal lipid metabolism during pregnancy in the pathogenesis of atherosclerosis, ischaemic heart disease, intrauterine growth disease intrauterine growth retardation and hypertension [18]. Hence estimation of lipid profile is strongly recommended as part of the laboratory investigations during pregnancy so as to institute prompt management strategies to prevent deleterious effect of hyperlipidaemia associated with pregnancy.

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