Trends in Triglyceride (Fat) Levels of Various Stages of Pregnancy in Nigerian Women

Affi Ayuba[1]*, Josiah Mutihir[1], Dalili Shabbal[2], A. S. Longwan[1], T. S. Selowo[1], A. Lukden[1], Stephen Pam[1], Mercy Solomon[1]

[1]Department Obstetric and Gynaecologist, Jos University Teaching Hospital, Jos, Nigeria
[2]Department of Chemical Pathology, University of Abuja, Abuja, Nigeria
Email: *ayubaaffi67@gmail.com, turimutihir@gmail.com, dalilishabbal@yahoo.com, longwan@yahoo.com, selowomd@gmail.com, mlukden@gmail.com, stephenpamo@yahoo.com, mercygunat@gmail.com

Abstract

Background: In developing countries like Nigeria, with poor socio-economic, early marriage, poor acceptance of contraception, poor spacing of pregnancies, high fertility rate and poor maternal and child health indices, leading to poor maternal-child outcome. There is a need to investigate the pattern of serum lipid changes during pregnancy in Nigeria women as hyperlipidemia may lead to poor maternal outcome. **Materials and methods:** A total of one hundred and forty (140) subjects between the ages of 20 and 45 years with mean age 29.74 ± 6.5 years of the study population. Group 1: the control comprises of thirty-five (35) healthy non pregnant subjects with mean age of 26.84 ± 5.2 volunteers of Nigeria origin. Group 2: the test involved one hundred and five (105) apparently healthy pregnant Nigerian women sub-divided into three groups; X, Y and Z each made of thirty-five (35) subjects distributed into 1st, 2nd and 3rd trimester of pregnancy respectively. The TG assay was analyzed using enzymatic spectrophotometric method as described by Biosystems. **Results:** The result analysis showed a significant increase (p ≤ 0.05) in the TG 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 TG levels during the second trimester of pregnancy when compared with that of the control subjects. During the third trimester of pregnancy there was a significant increase in TG levels when compared with the control subjects. **Conclusion:** This work revealed that the most dramatic change in the lipid profile in normal pregnancy is serum hypertriglyceridemia, which may be as high as two-three folds in the third trimester over the levels in non pregnant subjects. The estimation of lipid profile is strongly recommended as part of the laboratory investigations during pregnancy. Since studies in recent past have incriminated abnormal lipid metabolism during pregnancy in the

pathogenesis of atherosclerotic, ischemia heart disease, intrauterine growth disease, intrauterine growth retardation and hypertension.

1. Introduction

During pregnancy, there are physiological changes in TG metabolism which may be related to increased metabolic rate [1] [2] [3].

There is accumulation of fat during early pregnancy due to hyperphagia and increased lipogenesis. It has been noted that in normal pregnancy, TG is elevated with increasing gestational age. It was suggested that increased progesterone in mid gestation acts as lipostat in the hypothalamus [4] [5]. It has been 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.

However, in complicated pregnancy there is a possible defect in the mechanism of adjusting physiological hyperlipidemia. Plasma TG in 1st trimester of pregnancy may predict the incidence of severe preeclampsia [6] [7].

A study in port-Harcourt showed that pregnancy in black Nigerian women is associated with hyperlipidemia [8]. The study determined the changes in the TG levels of women at various stages of pregnancy.

The serum lipid of 269 pregnant women in North Eastern Borno was studied. Thirty four apparently healthy non pregnant women were used as controls. There was hyperlipidemia in these subjects [9].

In Israel, a done study showed that TG level doubled in 3rd trimester [10] [11] [12]. However it was also demonstrated that there was an initial decrease in TG level in 1st trimester a pattern not shown in previous studies. In these studies consecutive pregnancies do not influence baseline (non-pregnant) TG levels.

This study examines the extent of changes in TG levels at various stages of gestation which may indicate a risk factor for atherogenicity.

2. Patients and Methods

2.1. Study Design and Settings

This is a prospective interventional study done between the months of august and October 2008 at the ante-natal clinic (ANC) of Jos University Hospital, Jos Plateau state, North-Central Nigeria.

2.2. Sample and Sampling Technique

A total of one hundred and forty subjects were recruited by random sampling techniques. Sample size was approximated from the calculated sample size be-

low.

$$N = \frac{Z^2 PQ}{d^2}$$

where N = Sample Size, P = Prevalence of 1% was assumed; d = Permissible error of 5% (0.05) or degree of accuracy; $Q = 1 - P$; $Z = 1.96$ (Confidence Interval)

$$N = \frac{(1.96)^2 \times (0.1) \times (1 - 0.1)}{0.0025} = 153.63$$

They were between the ages of 18 to 45 years with mean of 29.74 ± 6.5 years of the study population. Group 1; the control comprises of thirty-five (35) healthy non pregnant volunteers of Nigeria origin with mean age of 26.84 ± 5.2. Group 2; test involved one hundred and five apparently healthy pregnant Nigerian women attending ante-natal clinic at JUTH, Jos between March 2008 and December 2008.

All subjects were advised to have an overnight fast. 5mls venous blood was collected from the antecubital vein under aseptic precaution from each subject into the plain bottles. Serum was separated by centrifugation at 4000 rpm for 5 minutes at 36°C and stored at −20°C till estimation.

2.3. Data Analysis

The stored serum sample was thawed and TG was assayed using a three step enzymatic method. The values of TG concentration in mmol/L were determined by reading off the concentration from the absorbance from a standard curve. The NCEP adult treatment panel has identified borderline high TG as levels of (1.7 - 2.3 mmol/L) and very high as 5.6 mmol/L.

1) Ethics

The study was conducted in compliance with the declaration on the right of the patient after the approval by the ethical committee of JUTH, Jos. Also an informed consent was obtained from all subjects enrolled for the study.

Inclusion Criteria: consented pregnant women with uncomplicated pregnancy were included in the study.

Exclusion Criteria: Patient with hypertension, diabetes, heart disease as well as those unwilling to participate.

2) Statistics

All measured variables for the study groups were presented as mean, standard deviation and was used to compare between different groups. All data was analyzed.

Student t-test was used for comparison of means and $P < 0.05$ was considered to be statistically significant.

3. Results

A total of one hundred and forty subjects were recruited by random sampling techniques. They were between the ages of 18 to 45 years with mean of 29.74 ±

6.5 years of the study population. Group 1; the control comprises of thirty-five (35) healthy non pregnant volunteers of Nigeria origin with mean age of 26.84 ± 5.2. Group 2; test involved one hundred and five apparently healthy pregnant Nigerian women attending ante-natal clinic at JUTH, Jos.

A mean SD of TG in pregnant women were 1.78, 2.80, 3.84 mmol/L respectively and for control 1.68, 1.08 and 1.68 mmol/L respectively.

The result analysis shows a significant increase (p ≤ 0.05) in the TG 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 TG levels during the second trimester of pregnancy when compared with that of the control subjects (Table 2).

The result shows a significant increase (p < 0.05) in the TG, levels during the third trimester of pregnancy when compared with the control subjects (Table 3).

4. Discussion

Studies revealed that the most dramatic damage in the lipid profile in normal pregnancy is serum hypertriglyceridemia, which may be as high as two three folds in the third trimester over the levels in non pregnant women [13]. In this study, this observation holds true. Here it was observed that the concentration of serum triglyceride in normal pregnancy increased with increasing gestational age and 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. The principal modulator of this hypertriglyceridemia is estrogen as pregnancy is associated with hyperestrogenemia. Estrogen induces hepatic biosynthesis of endogenous triglycerides, which is carried by VLDL (12).

Table 1. TG level (Mean ± S.D in mmol/L) of pregnant women in the first trimester and normal control. t-Test comparing 1st stage and normal, (a) Group Statistics; (b) Independent Samples Test.

(a)

Stages	N	Mean	Std Deviation	Std. Error Mean
1st Stage	35	1.7834	0.79898	0.13505
Control	35	1.6810	0.63083	0.10663

(b)

		Levene's test for Equality of Variance		T-Test for equality of Means						
		F	Sig	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence interval of the Difference	
Conc.	Equal Variance	0.013	0.91	0.455	68	0.651	0.07829	0.17207	−0.2651	0.42165
	Equal Variance not			0.455	64.527	0.651	0.07829	0.17207	0.2654	0.42199

Table 2. TG LEVEL (Mean ± S.D in mmol/L) of pregnant women in their second trimester and normal control as compared with second trimester. t-Test comparing 2nd stage and normal, (a) Group statistics; (b) Independent Samples Test.

(a)

	Stages	N	Mean	Std Deviation	Std. Error Mean
Conc.	2nd Stage	35	2.8031	0.94121	0.15909
	Control	35	1.0810	0.63083	0.10663

(b)

		Levene's test for Equality of Variance		T-Test for equality of Means						
		F	Sig	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence interval of the Difference	
Conc.	Equal Variance	5.805	0.019	5.733	68	0	1.098	0.19152	0.7158	1.48118
	Equal Variance not			5.733	49.417	0	0.098	0.19158	0.7158	1.48118

Table 3. TG LEVEL (Mean ± S.D in mmol/L) of pregnant women in their third trimester and normal control as compared with second trimester. T-Test comparing 3rd stage and normal, (a) Group statistics; (b) Independent Samples Tests.

(a)

	Stages	N	Mean	Std Deviation	Std. Error Mean
Conc.	3rd Stage	35	3.8483	0.49845	0.08425
	Normal Stage	35	1.6810	0.63083	0.10663

(b)

	Levene's test for Equality of Variance		T-Test for equality of Means						
	F	Sig	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence interval of the Difference	
Equal Variance	7.741	0.007	15.77	68	0	2.14314	0.1359	1.872	2.41433
Equal Variance not			15.77	64.548	0	2.14314	0.1359	1.8717	2.41459

Furthermore, this study showed that 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 triglyceride in the first trimester [15]. Total triglyceride of the test subjects in the second trimester was 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 of fat metabolism which is an alternative pathway for energy generation due to high energy demand. Total triglyceride, of the test subjects in the third trimester was higher than those of the control subjects. This is in line with results of Russed and cooper [16], in

which they reported that there is development of foetal organ in the Third Trimester.

This is in agreement with Munoz *et al.* [17], who reported that total Triglyceride increased progressively throughout pregnancy with significantly higher values after 25th week of gestation. This study also showed significant increase (p < 0.05) in triglyceride, levels during the third trimester when compared with the first trimester of pregnancy. This agrees with the study conducted by Desoye *et al.* [18] [19] [20]. In which they observed that LDL levels peaked at approximately week 36.

Two consistent manifestations of altered maternal lipid metabolism associated with gestation are the accumulation of lipids in maternal issues and the development of material 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 [20] [21] [22].

5. Conclusions and Recommendations

Lipid profile result showed that TG was significantly lower in the control group than in pregnant women. These changes may be due to the change in metabolism of the pregnant women as well as diet during and after pregnancy.

The highest TG level in the first trimester was clearly more than the control. The increased blood TG level was due to delayed TG clearance and when there is concurrent high blood pressure, pre-eclampsia may ensue.

This study illuminates and brings to understanding the possible mechanism of developing pre-eclampsia.

Lipid profile can be recommended as part of routine antenatal tests and if possible adopted by the clinical services department of this institution.

This may reduce or even eliminate complications of hyperlipidemia in pregnancy.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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