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Serum Lipid Profile of Hypertensive Pregnant Women in the Western Region of Nigeria

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Abstract

The levels of lipids in the serum of hypertensive pregnant women were determined in order to establish any relationship between lipids and hypertensive pregnancy. Plasma levels of triacylglycerols (TG), total cholesterol (TC), high density lipoprotein cholesterol (HDLC), low density lipoprotein cholesterol and very low density lipoprotein cholesterol (VLDLC) were estimated by established methods. The results in hypertensive pregnancy were compared with those of normotensive pregnancy. The results have confirmed the findings of hyperlipidaemia in pregnancy. In the third trimester, there are higher levels of hyperlipidaemia in both normotensive and hypertensive pregnancy with low levels of HDLC and LDLC in both groups. In 3-6days post partum, plasma lipid levels in hypertensive pregnancy were now normal except for HDLC which was still raised. Multiple regression analysis indicated that there is no correlation between the high lipids and high blood pressure in hypertensive pregnancy. This suggests that hyperlipidaemia is very unlikely to be the aetiological factor of pregnancy induced hypertension.

Key words: hyperlipideamia, normotensive, hypertension, pregnancy, lipids.

Introduction

Pregnancy induced hypertension (PIH) are characterized by elevated blood pressure, proteinuria, and edema [1]. Although considered to be relatively rare in the United States, PIH occurs worldwide in from 2 to 35 percent of pregnancies, depending on diagnostic criteria and study population [2].

PIH is also called preeclampsia and it occurs most often in young women with a first pregnancy. It is more common in twin pregnancies, in women with chronic hypertension, preexisting diabetes, and in women who had PIH in a previous pregnancy.

Hypertensive disorders of pregnancy, contribute significantly to serious complications for both the fetus and the mother [3].

PIH occurs more frequently and is more severe in women with preexisting hypertension than in women who are normotensive prior to pregnancy. The hypertensive disorders of pregnancy collectively represent a significant public health problem in the United States and throughout the world.

The cause and nature of these disorders is only partially understood [4]. Therefore, the present study was carried out to evaluate plasma lipid concentrations in normal and hypertensive pregnancy in order to establish whether hypertension induces abnormal lipid concentrations that could constitute potential metabolic risk factors for pregnancy complications.

Materials and Methods

Subjects

The subjects used for this work were divided into two groups. Subjects in group one were forty hypertensive pregnant women with symptoms of pre-eclampsia who were admitted into Ekiti State Specialist Hospital, Ado-Ekiti. Twenty each of the forty subjects were in their second and third trimesters of pregnancy respectively. Group two was made up of randomly selected forty normotensive pregnant women in their second and third trimesters of pregnancy respectively. They served as controls. The subjects in both groups were monitored to three to six days after delivery. All the subjects were ranging in age from 20 to 40years with similar socio-economic status.

Collection of samples

Venous non fasting blood samples was collected from resting supine subjects in all the groups into lithium heparinized anticoagulant bottles. The blood was immediately centrifuged at 4,000rpm for fifteen minutes after which the plasma was separated and stored at -20^{o}C until ready for assay. Determinations of TC and HDLC were done by CHOD-PAP method described by [5]. Estimations of LDLC and VLDLC were calculated by Frederickson-Friedewald's formula [6] while the determination of TG was done using the GPO-PAP method [5].

The data was subjected to statistical analysis using the mean, standard error and student's unpaired t-test. P value < 0.05 was accepted as significant.

Results

Table I: The Mean ± Standard Error of Mean (SEM), Level of significance, age, parity, Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), plasma levels of TC, HDLC, LDLC, VLDC and TG in normotensive pregnant women at second (2nd) trimester [A] and hypertensive pregnant women at second (2nd) trimester [B]

GROUP	SBP (mm/Hg)	DBP (mm/Hg)	TC (mmol/l)	HDLC mmol/l)	LDLC (mmol/l)	VLDLC (mmol/l)	TG (mmol/l)	TG (mmol/l)
Mean + SEM A	106.50 ± 9.99	65.31±6.46	4.30±0.48	3.20±0.31	0.80±0.41	0.35± 0.13	0.77± 0.28	0.77±0.28
Mean ± SEM B	157 ± 10.81	103.50±2.65	3.90±0.39	1.77±0.37	1.36± 0.42	0.76± 0.21	1.65± 0.42	1.65±0.42
Level of significance	P<0.000	P<0.000	P<0.000	P<0.020	P<0.000	P<0.001	P<0.001	P<0.001

No of observations in each group are 20

Table II: The Mean ± Standard Error of Mean (SEM), Level of significance, age, parity, Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), plasma levels of TC, HDLC, LDLC, VLDC and TG in normotensive pregnant women at third (3rd) trimester [C] and hypertensive pregnant women at third (3rd) trimester [D].

GROUP	SBP (mm/Hg)	DBP (mm/Hg)	TC (mmol/l)	HDLC (mmol/l)	LDLC (mmol/l)	VLDLC (mmol/l)	TG (mmol/l)
Mean+ SEM C	110.20±0.50	66.54±11.43	4.98±0.35	2.90± 0.41	1.52± 0.65	0.61±0.30	1.28±0.64
Mean ± SEM D	163.65± 4.18	106.23±10.95	4.46±0.52	1.52± 0.30	2.48± 0.56	0.50±0.05	0.99±0.09
Level of significance	P<0.005	P<0.000	P<0.000	P<0.020	P<0.000	P<0.000	P<0.000

No of observations in each group are 20

Table III: The Mean ± Standard Error of Mean (SEM), Level of significance, age, parity, Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), plasma levels of TC, HDLC, LDLC, VLDC and TG in normotensive pregnant women [E] and hypertensive pregnant women [F] at 3 to 6days after delivery.

GROUP	SBP (mm/Hg)	DBP (mm/Hg)	TC (mmol/l)	HDLC (mmol/l)	LDLC (mmol/l)	VLDLC (mmol/l)	TG (mmol/l)	TG (mmol/l)
Mean+SEM E	103.22±4.83	69.45±3.16	4.28±0.53	2.38±0.36	1.52±0.56	0.19±0.13	0.94±0.45	0.94±0.45
Mean± SEM F	150.12±4.71	97.43±11.6	4.00±0.81	2.70±0.30	1.04±0.43	0.38±0.32	0.83±0.70	0.83±0.70
Level of significance	P<0.000	P<0.000	P<0.05	P<0.000	P<0.000	P<0.000	P<0.002	P<0.002

No of observations in each group are 20

Table IV: Multiple Regression analysis showing correlation matrices between Age, Parity, Blood Pressures and plasma Parameters in hypertensive pregnant women at second trimester

Parameters	Age	Parity	SBP	DBP	TC	HDLC	LDLC	VLDLC	TG
Age	NC	NC	NC	NC	NC	NC	NC	NC	NC
Parity	NC	NC	NC	NC	NC	NC	NC	NC	NC
BP	NC	NC	NC	NC	NC	NC	NC	NC	NC
DBP	NC	NC	NC	NC	NC	NC	NC	NC	NC
TC	NC	NC	NC	NC	NC	NC	-0.66*	-0.50*	-0.49*
HDLC	NC	NC	NC	NC	NC	NC	NC	NC	NC
LDLC	NC	NC	NC	NC	-0.66**	NC	NC	-0.75**	-0.76
VLDLC	NC	NC	NC	NC	-0.55*	NC	NC	NC	NC
TG	NC	NC	NC	NC	0.47*	NC	-0.75	NC	NC
TP	NC	NC	NC	NC	NC	NC	-0.76	NC	NC
ALB	NC	NC	NC	NC	NC	NC	NC	NC	NC
FFA	NC	NC	NC	NC	NC	NC	NC	NC	NC

NC means no correlation, Significant R values* P<0.05, ** P<0.001

Table V: Multiple Regression analysis showing correlation matrices between Age, Parity, Blood Pressures and plasma parameters in Hypertensive pregnant women at third trimester

Parameters	Age	Parity	SBP	DBP	TC	HDLC	LDLC	VLDLC	TG
Age	NC	0.56**	NC	NC	NC	NC	NC	NC	NC
Parity	0.56**	NC	NC	NC	NC	NC	NC	NC	NC
SBP	NC	NC	NC	NC	NC	NC	NC	NC	NC
DBP	NC	NC	NC	NC	NC	NC	NC	NC	NC
TC	NC	NC	NC	NC	NC	NC	0.85**	NC	NC
HDLC	NC	NC	NC	NC	NC	NC	0.53**	NC	NC
LDLC	NC	NC	NC	NC	0.85**	0.53**	NC	NC	0.47*
VLDLC	NC	NC	NC	NC	NC	NC	NC	NC	0.10*
TG	NC	NC	NC	NC	NC	NC	0.47**	0.10**	NC
TP	NC	NC	NC	NC	NC	NC	NC	NC	NC
ALB	NC	NC	NC	NC	NC	NC	NC	NC	NC
FFA	NC	NC	NC	NC	NC	NC	NC	NC	NC

NC means no correlation, Significant R values* P<0.05, ** P<0.001

Table VI: Multiple Regression analysis showing correlation matrices between Age, Parity, Blood Pressures and plasma parameters in normotensive pregnant women at second trimester

Parameters	Age	Parity	SBP	DBP	TC	HDLC	LDLC	VLDLC	TG
Age	NC	NC	NC	NC	NC	NC	NC	NC	NC
Parity	NC	NC	-0.29*	NC	NC	NC	NC	0.20*	NC
SBP	NC	-0.29*	NC	NC	NC	NC	NC	NC	NC
DBP	NC	NC	NC	NC	NC	NC	NC	NC	NC
TC	NC	NC	NC	NC	NC	NC	0.61**	NC	NC
HDLC	NC	NC	NC	NC	NC	NC	-0.67**	0.67**	NC
LDLC	NC	NC	NC	NC	-0.61**	-0.67**	NC	0.61**	NC
VLDLC	NC	0.20*	NC	NC	NC	0.61**	0.61**	NC	0.21*
TG	NC	NC	NC	NC	NC	NC	NC	0.21*	NC
TP	NC	NC	NC	NC	NC	NC	NC	NC	NC
ALB	NC	NC	NC	NC	NC	NC	NC	NC	NC
FFA	NC	-0.52*	NC	NC	NC	NC	NC	NC	NC

NC means no correlation, Significant R values* P<0.05, ** P<0.001

Table VII: Multiple Regression analysis showing correlation matrices between Age, Parity, Blood Pressures and plasma parameters in normotensive pregnant women at third trimester

Parameters	Age	Parity	SBP	DBP	TC	HDLC	LDLC	VLDLC	TG
Age	NC	0.56*	NC	NC	NC	NC	NC	NC	NC
Parity	NC	NC	NC	NC	NC	NC	NC	NC	NC
SBP	NC	NC	NC	NC	NC	NC	NC	0.40	NC
DBP	NC	NC	NC	NC	NC	NC	NC	NC	NC
TC	NC	NC	NC	NC	NC	NC	0.54**	NC	0.58*
HDLC	NC	NC	NC	NC	NC	NC	0.52**	NC	NC
LDLC	NC	NC	NC	0.40*	0.54**	0.52*	NC	NC	NC
VLDLC	NC	NC	0.40*	NC	NC	NC	NC	NC	NC
TG	NC	NC	NC	NC	0.58*	NC	NC	NC	NC
TP	NC	NC	NC	NC	NC	NC	NC	NC	NC
ALB	NC	NC	NC	NC	NC	NC	NC	NC	NC
FFA	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table VIII: Cardiovascular risk indices in hypertensive and normotensive pregnancy

GROUP	GESTATIONAL AGE	TC/HDLC	LDLC/HDLC	HDLC/TC
Hypertensive pregnancy	Second (2^{nd}) trimester	2.20 1.05	1.14 0.79*	0.44 0.21*
Normotensive pregnancy	Second (2^{nd}) trimester	0.85 1.34	1.32 0.25	0.74 0.35**
Hypertensive pregnancy	Third (3^{rd}) trimester	1.73 2.93*	1.87 1.67*	0.34 0.11
Normotensive pregnancy	Third (3^{rd}) trimester	0.85 1.72	1.59 0.52	0.58 1.17**
Hypertensive pregnancy	3-6days after delivery	2.70 1.48	1.43 0.39*	0.68 0.37**
Normotensive pregnancy	3-6days after delivery	1.77 1.47	0.64 0.25	0.57 0.12*

The results of SBP, DBP, TC, HDLC, LDLC, VLDLC and TG in hypertensive and normotensive pregnant women in both second and third trimesters are presented in Tables 1 and 2 respectively. These results show that the levels of SBP, DBP, TC, HDLC, LDLC, VLDLC and TG were significantly higher in hypertensive patients than in normotensive subjects ($P< 0.000$ SBP, DBP, TC, LDLC, < 0.020 for HDLC and < 0.001 for VLDLC and TG. Table 3 show the results of SBP, DBP, TC, HDLC, LDLC, VLDLC and TG in hypertensive and normotensive women at 3-6days after delivery. The results reveals a statistically significant difference ($P<0.005$) in the mean values in each of the parameters evaluated between the two groups except for TC. In Table 4, there was a significant but negative correlation matrices between TC, VLDLC and TG in hypertensive pregnant women at second trimester but no significant correlation between the blood pressures and all the parameters evaluated.

In Table 5, there was no significant correlation between the blood pressures and each of the other parameters evaluated in hypertensive patients at third trimester. However, TC is positively and significantly correlated with LDLC and LDLC is also positively and significantly correlated with HDLC and TG. TG is also positively correlated with VLDLC.

Table 6 shows that in normotensive pregnant women in the second trimester, that parity correlates significantly but negatively with SBP but positively with VLDLC whereas HDLC is negatively and significantly correlated with LDLC. The result in Table 7 shows that there was a negative and significant correlation between LDLC and DBP but positive and significant correlation between parity and LDLC in normotensive subjects at third trimester.

Table 8 describes the cardiovascular disease risk indices in hypertensive and normotensive pregnant women in all the groups studied.

Discussion

The results obtained from this study show that in hypertensive pregnancy at second trimester (Table 1), the plasma levels of LDLC, VLDLC and TG are significantly ($P<0.001$) higher and TC and HDLC are significantly ($P<0.02$) lower than those in normotensive pregnant women at second trimester. This pattern of hyperlipideamia is similar to the reports in Caucasians from [7; 8]. So that even though the blood pressure in pregnancy induced hypertension is significantly lower in Nigerian women than Caucasian women, the pattern of change in the plasma lipid is similar. In hypertensive pregnancy at second trimester, plasma TC is negatively correlated with

plasma TG, LDLC and VLDLC. This appears to indicate that when plasma TC rises, the plasma LDLC that should form atheromatous plaques when excessive falls and the plasma VLDLC and TG that can also cause cardiovascular disease when they are excessive also falls. The hypertensive pregnant women is thus protected from permanent cardiovascular disease resulting from the condition.

In the third trimester, (Table 2), hypertensive pregnant women have significantly ($P<0.001$) higher plasma levels of LDLC and lower levels of HDLC, VLDLC, TC and TG than normotensive pregnant women. The values for plasma TC, LDLC, VLDLC and TG were significantly higher in the third trimester than the second trimester in normotensive pregnancy while HDLC was significantly ($P<0.05$) lower. Whereas in hypertensive pregnancy, plasma TC and LDLC were raised while HDLC was reduced, HDLC is consistently reduced in both groups as the pregnancy is getting to term presumably because LDLC which delivers cholesterol to the tissues for the cellular and tissue growth is badly needed in this period of rapid foetal growth and differentiation. This supports the findings of [9].

The rise in TG and VLDLC in normotensive pregnancy in third trimester (Table 2) is presumably because of the increased demand for energy from the growing foetus. The fall in TG and VLDLC in the third trimester of hypertensive pregnancy is not understood.

The multiple regression analysis has shown in Table 6 that LDLC and HDLC are positively correlated with VLDLC. The positive correlation of TG and VLDLC seems to be adaptational in this condition in this trimester. The HDLC scavenges cholesterol to the liver for excretion as bile salts but at this time a lot of cholesterol is needed for fetal growth as said above. The cholesterol is delivered by LDLC to the tissue hence the negative correlation with HDLC. Similarly, VLDLC levels and TG are responsible for energy production for the foetus hence the positive correlation between them. All these correlations disappear in the third trimester when the foetus presumably is engaged in differentiation of the tissues and organs thereby overriding the hypothetical protective mechanism against permanent cardiovascular disease in pregnancy induced hypertension.

The cardiovascular risk indices are indicated in Table 8. There is considerable lack of consistency among the three cardiovascular risk indices. These findings were similar to that of [10]. The least likely to be acceptable is the HDLC/TC in which third trimester hypertensive pregnancy present no cardiovascular risk, whereas all the other groups including normotensive pregnancy in 3-6days post partum have cardiovascular risk values. But if the other two indices LDLC/HDLC and TC/HDLC respectively are considered however, they indicate that only the third trimester hypertensive pregnant women have significant ($P<0.05$) cardiovascular risk indices.

Conclusion

It can be concluded that the high lipid concentrations in hypertensive pregnant Nigerian women obtained from this study seems not to be directly involved in hypertensive pregnancy and appear to be a reflection of the metabolic condition of pregnant women.

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