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Study of Serum Lipid Profile in Normal Pregnancy

Dr. Amit D. Sonagra[1]*, Dr. Shylaja T.V.[2], Dr. Zahoorunissa Deba[3], Dr. Asmabi Makandar[4],

[1] Assistant Professor, Department of Biochemistry, G.M.E.R.S. Medical College, Dharpur-Patan, Gujarat (India).

[2] Assistant Professor, Department of Biochemistry, East Point Medical College, Bangalore, Karnataka (India).

[3]Assistant Professor, Department of Biochemistry, Khaja Banda Nawaz Institute of Medical Sciences, Gulbarga, Karnataka (India).

[4]Assistant Professor, Department of Biochemistry, East Point Medical College, Bangalore, Karnataka (India).

Abstract

Background: Normal pregnancy is a state of insulin resistance (IR). Purpose of insulin resistance adapted by mother is to deliver enough quantity of nutrients to the growing fetus. Elevated IR may cause dyslipidemic changes in maternal lipid profile.

Aim : The study aims at evaluating serum lipid profile at different trimesters of pregnancy.

Methods: Pregnant women at 1st, 2nd and 3rd trimester were divided into groups I, II and III respectively (n=20 in each group). Healthy non-pregnant women were taken as controls (n=30). Serum lipid profile was estimated from fasting serum sample using commercially available kits. The student's t-test and one way ANOVA were used for data analysis.

Results: The mean levels of serum triglycerides, total cholesterol, LDL were significantly higher in 2nd and 3rd trimesters while HDL was significantly lower in 2nd and 3rd trimesters of pregnancy when compared with controls.

* *Corresponding author's email id: amitsonagra@gmail.com*

Conclusion: As pregnancy advances, IR increases. Increased IR leads to dyslipidemic changes in mother. Dyslipidemia is associated with poor maternal and fetal outcome. Screening of all pregnancy for lipid profile and early intervention may help to reduce the associated complications.

Keywords: HDL cholesterol, LDL cholesterol, normal pregnancy, total cholesterol, triglycerides.

INTRODUCTION

Pregnancy is associated with many metabolic changes in mother. Due to this reason, maternal physiological, biochemical and hematological parameters change drastically. If pregnancy goes without any complicaitons, these changes are reversible after delivery [1]. As pregnancy advances, there is increased demand of energy for growing fetus. Pregnant women require an additional energy of 300 kcal/day over routine energy intake [2]. The average glucose utilized by a growing fetus at the 3rd trimester reaches approximately to 33 µmol/kg/min [3].

Normal pregnancy is associated with increased insulin resistance[4]. Decline in maternal insulin sensitivity is reported to be mediated by increase in the levels of estrogen, progesterone, human placental lactogen (hPL), human placental growth hormone (hPGH), cortisol, TNFα, ILs etc. [5-9] Due to insulin resistance in mothers, there is more utilization of fats than carbohydrates for energy by mother and carbohydrates are spared for fetus. Thus, it serves as a physiological adaptation of the mother to ensure adequate carbohydrate supply for the rapidly growing fetus [4].

Elevated insulin resistance is associated with development of dyslipidemia in the form of elevated serum triglycerides, total cholesterol & LDL cholesterol while decreased HDL cholesterol[10,11]. Presence of dyslipidemia leads to many maternal complications such as geastational diabetes mellitus (GDM), preeclampsia, intrahepatic cholestasis, etc and fetal complications such as macrosomia, intrauterine growth retardation, preterm birth, etc [12,13]. Mothers with such complications are at higher risk of developing diabetes mellitus, cardiovascular diseases, atherosclerosis, hypertension etc in later life [14].

Present study was conducted to evaluate changes in serum lipid profile during different trimesters of pregnancy.

MATERIAL AND METHODS

Case control study was carried out in antenatal clinic of tertiary care hospital attached teaching institute. Those participating as controls in the experiment were taken from

households surrounding the hospitals. Approval from institutional ethical committee was taken and each subject gave an informed consent for participation in study.

Inclusion criteria for selection of study subjects:

Cases: 60 pregnant women were taken as cases and divided into 3 subgroups as per trimester[15].

Group I: 20 healthy women in 1st trimester of pregnancy.

Group II: 20 healthy women in 2nd trimester of pregnancy.

Group III: 20 healthy women in 3rd trimester of pregnancy.

Controls: 30 age matched healthy non-pregnant women without any significant illness were taken as controls.

Exclusion criteria:

The women with history of hypertension, diabetes mellitus, insulin therapy, hypoglycemic or hypolipidemic drugs intake, smoking, alcoholism, liver, cardiac or renal diseases or any other major illness were excluded from the study. Women with molar pregnancy, twins or multiple fetuses were also excluded from the study.

Sample collection

3 ml of venous blood was collected 12 hours post overnight fasting in a plain vial for the collection of serum. Serum was separated by centrifugation and used for the estimation of serum lipid profile.

Sample analysis

Serum lipid profile was determined by using analytical kit from ERBA Diagnostics Mannheim GmbH in semi-autoanaylzer (CHEM-5 plus V_2, Erba Mannheim). Determination of serum triglycerides (TG) was done by Enzymatic glycerol phosphate oxidase – Phenol aminoantipyrine method (GPO-PAP) [16]; serum total cholesterol by Enzymatic cholesterol oxidase – Phenol aminoantipyrine method (CHOD-PAP) [16] & serum high density lipoprotein (HDL) by Phosphotungstic acid and CHOD-PAP method[16]. Serum low density lipoprotein (LDL) concentration was calculated by Friedwald's formula [17].

$$\text{LDL (mg/dl)} = \text{total cholesterol (mg/dl)} - \text{HDL (mg/dl)} - \frac{\text{Triglycerides (mg/dl)}}{5}$$

Statistical analysis

Values are presented as mean ± SD and the statistical analysis was done using SPSS 17.0 software. Student's unpaired t-test was used for comparison between two groups while one way ANOVA test was used to compare all the groups simultaneously.

RESULTS

Table 1 shows that the mean levels of serum triglycerides and total cholesterol were significantly higher & mean level of serum HDL were significantly lower in 2nd and 3rd trimesters of pregnancy when compared with healthy non-pregnant controls. The mean level of serum LDL was significantly higher in 3rd trimesters of pregnancy when compared with controls. The mean level of serum triglycerides was significantly higher and serum HDL was significantly lower in 1st trimester when compared with controls. There was no significant difference in serum total cholesterol and serum LDL in 1st trimester when compared with controls.

Table 1: Comparison of parameters among study groups.

		1st Trimester (Group I) (n=20)	2nd Trimester (Group II) (n=20)	3rd Trimester (Group III) (n=20)	Controls (n=30)
POG (weeks)	Mean±SD	10.4±0.82	16.35±0.93	34.35±2.76	-
Age (years)	Mean±SD	22.6±2.60	22.45±1.82	22.05±3.52	22.83±2.98
	t test (p)*	0.771	0.576	0.283	-
Serum Triglycerides (mg/dL)	Mean±SD	157.5±27.23	160.82±33.27	177.87±36.79	140.36±30.42
	t test (p)*	< 0.05†	< 0.05†	< 0.001‡	-
Serum Total cholesterol (mg/dL)	Mean±SD	168.82±26.89	184.90±29.45	209.03±33.30	165.24±25.36
	t test (p)*	0.638	< 0.05†	< 0.001‡	-
Serum HDL cholesterol (mg/dL)	Mean±SD	41.84±5.44	41.99±4.95	40.51±6.02	45.29±6.34
	t test (p)*	< 0.05†	< 0.05†	< 0.05†	-
Serum LDL cholesterol (mg/dL)	Mean±SD	92.65±24.42	105.40±27.09	114.71±30.23	91.87±22.38
	t test (p)*	0.909	0.072	< 0.05†	-

* p-value of unpaired student's t-test between respective case groups and controls.

POG – period of gestation; HDL - High density lipoprotein; LDL - Low density lipoprotein.

† Significant ‡ Highly Significant

One way ANOVA test in table 2 shows significant difference in levels of all the parameters among study groups.

Table 2: One way ANOVA test for parameters among study groups.

	F value	**p value**
Serum Triglycerides	5.616	< 0.05†
Serum Total cholesterol	10.804	< 0.001*
Serum HDL cholesterol	3.201	< 0.05†
Serum LDL cholesterol	3.997	< 0.05†

† Significant * Highly Significant

DISCUSSION

Pregnancy causes drastic changes in maternal physiology and metabolism. These changes are mainly due to alteration in various hormonal levels[18]. Elevated levels of progesterone, estrogen, hPL, hPGH, inflammatory mediators etc leads to alteration in insulin signaling pathway causing state of insulin resistance[4]. Increased IR is associated with development of dyslipidemia [19].

Age is one of the factors which can affect serum lipid profile [20]. In the present study, there was no significant difference in age of mother in all the case groups ($p>0.05$). Age matched cases and controls were taken in order to remove one of the major confounding factor.

In our study, we found elevated serum triglyceride, serum total cholesterol & serum LDL levels while decreased serum HDL levels in pregnant women than non pregnant women. This finding is in accordance with studies done by Parchwani D et al [21] & Pusukuru R et al [22].

Insulin resistance is associated with increased mobility of fats from adipose tissue to liver leading to increased production of TG rich VLDL particles by liver which causes elevated serum triglycerides in such persons [19]. In such condition, cholesteryl ester transfer protein (CETP) transfers more TG molecules from VLDL to HDL in exchange of cholesterol ester (CE). Because of it, there is formation of TG rich and cholesterol ester poor HDL particle which shorter life span than normal HDL particles. Thus, serum HDL declines [23].

HDL causes reverse cholesterol transport in our body. Decline in HDL is associated with elevated total cholesterol and LDL levels [23]. Need for cholesterol also increases in pregnancy due to elevated steroid hormone synthesis [21]. Therefore in pregnancy serum total cholesterol and LDL cholesterol are elevated.

In our study, we found that as pregnancy advances, dyslipidemia increases. Such

changes are more marked in 3rd trimester than in 2nd trimester than in 1st trimester. This finding is in accordance with studies done by Parchwani D et al [21] & Kumar S et al [24].

Presence of dyslipidemia is associated with increased maternal and fetal morbidity and mortality. It may also have long term effect on maternal health and lead to increased risk of development of obesity, atherosclerosis, type 2 diabetes mellitus, etc.[25] Therefore, it is advisable to screen pregnant women for serum lipid profile. If dyslipidemia is diagnosed in pregnant mother, she should be given meticulous antenatal care, proper dietary and lifestyle modification advice so that risk of complicated pregnancy can be reduced [26].

CONCLUSION

Normal pregnancy is associated with elevated insulin resistance due to elevated pregnancy related hormones. Increased IR leads to production of dyslipidemic changes in mother in the form of elevated TG, total cholesterol, LDL and decreased HDL in serum. Dyslipidemia can complicate the pregnancy and increase maternal & fetal morbidity & mortality. Therefore, pregnant women should be screened for lipid profile and dyslipidemia should be identified. Dyslipidemic mothers should be advised for necessary dietary and lifestyle modifications which can reduce maternal and fetal complications.

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