Gestational Lipid Profile in Pakistani Pregnant Women

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ABSTRACT

Objective; To determine the significance of lipid profile in each trimester of pregnancy
Methods; Prospective analytical study of 100 pregnant women (non-diabetic and non –hypertensive) was carried out in Social Security Hospital, Lahore. Lipid profile estimation was done in each trimester of pregnancy and comparison was done among them.
Results; Lipid profile increases with increasing duration of pregnancy.
Conclusion; Changes in the Lipid profile occur in normal non-diabetic, non-hypertensive pregnancy in Pakistani pregnant women.
Key words: Total Cholesterol, Triglycerides, High density lipoprotein, Low density lipoprotein, Trimesters.

INTRODUCTION

Lipid metabolism undergoes major adjustment during pregnancy, although there is no change in either basal carbohydrate oxidation or non-oxidizable carbohydrate metabolism, there is a significant 50–80% increase in basal fat oxidation during pregnancy and also in response to glucose (Okereke et al 2004). There is also marked hyperlipidemia in pregnancy (Knopp et al 1973; Warth et al 1975; Alvarez et al. 1996).

In obese pregnant women, this hyperlipidemia is exaggerated. Total and VLDL triglycerides are increased further and plasma HDL is even lower, whereas, in contrast, LDL is unaltered (Merzouk et al., 1998; Ramsay et al., 2002; Rajasingam et al., 2009). The relative inability of insulin to suppress whole-body lipolysis leads to a marked increase in plasma free fatty acids in obese patients (Sivan et al., 1999), thereby further amplifying the already higher concentrations associated with obesity (Catalano et al, 2002).

Fat is the major form of stored energy during pregnancy. Approximately 4 kg are stored by 30 weeks, which is in the form of depot fat, and stored in the abdominal wall, back and thighs, and breast. So we can say that total metabolism and demand for energy are increased during pregnancy, but as the glycogen is decreased so the energy obtained directly from carbohydrates is decreased. Although blood fat is increased only moderate amount is laid down in fat stores. (Kelvin, 2003).

Hyperlipidemia in pregnancy is due to increased plasma fats. The neutral fats are increased in first trimester and cholesterol and phospholipids in second trimester. At term neutral fat is elevated 100% while Cholesterol 25% above their normal values (Boyd, 1934)

According to Knopp et al (1988) there is two- to four-fold increase in total triglyceride concentration and a 25% to 50% increase in total cholesterol concentration during gestation. Additionally, there is a 50% increase in low-density lipoprotein (LDL)-cholesterol and 30% increase in high-density lipoprotein (HDL)-cholesterol by midgestation that decreases to some extent in the third trimester. Maternal triglyceride and very low-density lipoprotein (VLDL) triglyceride levels in late gestation are positively correlated with maternal estriol and insulin concentrations. The increase in maternal lipid concentration, especially free fatty acids, in late gestation is most probably due to the decrease in maternal glucose insulin sensitivity in late pregnancy. (Sivan et al 1999).

As in pregnancy changes occur in hepatic and adipose metabolism, as a result of this concentration of triacylglycerols, fatty acids, cholesterol, and phospholipids is increased in the circulating blood (Lesser and Carpenter, 1994). Initially there is decrease in the first 8 weeks of pregnancy but after that the concentration of triglyceride, fatty acids, cholesterol, lipoproteins, and phospholipids is increased and remains elevated through out pregnancy. This is thought to be due to the higher concentration of estrogen and insulin resistance.

Cholesterol is increased by 10th weeks of pregnancy and is due to the increased concentration of oestrogen and it remains elevated through out pregnancy changes in total cholesterol concentration reflect the changes in the various lipoprotein fractions. HDL cholesterol increases by 12th wk of gestation in response to oestrogen and remains elevated throughout pregnancy (Halstead et al 1993). Total and LDL-cholesterol concentration decreases initially, but then increases in the second and third trimesters. and triacylglycerol decrease in the first 8 wk of gestation and then continuously increases until term. In the second half of pregnancy, VLDL clearance is altered because of the decreased activity of lipoprotein lipase (LPL) in the adipose and liver and because of the increased activity in theplacenta. In the fed state, hepatic LPL is low, but increases with fasting, which increases fatty acid and ketone production for the fetus while the supply of glucose is decreased.

Changes in lipid metabolism promote the accumulation of maternal fat stores in early and mid pregnancy and enhance fat mobilization in late pregnancy. Due to the increased oestrogen, progesterone, and insulin production lipid deposition occur and lipolysis is inhibited. (Rebuffe et al 1985.)

In late pregnancy, HCS promotes lipolysis and fat mobilization. Due to the mobilization of lipid stores plasma fatty acid and glycerol concentration is increased. As an anabolic state is shifted to a catabolic state, the use of lipids as a maternal energy source is increased while glucose and amino acids are preserved for the fetus. With prolonged fasting (48 h), as well as shorter periods of fasting (18 h), there is a rapid diversion of maternal metabolism to fat oxidation, with an elaboration of ketones (Metzger et al 1980). Decrease in plasma glucose, insulin, and alanine, and increase in plasma fatty acid and ß-hydroxybutyrate are seen in pregnant women hours before these changes are seen in nonpregnant women (Metzger 1991). Due to this increased lipolysis and ketogenesis pregnant women utilize stored lipid to fulfil the energy needs and minimize protein catabolism.

MATERIALS AND METHODS

This prospective analytical study was conducted out in Social Security Hospital, Multan road Lahore. Total 110 pregnant women (n=110) were enrolled. During this whole period of study 10 were excluded out, because three developed hypertension, three became diabetics and four delivered before 37th weeks of pregnancy. So 100 women were left for analysis , three blood samples were taken during first , second, and third trimester for biochemical analysis from each woman up to the time of delivery. Those Pregnant women were not enrolled, who were having **d**iabetes, chronic cardiac disease, thyroid disease, family history of having obese children, fetal abnormality and multifetal pregnancy.

The patients were advised to come after overnight fasting. Blood sample of 2mL volume were collected at 12th, 24th, 34th weeks of the pregnancy, using sterile technique (Venepuncture). Blood samples were allowed to clot for 1- 2 hours at room temperature. To separate the Serum completely centrifugation process was done at 3000rpm for 10 minutes and serum was stored in deep freezer at – 2 to 4 ^{o}C prior to processing.

The serum samples were analysed for the estimation of total cholesterol (TC), Triglyceride (TGs), Low density lipoprotein (LDL) and High density Lipoprotein (HDL) according to methods of Cohn et al (988), Bucolo and David (1973), Friedwald et al(1972) and Lopes (1977) respectively by processing in spectrophotometer.(Mapada V. 1100) The Randox enzymatic kit was used. Cholesterol estimation was done by using (CHOD-PAP Method) by the principle of Cohn et al 1988. Triglycerides estimation was done by GPO-PAP enzymatic colorimetric method under the principle of Bucolo and David 1973.

HDL concentration was estimated by adding reagent,R_1 (phosphotungstic acid and magnesium chloride). After centrifugation the supernatant fluid contained the HDL fraction, which was assayed for HDL cholesterol using cholesterol reagent kit (Lopes,1977). LDL-Cholesterol level was estimated according to the Friedewald formula(mg/dl): LDL cholesterol = Total Cholesterol **-** triglyceride - HDL cholesterol (Friedwald et al 1972)[5].

RESULTS

Total 100 pregnant women were included in the study. Lipid profile, Total Cholesterol (TC), Triglyceride (TGs), High density Lipoprotein (HDL-C) and Low density Lipoprotein(LDL-C) were recorded in each trimester.

The data thus obtained was subjected to the statistical analysis and represented by means and standard deviation for lipid profile for each trimester. Means and standard deviations were calculated

according to standard methods. All analysis was performed through SPSS 16 version. Difference was considered significant when $p \leq 0.05$. (Domenic, 1999).

Graph 1 shows that mean total cholesterol level observed in 100 pregnant women during first trimester was 206.78 ± 29.99mg/dl, while during 2nd trimester it was 233.84±37.91mg/dl, and during third trimester it was 267.84±43.21 and were significantly different from each other in all three trimesters indicating increase with progressing pregnancy.

Graph 2 ; The mean TGs levels observed in 100 pregnant women during Ist , 2nd and 3rd trimesters were 176± 34.39, 199.28± 38.94 and 199.68±38.94 respectively indicating that there was progressive increase in the TGs levels with progressing pregnancy. And the mean neonatal weight was 3.42±0.04. The difference was *Significant ($p<0.05$).

Graph 1:

Graph 2:

Graph 3; The mean HDL- C level observed in 100 pregnant women, during 1st trimester was 54.55±1.26. During 2nd trimester it was 54.35±1.34, and during 3rd trimester it was 54.28±1.35. Indicating

there was insignificant increase in the HDL levels during pregnancy. The difference was insignificant (P > 0.05).

Graph 3:

Graph 4; The mean LDL levels observed in 100 pregnant women during1st trimester was 121.82±34.48. During 2nd it was 140.29±36.68, and during 3rd it was 165.24±36.93, which showed that there was progressive increase in LDL level with progressing pregnancy.The difference was *Significant ($p<0.05$).

Graph 4:

DISCUSSION

Total 110 pregnant women, during first trimester, were recruited in the study. Who were having pregnancy test positive, their pregnancy was further confirmed by ultrasonic examination. Their lipid profiles were checked up during 1st, 2nd and 3rd trimesters of pregnancy. During this whole period, three women were found to be hypertensive, three were diagnosed as having diabetes, four women delivered before 37th weeks of pregnancy, were excluded of the study (any patient who delivered before 37th weeks

of pregnancy or after 40th weeks of pregnancy were excluded of the study). So total ten women were excluded, Therefore the data for 100 women was available for analysis. Significantly elevated levels of mean total cholesterol were observed during 2nd & 3rd trimesters as compared to 1st trimester of pregnancy (P<0.05). Present findings are in accordance with the findings of Van-Stiphout et al (1987) who studied that total cholesterol level is increased with the duration of pregnancy. They stated that major cause for elevated cholesterol levels, in the succeeding pregnancy is the hormonal changes and observed that parity had effect on total cholesterol levels. Present findings are also in agreement with the findings of Rebuffe et al (1985). Who observed that lipid deposition occur in early and mid pregnancy, while in late pregnancy lipolysis and fat mobilization is increased, due to the mobilization of lipid stores plasma fatty acids and glycerol concentration is increased, so the use of lipids as a maternal energy source is increased while glucose and amino acids are preserved for the fetus. In the early pregnancy due to the increased production of oestrogen, progesterone and insulin lipid deposition occur and lipolysis is inhibited, while in late pregnancy HCS promote lipolysis and fat mobilization (Rebuffe et al 1955).

Significantly elevated levels of Triglycerides were observed during 2nd and 3rd trimesters as compared to 1st trimester of pregnancy (P<0.05). Which is in agreement with the studies of Montelongo (1992), Who observed that hypertriglyceridemia is the characteristic feature of pregnancy. No Significant change in the level of HDL- C was observed during 2nd and 3rd trimesters as compared to 1st trimester of pregnancy (P >0.05).

`Significantly elevated levels of LDL were observed during 2nd and 3rd trimesters as compared to 1st trimester of pregnancy (P<0.05). Which is in agreement with the studies of Schafer et al (2008) and Van-Stiphout et al (1987) who studied that total cholesterol and LDL-C levels are increased with the duration of pregnancy. They stated that most probable cause for the elevated LDL during pregnancy is the hormonal changes. It is also in line with the studies of Munoz et al (1995) Who reported that LDL and HDL concentration in normal pregnancies are closely related to circulating progesteron and oestrogen and to the pregnancy period in which they are determined.

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