SERUM LIPO-PROTEINS IN PREGNANCY

by

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and

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Introduction

Recently, lipo-proteins have attracted more importance in the study of lipids, in addition to the other lipid constituents in the pathogenesis of atherosclerosis. The lipid constituents of the blood are usually combined with proteins under physiological conditions. Since lipids account for much of the energy expenditure of the body, the transport of a large quantity of hydrophobic material (lipid) in an aqueous environment is solved by associating the more insoluble lipids with more polar ones such as phospho-lipids and then combining with proteins to form hydrophilic lipo-proteins.

Free fatty acids in unesterified state are carried in the plasma as albumin free fatty acid complexes. Except for these small quantities of fatty acids which are circulated as fatty acid albumin complexes, the remaining plasma lipid is present as lipo-proteins.

Alpha and beta lipo-proteins take part in triglyceride transport. Elevation of plasma free fatty acids will also lead to increased lipo-protein release by the liver, involving extra triglyceride and cholesterol output into the circulation.

Material and Methods

Majority of subjects were selected from the patients attending antenatal clinic of Dr. B. N. Purandare's Maternity Hospital and rest of the patients were selected from the patients attending K. E. M. Hospital and Wadia Maternity Hospitals. Subjects were classified accordingly to their trimesterwise gestational period.

Normal non-pregnant control group included 50 healthy women belonging to medium socio economic class and having normal menstrual function with no evident hormonal deficiency.

Thirty cases in the first trimester, 31 cases in the 2nd trimester and 51 cases in the 3rd trimester of normal pregnancy were studied. These patients had systolic pressure, 130 mm of Hg or less and diastolic pressure 100 mm of Hg or less. Cases of anaemia and threatened abortion were excluded. Nausea and vomiting were observed in two thirds of cases in the first trimester and the incidence of glycosuria was recorded in the third trimester.

Thirty cases of pre-eclamptic conditions were studied who had high blood pressure

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(systolic 140 mm of Hg or more and diastolic pressure 100 mm of Hg or more than 100 mm of Hg). Patients had oedema of feet and on body and albuminuria were observed. Fasting blood samples were collected from above patients and the sera were separated.

Results

Table I gives average mean values of the percentage of alpha and beta lipoproteins. Since beta lipo-protein is (100 — alpha) the standard deviation and standard error are the same for beta, alpha and beta lipo-proteins. As pregnancy advances, alpha lipo-protein value decreases and beta lipo-protein value increases. Normal non-pregnant group shows mean average alpha lipo-protein as 45.5%. This is decreased by 5% in the 1st trimester. At the same time, beta value is increased by 5%. There is a further decrease of 4.9% in the alpha value in the 2nd trimester. At the same time, there is a rise of 4.9% in beta value above the 1st trimester. This shows that in the 2nd trimester, there is a fall of 9.9% in alpha value from normal non-pregnant control group to 2nd trimester group. In the third trimester, there is a fall of 14.0% in the alpha value from normal non-pregnant control group to 3rd trimester and a fall of 4.1% from 2nd trimester to 3rd trimester. A fall in alpha value shows a corresponding rise in beta value. In pre-eclampsia, there is a fall of 21.5% from normal non-pregnant group in alpha value which shows a corresponding rise of 21.5% in beta lipo-protein value. A difference of 7.4% is seen in alpha value in 3rd trimester and pre-eclampsia group which shows that alpha value is much lowered in pre-eclampsia group.

Table II represents the t-test for significance.

Table III represents the mean average value of ratios obtained in different groups. The ratio in normal non-pregnant control group is 1.202. It is increased in 1st trimester by 0.279. The difference between 2nd trimester and 1st trimester is 0.351 and in 2nd trimester and normal non-pregnant group is 0.63. In the 3rd trimester the ratio is distinctly increased and the difference between 3rd trimester

TABLE I

Serum Alpha and Beta Lipo-Protein

Groups	Non-pregnant	1st trimester	2nd trimester	3rd trimester	Pre-eclampsia
Number of cases	50	30	31	55	30
Alpha lipo-protein (in per-cent %)	45.5	40.5	35.6	31.5	24.0
Beta-lipo-protein (in per-cent %) (100-α)	54.5	59.5	64.4	68.5	76.0
Standard deviation (SD)	± 2.33	± 3.07	± 3.44	± 3.79	± 1.58
Standard error (SE)	± 0.33	± 0.56	± 0.62	± 0.51	± 0.29
Coeffieient of variation (CV)	5.1	7.6	9.7	12.0	6.6

All differences are significant as the standard errors are very small compared to the differences observed $P < 0.001$.

TABLE II

t-Test for Significance (Alpha & Beta Lipo-protein)

Group difference	t	df	Probability P
Normal non-pregnent — 1st trimester	7.692	78	<0.001
Normal Non-pregnant — 2nd trimester	15.230	79	<0.001
Normal Non-pregnant — 3rd trimester	22.951	103	<0.001
Normal Non-pregnant — pre-eclampsia	48.864	78	<0.001
1st Trimester — 2nd trimester	5.868	59	<0.001
1st Trimester — 3rd trimester	12.532	83	<0.001
1st Trimester — pre-eclampsia	26.19	58	<0.001
2nd Trimester — 3rd trimester	5.119	84	<0.001
2nd Trimester — pre-eclampsia	17.058	59	<0.001
3rd Trimester — pre-eclampsia	12.74	83	<0.001

TABLE III

Ratio of Beta/Alpha Lipo-protein in Different Groups

Groups	Normal non-pregnant	1st Trime-ster	2nd Trime-ster	3rd Trime-ster	Pre-eclamp-sia
Number of cases	50	30	31	55	30
Ratio of Beta/Alpha lipo-protein	1.202	1.481	1.832	2.218	3.15
Standard deviation (SD)	± 0.206	± 0.173	± 0.293	± 0.377	± 0.311
Standard error (SE)	± 0.029	± 0.032	± 0.053	± 0.051	± 0.057
Coefficient of variation	17.1	11.6	16.0	17.0	9.9

All differences are significant as the standard errors are very small compared to the differences observed $P < 0.001$.

and 2nd trimester is 0.386 while the difference in 3rd trimester and 1st trimester is 0.737 and the difference between 3rd trimester and normal non-pregnant group is 1.016. This shows that the ratio of beta/alpha lipo-protein is increased as the pregnancy advances.

In pre-eclampsia the ratio of beta/alpha lipo-protein is high (3.15). The difference between pre-eclampsia and normal non-pregnant control group is 1.948 and the difference between pre-eclampsia and 3rd trimester is 0.932. Values are statistically significant ($P < 0.001$).

Table IV represents the t-test for significance.

Discussion

Oliver & Boyd (1955) have studied twelve young primigravidas during pregnancy. The cholesterol estimation in alpha lipo-protein and beta lipo-protein was also done. The authors state that beta lipo-proteins contain more cholesterol. The present studies denote that with progressive increase of cholesterol, there is also a progressive rise in beta fraction.

Watson (1957) performed a serial

TABLE IV

t-Test for Significant (Ratio of Beta/Alpha Lipo-protein)

Group difference	t	df.	Probability (P)
Normal non-pregnant — 1st trimester	6.488	78	<0.001
Normal non-Pregnant — 2nd trimester	10.430	79	<0.001
Normal non-pregnant — 3rd trimester	17.278	103	<0.001
Normal non-pregnant — pre-eclampsia	30.438	78	<0.001
1st trimester — 2nd trimester	5.661	59	<0.001
1st trimester — 3rd trimester	12.201	83	<0.001
1st trimester — pre-eclampsia	25.519	58	<0.001
2nd trimester — 3rd trimester	5.251	84	<0.001
2nd trimester — pre-eclampsia	16.941	59	<0.001
3rd trimester — pre-eclampsia	12.183	83	<0.001

study throughout gestation from 13th week onwards and in the puerperium. He has noted, a progressive elevation in the ratio of beta to alpha lipo-protein.

Scandrett (1959) has studied 64 normal pregnant cases in the last trimester and some cases of pre-eclamptic conditions. Grouping in normal pregnant cases was done according to gain in weight during pregnancy. The maximum ratio (3.9) of beta lipo-protein to alpha lipo-protein was noted, when the gain in weight was 30 to 34 pounds. This was a high ratio noted as compared to the ratio noted in present studies (2.218). The ratio of beta to alpha lipo-protein noted by these authors in pre-eclamptic conditions was 4.9 against the ratio noted in present studies in the pre-eclamptic condition as 3.15.

Smith *et al* (1959) studied a healthy young woman from their own laboratory who incidently became pregnant. In addition to this only control and gravid subject they studied in all 10 pregnant cases. The authors have noted a decrease in serum alpha-lipoprotein. The decrease has been co-related with the increase in cholesterol and lipid phosphorus.

Mullick *et al* (1964) studied the serum lipids a healthy lipids in women from New Delhi belonging to high and low socio-economic status. They found significantly higher total lipids, total cholesterol and beta to alpha lipo-protein ratios in the sera of the more affluent women. The ratio of Beta/Alpha lipo-protein noted by these authors are comparatively higher than that noted in present studies.

Gupta *et al* have noted in 38 pregnant women between 20-38 years that there is decreases in alpha lipo-protein percentage as the pregnancy advances. These authors state that high beta lipo-protein level may be due to the fall of non-esterified fatty acids as well as of albumin. Findings in present studies are in contrast with this statement. The authors further state that rise in globulin level, particularly beta globulin level, may be related to the rise of beta lipo-protein percentages, since beta lipo-protein fraction forms about 75% of the lipids. Therefore, any small change in the protein fraction could bring about considerable change in the lipid fraction, particularly the cholesterol fraction.

The present studies have noted that with the increase of cholesterol level there is a rise in beta lipo-protein fraction. Even so, the relationship of the beta globulin and the beta lipo-protein will be

questionable. The present studies have noted the value as 24 per cent for alpha lipo-protein fraction and the ratio of beta to alpha lipo-protein is 3.15 in pre-eclamptic condition.

Thus it suggests that the determination of lipo-proteins during pregnancy in percentage will be useful as a diagnostic and prognostic test, in addition to the clinical symptoms noted in pre-eclamptic condition.

Summary

1. Fractionation of serum lipo-proteins were carried out in normal gravidas of 1st, 2nd and 3rd trimesters and in pre-eclamptic cases in the third trimester. The results are compared with normal non-pregnant control group.

2. Alpha lipo-protein percentage goes on decreasing while beta lipo-protein percentage (100 — Alpha) goes on increasing as pregnancy advances. In pre-eclamptic group the alpha lipo-protein percentage is 24% ($P < 0.001$).

3. Elevation of beta lipo-protein is accompanied with the elevation of serum cholesterol.

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