

SERUM PHOSPHOLIPIDS IN PREGNANCY AND ITS RELATION WITH CHOLESTEROL IN PREGNANCY

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The concept that the impaired carbohydrate metabolism may be responsible for hyperlipemia of pregnancy has been disputed by Randle *et al* (1963) who opine that changes in carbohydrate metabolism is secondary to the elevation of the fatty acids.

We are still in dark about the aetiology of hyperlipemia in pregnancy. Many possible theories have been put forward to explain the aetiology of hyperlipemia.

Hormones produced by the pituitary, adrenal, thyroid and placenta have been known to have an influence on the synthesis, oxidation and metabolisation of lipids as well as plasma lipid levels. Bleicher *et al* (1964) have described a lipolytic substance.

Among the factors which regulate the serum lipid level are the sex hormones, which have received increased attention because of the difference in the incidence of atherosclerosis between the sexes in the fertile age. During pregnancy the hormonal status is changed and several

investigators have observed increased serum cholesterol, phospholipid and neutral fat levels, which increase towards term and decrease after delivery (Oliver and Boyd, 1955; Dickman and Wegner, 1934; Russel *et al* 1964; Watson 1955; Jacina *et al* 1961). Recently free fatty acids which represent a potential pool of energy for muscular activity have been found to be increased during normal pregnancy (Burt, 1960).

Toxaemia which manifests several factors (e.g. hypertension and effected renal function) which may cause disturbances in lipid metabolism has received little attention in this report. Boyd (1934) reported an elevated plasma level and phospholipid level in toxaemia of pregnancy. De Alvarez and Bratvold (1961) noted some increase of serum cholesterol, phospholipids and neutral fats in the serum in pre-eclampsia as compared with normal pregnant values, the difference however was not thought to be significant. Boyd (1934) also stated that pregnancy was accompanied by a rise in serum lipid concentration, phospholipid in first trimester and cholesterol later. He also noted an increase in neutral fat. Dickmann and Wegner (1934) in a review of literature concluded that serum cholesterol increases late in pregnancy be-

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cause there was either faulty elimination by the liver or retention for lactation.

Material and Methods

One hundred and Seventy cases were taken from Upper India Sugar Exchange Maternity Hospital, Department of Obstetrics and Gynaecology, G.S.V.M. Medical College, Kanpur during the period from February 1975 to May 1976 for the study of phospholipid and total serum cholesterol in pregnancy.

The patients studied were divided into following groups:

Control Group

Consists of 30 normal healthy non-pregnant women.

Study Group

Consists of:

- A. Normal pregnancy 58
- B. Abnormal pregnancy 82
 - (a) Pre-eclampsia 32
 - (b) Eclampsia 12
 - (c) Essential hypertension 7
 - (d) Diabetes mellitus 4
 - (e) Hydramnios 4
 - (f) Jaundice 4
 - (g) Hyperemesis gravidarum 5
 - (h) Post-maturity 6
 - (i) Pre-maturity 7
 - (j) Thyroid goitre 1

Cases were studied to find out value of phospholipid in mg%, cholesterol in mg% in normal non-pregnant women and the

changes which follow as pregnancy advances, and any change in abnormal pregnancy. General, systemic, local abdominal examinations were done. Urine was tested for albumin and sugar and blood for Hb% and blood cholesterol. Other special investigations were done according to the need of the case.

Serum phospholipids were estimated by John, A. K. *et al* method.

Observations

TABLE I
Serum Phospholipids Level in Non-pregnant Women in mg%

Serum phospholipids (mg%)	
Range	192-250
Mean	214.48
S.D.	20.35

As pregnancy advances the level of serum phospholipid also increases (Table II).

Table III shows that the maximum number of cases (21.38%) of pre-eclampsia belong to 250-300 mg% serum phospholipid level, while 11.69% belong to eclampsia group showing serum phospholipid levels more than 300 mg%. There was no significant change in cases of essential hypertension and hyperemesis gravidarum.

Table IV shows that percentage rise in both serum cholesterol in first, second and third trimesters as compared to non-pregnant level is almost twice as compared to serum phospholipid.

TABLE II
Serum Phospholipids in Normal Pregnancy (mg%) According to Period of Gestation

Period	Range	Mean	S.D.
First trimester	200-277	235.0	28.84
Second trimester	210-255	243.8	19.03
Third trimester	220-287	257.54	21.29

TABLE III
Serum Phospholipids in Abnormal Pregnancy

Disease	150-200 (%)	200-250 (%)	250-300 (%)	Above 300 (%)
Pre-eclampsia	—	—	21.38	12.98
Eclampsia	—	—	2.6	11.69
Essential hypertension	2.6	—	5.19	1.3
Hydramnios	—	1.3	3.9	—
Jaundice	—	—	5.6	—
Diabetes mellitus	—	—	—	3.9
Hyperemesis gravidarum	2.6	2.6	—	—
Postmaturity	—	—	1.3	6.49
Prematurity	—	—	5.19	3.9
Thyroid goitre	—	1.3	—	—

TABLE IV
Percentage Rise in Total Serum Cholesterol and Serum Phospholipid in Normal Pregnancy as Compared to Non-pregnant Group

Period	Serum cholesterol	Serum phospholipid
First trimester	27.1%	7.8%
Second trimester	31.2%	11.32%
Third trimester	39.8%	17.3%

TABLE V
Percentage Rise in Serum Cholesterol and Phospholipid Levels in Toxaemia of Pregnancy

Toxaemia	Serum cholesterol (mg%)	Serum phospholipid (mg%)
Mild pre-eclampsia	63.0%	31.7%
Severe pre-eclampsia	67.9%	55.5%
Eclampsia	70.1%	43.1%
Essential hypertension	32.1%	11.04%
Hyperemesis gravidarum	34.4%	10.3%

Table V shows that there is rise in both serum cholesterol and phospholipid but rise in percentage of serum cholesterol is much higher in toxaemias of pregnancy as compared with serum phospholipid. Only in hyperemesis gravidarum serum cholesterol showed percentage rise while phospholipid level showed decrease of percentage as compared to serum phospholipid of normal pregnancy.

Discussion

It is evident from Table I that the range for serum phospholipid in non-pregnant women is 198-250 mg% and mean value is 219.48 ± 20.85 mg%. Taylor (1972) studied serum phospholipid in 23 non-pregnant women and the mean value of serum phospholipid was 185.4 ± 38.0 . Gupta *et al* (1967) studied 10 non-preg-

nant women and reported a mean value of 199 ± 8.1 . Konttinen *et al* (1964) studied 15 non-pregnant control women and found mean value for serum phospholipid as 256 ± 36 . Aurell and Cramer (1966) found the mean serum phospholipid level 195.0, 194.0 and 185.0 mg% respectively with S.D. 37.0, 37.0, 37.0 and 40.0 while Bhowmic and Mukherji (1972) reported mean value 159.7 ± 12.4 . Our findings are in agreement with the values of Gupta *et al* (1967) and Taylor (1972).

From Table II it is evident that serum phospholipid increases as pregnancy advances. Percentage rise in serum phospholipid as compared to non-pregnant women in first, second and third trimesters is 7.3%, 11.32% and 17.3%, while Russel *et al* (1964), Gupta *et al* (1967) concluded that serum phospholipid rises in second and third trimesters. In first trimester not much change was noticed from that of normal pregnancy. They found mean value 190 ± 4.7 , 214 ± 9.3 , 228 ± 12.4 in first, second and third trimesters respectively. Mullick *et al* (1964) reported serum phospholipid level 283.18 mg%, 254.80 mg% 257.09 mg% in first, second and third trimesters respectively. The reported increase was noticed at the end of first trimester and the rise continued throughout pregnancy. Bhowmick and Mukherjee (1972) studied normal pregnant women serially from 20 weeks, 26-28 weeks, 32 weeks and again at 36 weeks and reported serum phospholipid levels of 189.5 ± 18.7 , 223.5 ± 11.5 , 250.0 ± 15.2 and 263.9 ± 9.14 respectively. Taylor (1972) studied serum phospholipid in normal pregnancy. At the 24th week of gestation the serum phospholipid level was significantly higher than that in non-pregnant women. However, there was further increase in

the level of the phospholipid from 24th to 36th weeks of gestation.

Our findings are in agreement with those of Mullick *et al* (1964), Bhowmick and Mukherjee (1972); Boyd and Rochester (1935); Aurell and Cramer (1966); Taylor (1972) and Gupta *et al* (1967). However Russel *et al* (1964) reported much higher values.

Percentage rise of serum cholesterol and serum phospholipids as evident from Table V is 31.7%, 55.5%, 43.7%, 11.04% respectively in cases of mild pre-eclampsia, severe pre-eclampsia, eclampsia and essential hypertension, but in cases of hyperemesis gravidarum there was decrease in serum phospholipid levels, 10.3% as compared to normal non-pregnant levels. Konttinen *et al* (1964) also observed high values in pre-eclampsia. They obtained mean serum phospholipid levels of 374.6 mg% in normal pregnant and 404.6 mg% in pre-eclamptic mothers.

Bhowmick and Mukherjee (1972) obtained a value for serum phospholipid of 284 ± 19.6 in pre-eclamptic toxemia and of 292.6 ± 10.4 in essential hypertension. The values were higher than in normal pregnancy. Our results are in agreement with the findings of Konttinen *et al* (1964); Bhowmick and Mukherjee (1972). As cases of pregnancy associated with hydramnios, jaundice, prematurity, postmaturity and diabetes mellitus were very few, it was very difficult to draw any conclusion.

In our series there was positive correlation between total serum cholesterol and serum phospholipid which indicates that as total serum cholesterol rises serum phospholipid also rises, but rise in percentage of cholesterol was comparatively twice than that of serum phospholipid.

Summary

1. Serum phospholipid studies were carried out in normal gravidas and in pre-eclamptic conditions. The results were compared with normal non-pregnant control groups.

The results of pre-eclamptic group were compared with the results obtained in third trimester of normal gravidas.

2. A progressive rise was observed in serum phospholipid as compared to third trimester in normal gravidas.

3. In toxæmia of pregnancy we found a significant rise in total serum phospholipid as compared to third trimester in normal gravidas.

4. There was no significant change in serum phospholipid in essential hypertension as compared to normal pregnancy while serum phospholipid values were lower in cases of hyperemesis gravidarum.

5. Cases of diabetes mellitus complicating pregnancy showed a high value of serum phospholipid.

6. No significant change was observed in serum phospholipid values than in abnormal pregnancy.

7. There was positive correlation between serum phospholipid values and serum cholesterol but percentage rise of serum cholesterol was almost twice as compared to phospholipid in first, second

and third trimesters and in toxæmia of pregnancy.

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