

LIPID METABOLISM IN PREGNANCY. I.

(Total Lipids, Triglycerides and Phospholipids in Normal and Abnormal Pregnancy*)

by

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Introduction

There has been a continuous stimulus in understanding maternal lipid metabolism since Bacquerel and Rodier (1845) recognised that there was an increase in blood lipids during pregnancy. There is paucity of consolidated information that in normal healthy pregnant women the lipids increase progressively (Dieckman and Wegner, 1934; Schwarz, 1940; Von Studinitz, 1955; Watson, 1957; De Alvarez, *et al* 1959; Jerome, 1966; Quinto *et al*, 1967). Though hyperlipidemia in pregnancy is known, yet there is no agreement about the intensity of changes in many lipid fractions, and the period of pregnancy at which they start.

Lipid metabolism in pathological conditions, however, has received very little attention. The present re-

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search was, therefore, undertaken on various lipid fractions in pregnancy complicated by toxæmia and diabetes. The whole work has been divided into three parts; the first dealing with total lipids, triglycerides and phospholipids; second, concerning ratio of free cholesterol (FC) to ester cholesterol (EC) (FC/EC) and total cholesterol (TC) to phospholipids (PL) (TC/PL); and third, consisting of total, free (non-esterified fatty acids) and esterified fatty acids. Abnormal pregnancy cases selected are those of toxæmia, diabetes and nephrotic syndrome with pregnancy.

Material and Methods

In the present study 78 subjects were chosen as given below:

The first group consisted of 25 healthy adult non-pregnant women in the reproductive age group (18-37 years), mostly nurses and postgraduate medical students from the Postgraduate Institute of Medical Education & Research, Chandigarh. They were all apparently healthy, without any constitutional disease. They served as controls.

Group II consisted of 25 normal pregnant women in the last trimester

of pregnancy (28-40 weeks). They were selected from the antenatal clinic of the Institute.

Group III consisted of 25 cases of toxæmia of pregnancy, 2 cases of diabetes and 1 of nephrotic syndrome with pregnancy. All of them were admitted in the maternity ward of the Institute and were under treatment. Two cases were of eclampsia and 2 cases were of severe pre-eclamptic toxæmia (classification of the American Committee on Maternal Welfare). These severe cases were not considered as a separate statistical group. Cases of diabetes were not included in the statistical analysis. Routine laboratory tests like haemoglobin, urine, blood urea, uric acid, fasting blood sugar were carried out in all the subjects and ophthalmoscopic examination was carried out in the patients of the 3rd group.

Collection of samples was uniform in all the cases. Blood was taken at 8 A.M. after 12 hours of fasting and serum was separated. The extraction of lipids for the various analyses was done immediately (Folch *et al*, 1951). The extract was dried in vacuum to a constant weight and re-extracted with dry petroleum ether

(B.P. 40-60°C) and made up to a known volume with it. Aliquot volumes from this were used for different analysis. Total lipids were estimated by the semimicro method of Pande *et al* (1963), a modification of the dichromate oxidation. Phospholipids were estimated according to the methods of Consolazio *et al* (1951), as recommended by Hawk *et al* (1954) and Youngberg and Youngberg (1930), and the triglycerides were calculated from the differences as total lipids minus phospholipids and total cholesterol after applying Sunderman's correction (Sunderman and Sunderman, 1960).

All the data were evaluated statistically and the significance was deduced by applying Students 't' test.

Results

The experimental data are presented in Tables I, II and III. The levels of total lipids, triglycerides and phospholipids were significantly higher in normal pregnancy and in toxæmic group in comparison with those of non-pregnant women. The levels of total lipids and phospholipids in the toxæmic group were slightly higher than those of the normal pregnant

TABLE I
Serum total lipids in normal and abnormal pregnancy
(mgm. per 100 ml. of sera)

Group	No. of cases	Range	Mean	S.D.	't'*	't1'***
I Non-pregnant	25	410.0-966.3	684.40	± 135.54	—	—
II Normal pregnancy	25	826.0-1263.0	998.48	± 124.68	8.44+	—
III Abnormal pregnancy.	25	769.5-1321	1001.28	± 142.06	7.99+	0.73

+ Significant.

*t compared to non-pregnant group.

***t1 compared to normal pregnancy group.

TABLE II
Serum Triglycerides in normal and abnormal pregnancy
(mgm. per 100 ml. of serum)

Group	No. of cases	Range	Mean	S.D.	't'*	't1'***
I Non-pregnant	25	145.78—583.5	262.13	±105.18	—	—
II Normal pregnancy	25	195.5—656.0	341.68	± 97.71	2.65+	—
III Abnormal pregnancy.	25	232.0—698.0	331.68	±101.48	2.33+	0.33

† Significant.

*t compared to non-pregnant group.

**t1 compared to normal pregnancy group.

TABLE III
Serum Phospholipids in normal and abnormal pregnancy
(mgm. per 100 ml. of serum)

Group	No. of cases	Range	Mean	S.D.	't'*	't1'***
I Non-pregnant	25	100.28—289.30	195.84	±57.98	—	—
II Normal pregnancy	25	218.5—342.5	278.34	±33.2	5.24+	—
III Abnormal pregnancy.	25	185.0—397.5	302.25	±92.44	4.91+	1.75

+ Significant.

*t compared to non-pregnant group.

**t1 compared to normal pregnancy group.

women, but of no statistical significance. The triglycerides were found to be lower in these toxæmic patients than those of the normal pregnant group. In the two diabetic patients investigated total lipids (1370 and 1580 mgm./100 ml.), triglycerides (355.5 and 576.3 mgm./100 ml.) and phospholipids (552.5 mgm./100 ml.) were markedly higher than all the three groups examined above. In the nephrotic patient the levels of these lipids were 1293.0, 250 and 374.7 mgm. per 100 ml. of sera respectively.

Discussion

A general increase with high statistical significance in serum total lipids, triglycerides and phospholipids, was observed, as evident from the Tables I to III, both in normal pregnancy and

pregnancy with complications, as compared to the normal non-pregnant women. The difference between the normal pregnancy and pathological pregnancy cases was not so marked, although both total lipids and phospholipids were higher, whereas the triglycerides were slightly lower in the latter group. These findings are in general agreement with those of the previous studies (Gardner and Gainsborough, 1929; Boyd, 1934; Nelson *et al*, 1966 and Quinto *et al*, 1967). Among the different fractions studied, the phospholipids were found to be increased in the abnormal pregnant women as compared to the normal pregnant women. In this respect Quinto *et al* (1967) also observed that in toxæmic, obese and diabetic pregnant women, there is a re-

markable increase in plasma phospholipids in comparison with physiological levels of late pregnancy. Although he observed a rise of plasma glycerides in toxæmic pregnancies, the present authors found the triglycerides almost near to the late pregnancy level (3% lower). In the two diabetic patients the triglycerides were higher than those of the healthy pregnant women. These observations were contrary to those of Quinto *et al* (1967), whose values for the diabetic patients were lower than the normal pregnant women.

It is established that in normal pregnancy there is a reduced capacity of the tissues to metabolize glucose; in other words glucose tolerance is reduced (Kriss and Hirschorn, 1948; Gastaldi and Acerboni, 1960; Fajans and Conn, 1961; Orlandi and Bottiglioni, 1961). It is also known that in many clinical and experimental conditions characterized by a lack of utilizable glucose at the periphery (diabetes mellitus, fasting, muscular fatigue, alloxan poisoning) there is increased hydrolysis of glycerides in adipose tissues. This leads to hyperlipidemia (with a rise of plasma total fatty acids, glyceride, phospholipids and NEFA) related to the need for fat as an energy yielding substrate for oxidative catabolism (Gordon and Cherkes, 1956; Gordon, 1957; Bierman *et al*, 1957). Thus the increased triglycerides and phospholipids in the diabetic pregnant women are quite consistent with the present findings. Although in toxæmia, too, there is decreased glucose tolerance (Orlandi and Bottiglioni, 1958; Quinto *et al*, 1967), the derangement of the carbohydrate metabolism is not so marked

and severe as in the diabetic patients. Therefore, it could be expected to have a difference in the degree of changes in lipid metabolism in these two states of pregnancy.

Summary

(1) A total of 78 subjects consisting of 25 cases of normal pregnancy (3rd trimester), 25 of toxæmia of pregnancy, and 25 non-pregnant (control), 2 cases of diabetes and one of nephrotic syndrome with pregnancy were investigated.

(2) Total lipids, triglycerides and phospholipids content of their sera were determined.

(3) There was a marked increase of these lipids with high statistical significance in normal and abnormal pregnancy cases as compared to non-pregnant ones.

(4) The values of total lipids and phospholipids were higher in pathological cases studied than in normal pregnancy, and triglycerides were slightly lower in the toxæmic group than those of the normal pregnant women.

Conclusion

A general increase from those of non-pregnant women in total lipids, triglycerides and phospholipids, both in normal pregnancy and in the pathological states of pregnancy, (toxæmia, diabetes) was observed. However, the changes observed between the normal pregnancy and the abnormal ones were not statistically significant to attribute any derangement of the fat metabolism in these conditions.

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