

**EFFECT OF PREGNANCY ON THE LIPID PROFILE IN EGYPTIAN WOMEN****Ghada Ibrahim.***Cardiology Department, Faculty of Medicine, Zagazig University***ABSTRACT**

**Background:** Blood lipid concentration increase significantly during pregnancy. The increased progesterone in the 2<sup>nd</sup> half of pregnancy may act to reset the lipostat in the hypothalamus. There is conflicting evidence for an association between parity and the risk of cardiovascular disease in women. Previous studies have reported a decline in HDL cholesterol up to 10 years after the first pregnancy. **Objective:** To detect the effect of pregnancy on the lipid profile during normal pregnancy in the different trimesters. **Patients and Methods:** This study included 100 cases; 80 pregnant women and 20 healthy non-pregnant women matched for age as control. All patients subjected to: Complete history taking and clinical examination, twelve leads resting surface ECG, echocardiography and total Lipid Profile (at the middle of each trimester and 6-12 weeks post-partum) In general, the test performed following 12 hours overnight fast. **Results:** The total cholesterol and triglycerides were significantly increased from the 1<sup>st</sup> to the 2<sup>nd</sup> trimester with further significant increase in the 3<sup>rd</sup> trimester and after delivery there were highly significant decrease in both. (TC changed from 196±18 mg/dl to 216 ±19.3 mg /dl to 243±13.5 mg/dl with P<0.05 then to 187.1±19.3 mg/dl with P<0.001, respectively). The LDL cholesterol, HDL cholesterol and VLDL cholesterol were non-significantly changed from the 1<sup>st</sup> trimester to the 2<sup>nd</sup> trimester with significant increase in the 3<sup>rd</sup> trimester and after delivery it was highly significant decreased to the below or near the 1<sup>st</sup> trimester level (LDL changed from 119± 9 mg/dl to 111.9±11.5 mg /dl to 123.5±11.9 mg/dl with P>0.05 then to 112.6±13.8 mg/dl with P<0.001, respectively) (HDL changed from 41.9± 14 mg/dl to 42.8±15.4 mg /dl, with P<0.05 then to 57.9±23.1 mg/dl to 48.6±25 mg/dl with P<0.001, respectively) **Conclusions:** We have demonstrated that normal pregnancy is associated with raised triglycerides and cholesterol. By the third trimester most women have a lipid profile which would be considered highly atherogenic in the non-pregnant state. However this represents a transient disturbance which reverts to normal after delivery. Further studies are needed to determine the risk and cardiovascular effects of disturbed lipid profile during pregnancy especially in multipara women with repeated pregnancy.

**Keywords:** Pregnancy - Lipid profile**Abbreviations:**

TG: triglycerides.

TC: total cholesterol.

HDL-C: high density lipoprotein cholesterol.

LDL-C: low density lipoprotein cholesterol.

VLDL-C: very low density lipoprotein cholesterol.

SBP: systolic blood pressure.

DBP: diastolic blood pressure.

HTN: hypertension.

DM: diabetes mellitus.

**INTRODUCTION AND AIM OF THE WORK**

**B**lood lipid concentrations increases significantly during pregnancy.<sup>(1)</sup> Fat storage occurs primarily during early and mid-pregnancy.<sup>(2)</sup> There is some evidence that progesterone, which increases markedly in the second half of pregnancy, may act to reset the lipostat in the hypothalamus.<sup>(3)</sup> Hypercholesterolemia is an important cause of early atherosclerosis.<sup>(4)</sup> Nevertheless, there is conflicting evidence for an association between parity and the risk of cardiovascular disease in women.<sup>(5)(6)</sup> Also, estradiol and progesterone effect on the liver may have some effect.<sup>(7)</sup> It has been suggested that dyslipidemia during pregnancy might be used to identify women who will develop atherogenic changes later in life.<sup>(1)</sup> Previous studies have reported a decline in HDL cholesterol up to 10 years after the first pregnancy, independent of weight, central

adiposity and selected behavioral changes.<sup>(8)</sup> **Wald and Guckle,**<sup>(9)</sup> observed that the increase in the maternal lipid profile in the third trimester is in response to the maternal switch from carbohydrate to fat metabolism which is an alternative pathway for energy generation due to high energy demand. Also, dyslipidemia may activate the endothelial cells with placentally derived endothelial disturbing factors like lipid peroxides could be regarded as possible contributors for pathogenesis of Pregnancy induced hypertension.<sup>(10)</sup>

The present study was undertaken to elucidate any significant variation in the lipid profile during normal pregnancy in the different trimesters to study the effect of pregnancy on the lipid profile.

**MATERIAL AND METHODS**

**Patients:** This study included 100 cases 80 pregnant women and 20 healthy non-pregnant women matched for age as control.

**Inclusion criteria:** Patients included in the study if they are pregnant in the 1<sup>st</sup> trimester with age ranged from 20 to 40 years old with no history of known heart disease, HTN, DM, smoking or dyslipidemia.

**Exclusion criteria:** Patients excluded from the study if they had: chronic diseases that may affect the lipid profile, Women who used a medication that could possibly affect the lipid profile, patients with heart disease, as were patients with family history of dyslipidemia, Adolescents (< 20 years) and women over age 40 were excluded because of high risk pregnancy.

**Methods:** All patients subjected to the following:

1. Compete history taking and clinical examination.
2. Twelve leads resting surface ECG.
3. Transthoracic Echocardiography: to exclude cases with heart disease.
4. Total Lipid Profile: The lipid profiles obtained in the middle of each trimester during pregnancy and 6-12 weeks post-partum. In general, the tests performed following 12 hours overnight fast. Blood was also taken from non-pregnant women and used as control.<sup>(11)</sup>

**Statistic:** Data were analyzed using SPSS 14 Computer system with calculation of means and standard deviations and comparing the data with paired and unpaired T test and ANOVA test for analysis of variance for comparing between groups for significant differences.

**RESULTS**

This study included 80 pregnant females with age ranged from 20 to 40 years with mean age of 31 ± 4.5 years with no risk factors. There were no significant difference between the patients group and the control group in age, heart rate, SBP, DBP, parity, HTN, DM, Smoking or history of dyslipidemia as in table (1)

In the control group the mean total cholesterol was 190.7 ± 11.3 mg/dl, LDL-C was 122.6 ± 15.2 mg /dl, HDL-C 45 ± 10.1 mg/dl, VLDL-C 24.1 ± 2.3 mg/dl and total triglycerides 129.7 ± 11.8 mg/dl.

The mean total cholesterol was 196±18 mg/dl at presentation in the 1<sup>st</sup> trimester which significantly increased to 216 ±19.3 mg /dl in the 2<sup>nd</sup> trimester with further significant increase to 243±13.5 mg/dl in the 3<sup>rd</sup> trimester and after delivery it was highly significant decreased to the below the 1<sup>st</sup> trimester level (187.1±19.3 mg/dl).

The mean LDL cholesterol was 119± 9 mg/dl at presentation in the 1<sup>st</sup> trimester which non-significantly decreased to 111.9±11.5 mg /dl in the 2<sup>nd</sup> trimester with significant increase to 123.5±11.9 mg/dl in the 3<sup>rd</sup> trimester and after delivery it was highly significant decreased to the below the 1<sup>st</sup> trimester level (112.6±13.8mg/dl)

The mean HDL cholesterol was 41.9± 14 mg/dl at presentation in the 1<sup>st</sup> trimester with no significant changes to 42.8±15.4 mg /dl in the 2<sup>nd</sup> trimester with significant increase to 57.9±23.1 mg/dl in the 3<sup>rd</sup> trimester and after delivery it was highly significant decreased to near the 1<sup>st</sup> trimester level (48.6±25 mg/dl).

The mean VLDL cholesterol was 23±4 mg/dl at presentation in the 1<sup>st</sup> trimester which non-significantly changed to 23.5±3.8 mg /dl in the 2<sup>nd</sup> trimester with significant increase to 27.3± 1.9 mg/dl in the 3<sup>rd</sup> trimester and after delivery it was highly significant decreased to blow the 1<sup>st</sup> trimester level (11.3±5 mg/dl).

The mean total triglycerides was 198±10mg/dl at presentation in the 1<sup>st</sup> trimester which significant change to 221.1±11 mg /dl in the 2<sup>nd</sup> trimester with significant increase to 295 ±53.1 mg/dl in the 3<sup>rd</sup> trimester and after delivery it was highly significant decreased to near the 1<sup>st</sup> trimester level (211.1±39.8 mg/dl).

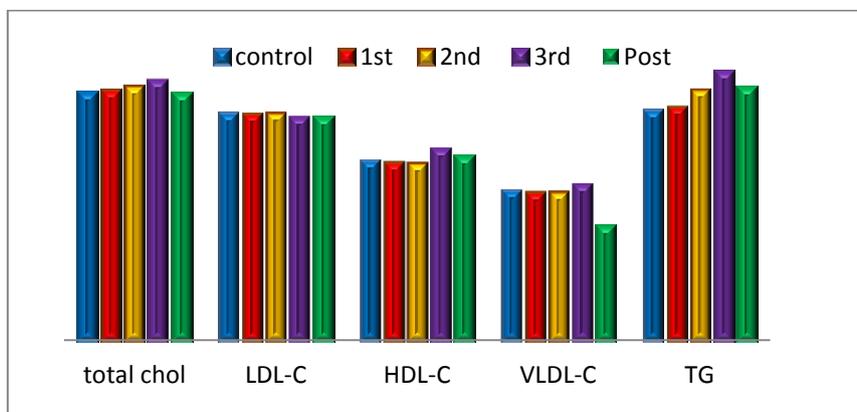


Figure (1): Shows the differences in total lipid profile in control and pregnant females in different stages of pregnancy.

**Table (1): The clinical data and risk factors of the study population.**

Variables	Pregnant		Control		P
	X ± SD		X ± SD		
Age	30±4.5		30±2.5		> 0.05
HR	76±11		77±10		> 0.05
SBP	132±8		126±7		> 0.05
DBP	67±11		69±8		> 0.05
Variables	N	%	N	%	P
Parity	Nullipara		20	25	> 0.05
	Multipara		60	75	
Hist. Oral contraceptive	8	10	3	15	> 0.05
HTN	0	0	0	0	> 0.05
DM	0	0	0	0	> 0.05
Smoking	0	0	0	0	> 0.05
Dyslipidemia	0	0	0	0	> 0.05

**Table (2): The changes in the lipid profile during pregnancy and after delivery in the study population.**

Variables	Total chol.	LDL-C	HDL-C	VLDL-C	Total TG
	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD
Nonpregnant	190.7 ± 11.3	122.6 ± 15.2	45 ± 10.1	24.1 ± 2.3	129.7 ± 11.8
1 <sup>st</sup> trimester	196±18	119± 9	42.9± 14	23±4	138±10
P	> 0.05	> 0.05	> 0.05	> 0.05	<0.05
2 <sup>nd</sup> trimester	216 ±19.3	123.5±11.5	42.8±15.4	23.5±3.8	200±11
P	< 0.05	< 0.05	> 0.05	> 0.05	<0.05
3 <sup>rd</sup> trimester	243±13.5	111.9±11.9	57.9±23.1	27.3± 1.9	295 ±53.1
P	< 0.05	< 0.05	< 0.05	<0.05	<0.05
Postpartum	187.1±19.3	112.6±13.8	48.6±25	11.3±5	211.1±39.8
P	< 0.05	< 0.05	< 0.05	<0.05	<0.05

## DISCUSSION

In this study, the total cholesterol level increased significantly in the 2<sup>nd</sup> and 3<sup>rd</sup> trimester, this result is in accordance with **Jayanta et al**,<sup>(10)</sup> Who observed that the concentration of serum total cholesterol, serum triglyceride, HDL cholesterol and LDL cholesterol in normal pregnant women increases with increasing gestational age.

In our study there was significant fall in LDL-C level in 3<sup>rd</sup> trimester of normal pregnancy, this result is in accordance with **Jayanta et al**,<sup>(10)</sup>

which stated that this decrease in LDL-C could be explained by hyperestrogenaemia.

In our study the serum triglycerides level increased starting from the 1<sup>st</sup> trimester with highly significant elevation by the 2<sup>nd</sup> trimester and increased markedly by the 3<sup>rd</sup> trimester. These results are in agreement with **Chiang et al**,<sup>(11)</sup> & **Ray et al**,<sup>(12)</sup> who showed that the most dramatic damage in the lipid profile in normal pregnancy is serum hypertriglyceridemia, which may be as high as two to three folds in the third trimester over the levels in nonpregnant women. The

principle modulator of this hypertriglyceridemia is estrogen as pregnancy is associated with hyperoestrogenaemia. Estrogen induces hepatic biosynthesis of endogenous triglycerides, which is carried by VLDL.<sup>(13)</sup> This process may be also modulated by hyperinsulinism found in pregnancy.<sup>(14)</sup>

This rise in TG, TC, and LDL may be due to an increase in hepatic lipase activity and a decrease in lipoprotein lipase activity. Hepatic lipase is responsible for the increased synthesis of triglycerides at the hepatic level, whereas the decreased activity of lipoprotein lipase is responsible for the decreased catabolism at the adipose tissue level, the net effect of which will be an increase in circulating TGs. The second step of uptake of the remnant chylomicrons by the liver is delayed so it leads to accumulation of TGs in plasma.<sup>(15)</sup>

In our study, the mean value of HDL-C was increased from  $41.9 \pm 14$  to  $57.9 \pm 23.1$  mg/dl about 28.7% higher in the third trimester of normal pregnancy over the nonpregnant women, with statistically significant difference. This result is in accordance with **Jayanta et al,**<sup>(10)</sup> and **Mankuta et al,**<sup>(16)</sup>

In present study, serum VLDL-C level rose significantly ( $P < 0.05$ ) in the third trimester of pregnancy in comparison to non-pregnant women, which is perhaps due to hypertriglyceridemia leading to enhanced entry of VLDL that carries endogenous triglyceride into circulation. These results are in accordance with **Teichmann et al,**<sup>(17)</sup> **& Knopp et al,**<sup>(18)</sup> and **Potter and Netel,**<sup>(19)</sup> whom reported that VLDL-C might rise up to 2.5 folds at term over the pre-pregnancy level.

Finally the return of all lipids profile including total cholesterol, LDL-C, HDL-C, VLDL-C and triglycerides level to normal within 6-12 weeks after delivery indicated that these changes in the lipid profile during pregnancy are due to the hormonal changes that occur with pregnancy.

### CONCLUSION

In conclusion, we have demonstrated that normal pregnancy is associated with raised triglycerides and cholesterol. By the third trimester most women have a lipid profile which would be considered highly atherogenic in the non-pregnant state. Although this represents a transient disturbance which reverts to normal after delivery, the long-term consequences of multiple pregnancies on LDL subfraction and lipid profile are unknown. Further studies are needed to determine if certain women are at increased risk of cardiovascular disease later in life because of

the effects of repeated pregnancy on their lipid profile.

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## تأثير الحمل على صورة دهون الدم في المرأة المصرية

المقدمة:

هناك بعض الأدلة على أنهرمون البروجسترونالذي يزداد بشكل ملحوظي النصفالثاني من الحمل، قد يؤدي إلى إعادة ضبط مركز تنظيم الدهون في الهايبوثلاموس. مما قد يؤدي إلى حدوث زيادة ملحوظة في تركيز الدهون بالدم في أثناء فترة الحمل. كما أن هناك أدلة متضاربة عن وجود علاقة بين تكرار الحمل وخطر الإصابة بأمراض القلب لدى السيدات. وقد اقترح أن حدوث خلل في الدهون أثناء الحمل من الممكن أن يشير إلى السيدات اللاتيمن الممكن إصابتهم بتصلب الشرايين فيما بعد. كم ذكرت بعض الدراسات السابقة أن هناك انخفاض في نسبة الكوليسترولعالي الكثافة (إتش ديال) في أثناء الحمل و التي قد تمتد إلى ١٠ سنواتبعدهالحمل الأول.

الهدف من البحث:

هدفت هذه الدراسة إلى دراسة تأثير الحمل على دهون الدم أثناء الحمل الطبيعي ومتابعته أثناء الأثلث المختلفة للحمل.

المرضى وطرق البحث:

إشتملت هذه الدراسة على ١٠٠ حالة، ٨٠ سيدة حامل و ٢٠ سيدة غير حامل و صحيحة من الناحية المرضية و متطابقة من ناحية السن كمجموعة حاكمة.

تم عمل الاتي لجميع الحالات:

التاريخ المرضي و الفحص الإكلينيكي الكامل ، تخطيط القلب الكهربائي، فحص القلب بالموجات فوق الصوتية (الايكو) للتأكد من عدم وجود أمراض فيالقلب ، صورة كاملة لدهون الدم لكل الحالات و كذلك للمجموعة الحاكمة (بصورة عامة تم عمل صورة دهون الدم بعد صيام الليل و لمدة ١٢ ساعة) و بالنسبة للنساء الحوامل تم عمل صورة الدهون في منتصف كل ثلث من أثلث الحمل المختلفة و من ٦ إلى ١٢ أسبوع بعد الولادة.

النتائج:

أظهرت النتائج أن الكوليسترول الكلي و الدهون الثلاثية زادت زيادة ذات دلالة احصائية مرورا من الثلث الاول إلى الثلث الثاني للحمل مع حدوث زيادة ملحوظة في الثلث الثالث للحمل و بعد الولادة كان هناك انخفاض ذو دلالة احصائية كبيرة في كل منهما.

(الكوليسترول الكلي تغير من  $196 \pm 18$  ملغ/دل الى  $216 \pm 19,3$  ملغ/دل ثم إلى  $243 \pm 13,5$  ملغ/دل على التوالي و بعد الحمل هبط إلى  $187,1 \pm 19,3$  ملغ/دل)

- الكوليسترول منخفض الكثافة (إل دي إل) و الكوليسترول عالي الكثافة (إتش دي إل) و الكوليسترول منخفض الكثافة جدا (في إل دي إل) جميعهم تغير تغيرا بسيطا مرورا من الثلث الاول إلى الثلث الثاني للحمل. مع حدوث زيادة اضافية ذات دلالة احصائية في الثلث الثالث للحمل. و بعد الحمل كان هناك انخفاض كبير الى مستوى الثلث الاول للحمل أو أقل منه.

(إل دي إل كوليسترول: تغير من  $119 \pm 9$  ملغ/دل إلى  $111,9 \pm 11,5$  ملغ/دل ثم إلى  $123,5 \pm 11,9$  ملغ/دل على التوالي و بعد الحمل انخفض إلى  $112,6 \pm 13,8$  ملغ/دل).

(إتش دي إل كوليسترول: تغير من  $41,9 \pm 14$  ملغ/دل إلى  $42,8 \pm 15,4$  ملغ/دل ثم إلى  $57,9 \pm 23,1$  ملغ/دل على التوالي و بعد الولادة تغير إلى  $48,6 \pm 5$  ملغ/دل).

الخلاصة:

خلصت هذه الدراسة إلى أن الحمل الطبيعي يكون مصحوب بزيادة في دهون الدم (الكوليسترول و الدهون الثلاثية) و أنه في الثلث الثالث و الاخير من الحمل تكون صورة دهون الدم مرتفعة بدرجة كبيرة و التي من الممكن اعتبارها مرضية و من الممكن أن تؤدي إلى تصلب الشرايين في غير أوقات الحمل، غير أن هذه التغيرات مؤقتة و تنتهي بانتهاء الحمل. إلا أنه ليس من المعروف مدى تأثير ارتفاع الدهون في أثناء الحمل على صحة النساء خاصة مع تكرار الحمل لمرات عديدة و متتاليه مما قد يؤدي إلى ارتفاع الدهون لفترة طويلة قد تؤدي إلى حدوث تصلب الشرايين. إلا أن هذه النقطة تحتاج إلى دراسة أكبر.