A cross sectional observational study to determine the baseline lipid profile in the first, second and third trimester among pregnant women of North India

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Abstract

Aim: To evaluate Lipid profile of pregnant women during all the three trimesters of pregnancy.

Materials and Methods: This prospective observational cross sectional study was conducted in the Department of Obstetrics and Gynaecology, Rajindra Hospital, Patiala in 1000 women attending antenatal clinic and labor room. Their lipid profile was done and proportion of dyslipidemia during pregnancy was recorded. Samples from all subjects were collected under aseptic precaution; 5 ml of non-fasting venous blood was collected in plain vacutainer from antecubital vein. After the clot retracts the sample was centrifuged at 4000 rpm for 5 min the serum separated and stored at 4°C pending assay for lipid profile. Serum TGs, TC, and HDL cholesterol was analyzed by enzymatic methods with the help of Glaxo kits on ERBA Chem-5 plus semi-auto analyzer in the department of biochemistry, GMC, Rajindra hospital Patiala.

Results: Out of 1000 patients, 5.6% patients were from <20 years age groups, 31.6% patients were from 20-25 years age groups, 35.7% patients were from 25-30 years age group, 20.9% patients were from 30-35 years age group and 6.2% patients were from >35 years age group. 20.5% patients came from rural area and 79.5% from urban area. The mean cholesterol levels in first second and third trimester were 187.86 mg/dl, 252.36 mg/dl and 294.43 mg/dl respectively showing significant rise in levels of TC with subsequent trimester. The mean TG levels in one, second and third trimester were 142.2 mg/dl, 252.33 mg/dl and 309.97 mg/dl respectively showing a significant rise in levels with subsequent trimester. The mean HDL levels in one, second and third trimester were 53.78 mg/dl, 57.12 mg/dl and 54.07 mg/dl respectively. Levels rise in 2nd trimester and there is significant fall in values between 2nd and 3rd trimester. The mean LDL levels in one, second and third trimester were 105.6 mg/dl, 144.8 mg/dl and 178.4 mg/dl respectively. Values increases with subsequent trimesters. The mean VLDL levels in one, second and third trimester were 28.4 mg/dl, 48.5 mg/dl and 57.6 mg/dl respectively showing

significant rise in levels with subsequent trimester. The mean TG/HDL ratio in one, second and third trimester was 0.16 mg/dl, 0.68 mg/dl and 1.73 mg/dl respectively.

Conclusion: After three months of pregnancy, there was a substantial increase in total cholesterol, triglyceride level, HDL, LDL, VLDL and TG/HDL ratio in the serum. Values of HDL rises in 2nd trimester and there is seen a decline in 3rd trimester.

Keywords: Lipid profile, trimester, pregnancy

Introduction

Pregnancy is a unique physiological condition with enumerous adaptations of various organ systems for support of developing foetus. All these system changes are required for providing adequate feto-placental circulation and indirectly, fetal circulation and wellbeing.

To meet the needs of the developing foetus and placenta, a pregnant woman's body undergoes several metabolic changes. Findings suggest that maternal basal metabolic rate by the third trimester increases approximately 20% compared with the nonpregnant state.[1]With increasing basal metabolic rate, energy expenditure also increases, despite that women acquire fat mass during pregnancy.[2]

Pregnancy results in physiological changes which can result in a naturally transient hyperlipidemic and hyperglycemic state. Hyperlipidemia or elevated blood lipid levels is of concern because of its associations with metabolic syndromes, a complex collection of metabolic disorders including obesity, hypertension, hyperlipidemia, insulin resistance and elevated glucose concentrations. Metabolic syndrome is known to increase an individual future risk of cardiovascular disorders.

Gestational hyperlipidemia is associated with metabolic morbidities such as obesity[3] and gestational diabetes and is a risk factor for acute pancreatitis,[4] preeclampsia[5] and preterm birth.[6] Hypertriglyceridemia at the end of gestation is associated with the development of dyslipidemia in the postpartum decades and the offspring is at greater risk of being born large for gestational age and develop atherosclerosis in adult life.[7,8]

Increased level of maternal Total cholesterol and triglyceride levels are associated with increased morbidity and mortality in both mother and fetus and level varies as per different trimester Therefore the present study was conducted with the aim to evaluate Lipid profile of pregnant women during all the three trimesters of pregnancy.

Materials and Methods

This prospective observational cross sectional study was conducted in the Department of Obstetrics and Gynaecology, Rajindra Hospital, Patiala in 1000 women attending antenatal clinic and labor room. Their lipid profile was done and proportion of dyslipidemia during pregnancy was recorded.

Inclusion criteria

1.   Pregnant women with singleton pregnancy.
2.   Pregnancy confirmed with LMP or USG.

3.   Females were taken between age group 18-45 years.

Exclusion criteria

1.   Family and personal history of dyslipidemia.

2.   Pregnant women with gestational diabetes mellitus, hypertension, smoking, alcoholism, and women with other diseases that may affect the lipid levels in body.

3.   Adolescents and women over 45 years of age because these may lead to high-risk pregnancy.

4.   Those using lipid altering medication (e.g. antiepileptic drugs, steroids, insulin, antidepressants, or sleep medication).

5.   Metabolic syndrome

Sample size estimation

Following formulae was used for sample size calculation

n = N*X/ (X+N-1)

$$\text{Where } X = Z_{\alpha/2}{}^2 x\ p\ x\ (1-p)/d^2,$$

And $Z_{a/2}$ is the critical value of the normal distribution at a/2 (e.g. for a confidence level of 95%, a is 0.05 and the critical value is 1.96), d is the margin of error, p is sample proportion and N is population size.

From different studies the hypothesized presence of dyslipidemia among the general population is 15-30%.[9] So we take the upper limit of 30% as hypothesized outcome factor. We have kept confidence limit as percentage of 100 and margin of error taken to be 2% for this study. Using this formula sample size was at 95% confidence limit = 979. By rounding off the above estimated sample size, for the study sample size was taken as 1000.

Sampling method:

1. To Randomize the study sample, first 5 cases who fulfilled the inclusion criteria and were reported daily in OPD and 2 cases in labor room were enrolled till the sample size of 1000 were achieved.

2. Informed consent was obtained from all the participants after explaining them the purpose of the study.

3. All cases were followed till immediate post-partum period.

Sample Collection and Analysis:

Samples from all subjects were collected under aseptic precaution; 5 ml of non-fasting venous blood was collected in plain vacutainer from antecubital vein. After the clot retracts the sample was centrifuged at 4000 rpm for 5 min the serum separated and stored at 4°C pending assay for lipid profile. Serum TGs, TC, and HDL cholesterol was analyzed by enzymatic methods with the help of Glaxo kits on ERBA Chem-5 plus semi-auto analyzer in the department of biochemistry, GMC, Rajindra hospital Patiala.

Following values were considered in pregnant patient for normal lipid profile[10,11]

	Non-pregnant adult	1st trimester	2nd trimester	3rd trimester
Total Cholestrol	<200	141-210	176-299	219-349
HDL (mg/dl)	40-60	40-78	52-87	48-87
LDL (mg/dl)	<100	60-153	77-184	101-224
TG (mg/dl)	<150	40-159	75-382	131-453

In our study, hyperlipidemia is considered when[10,11]

	Non-pregnant Adult	1st Trimester	2nd Trimester	3rd Trimester
Total- Cholestrol (mg/dl)	>210	>299	>349	>210
HDL-Cholestrol (mg/dl)	>78	>87	>87	>78
LDL-Cholestrol (mg/dl)	>153	>184	>224	>153
Triglyceride (mg/dl)	>159	>382	>453	>159

Statistical analysis

The data collected and analyzed using Microsoft excels software version 2019 and epi info CDC atlanta version 7.2.4.0. Chi- square test, Mann Whitney test and Krushkal Wallis test were used for assessment of level of significance. P-value of less than 0.05 was taken as significant.

Results

Table 1: Demographic profile of the study population

Variables	Frequency	%age
Age groups		
< 20 years	56	5.60
20-25 years	316	31.60
25-30 years	357	35.70
30-35 years	209	20.90
35 years & more	62	6.20
Area		
Rural	205	20.50
Urban	795	79.50
Parity Status		
Multiparous	638	63.80
Primigravida	362	36.20

Educational Status		
Illiterate	167	16.70
Literate	833	83.30
Diet		
Non-Vegetarian	300	30.00
Vegetarian	700	70.00
TOTAL	**1000**	**100.00**

Out of 1000 patients, 5.6% patients were from <20 years age groups, 31.6% patients were from 20-25 years age groups, 35.7% patients were from 25-30 years age group, 20.9% patients were from 30-35 years age group and 6.2% patients were from >35 years age group. 20.5% patients came from rural area and 79.5% from urban area. There were36.20% primigravidaand 63.80% multiparous female. Total 16.70% patients were illiterate and 83.30% patients were literate. Out of 1000, Total 30% patients were Non-Vegetarian and 70% patients were Vegetarian.

Table 2: Trimester wise comparison of different components of Lipid profile

Lipid Profile	Obs	Total	Mean	Var	Std Dev	Min	25%	Median	75%	Max	Mode
Total Cholesterol mg/dl											
1st Trimester	210	39450	187.86	622.47	24.95	127	168	188.5	207	256	201
2nd Trimester	279	70409	252.36	2541.04	50.41	168	216	247	292	392	221
3rd Trimester	511	150456	294.43	3557.76	59.65	185	244	267	351	482	267
p-value	0.001 (Sig.)										
Triglycerides mg/dl											
1st Trimester	210	29861	142.20	2330.22	48.27	54	114	136	154	299	136
2nd Trimester	279	70401	252.33	10028.15	100.14	87	171	228	313	493	188
3rd Trimester	511	158393	309.97	17988.12	134.12	93	205	274	400	599	301
p-value	0.001 (Sig.)										
High Density Lipoproteins mg/dl											
1st Trimester	210	11293.9	53.78	71.90	8.48	31	48	54	60	71	52
2nd Trimester	279	15937	57.12	54.91	7.41	38	52	55	62	74	52
3rd Trimester	511	27627.4	54.07	110.47	10.51	29	49	53	61	70	53
p-value	0.001 (Sig.)										
Low Density Lipoproteins mg/dl											
1st Trimester	210	22183.9	105.6	597.5	24.4	33	89.6	103.5	122.8	163.6	84.2
2nd Trimester	279	40391.8	144.8	2596.5	51.0	28.4	107.2	144.4	180	299	102.6

3rd Trimester	511	91150.0	178.4	3810.1	61.7	44.4	134.4	167.6	229.4	391.6	119.8
p-value	0.001 (Sig.)										
Very Low Density Lipoproteins mg/dl											
1st Trimester	210.0	5972.2	28.4	93.2	9.7	10.8	22.8	27.2	30.8	59.8	27.2
2nd Trimester	279.0	13540.7	48.5	287.6	17.0	17.4	34.2	45.6	62.6	81.8	37.6
3rd Trimester	511.0	29446.9	57.6	408.2	20.2	18.6	41.0	54.8	74.5	99.4	60.2
p-value	0.001 (Sig.)										
TG/HDL ratio											
1st Trimester	246.61	1.17	0.16	0.39	0.42	0.94	1.07	1.37	2.78	1.58	246.61
2nd Trimester	547.84	1.96	0.68	0.83	0.71	1.32	1.76	2.53	4.48	1.76	547.84
3rd Trimester	1337.19	2.62	1.73	1.32	0.78	1.65	2.25	3.47	8.50	3.59	1337.19
p-value	0.001 (Sig.)										

Test applied: Krushkal Wallis test

The mean cholesterol levels in first second and third trimester were 187.86 mg/dl, 252.36 mg/dl and 294.43 mg/dl respectively showing significant rise in levels of TC with subsequent trimester.

The mean TG levels in one, second and third trimester were 142.2 mg/dl, 252.33 mg/dl and 309.97 mg/dl respectively showing a significant rise in levels with subsequent trimester.

The mean HDL levels in one, second and third trimester were 53.78 mg/dl, 57.12 mg/dl and 54.07 mg/dl respectively. Levels rise in 2nd trimester and there is significant fall in values between 2nd and 3rd trimester.

The mean LDL levels in one, second and third trimester were 105.6 mg/dl, 144.8 mg/dl and 178.4 mg/dl respectively. Values increases with subsequent trimesters.

The mean VLDL levels in one, second and third trimester were 28.4 mg/dl, 48.5 mg/dl and 57.6 mg/dl respectively showing significant rise in levels with subsequent trimester.

The mean TG/HDL ratio in one, second and third trimester was 0.16 mg/dl, 0.68 mg/dl and 1.73 mg/dl respectively.

Discussion

During pregnancy there are profound improvements in the anatomy and physiology of almost every organ system. These adjustments start to occur during the conception process and proceed through the entirety of pregnancy. These improvements arise in order to make maternal and foetal needs more convenient.

The physiology of maternal metabolism is particularly affected by placental hormones during the last trimester of pregnancy. The difference in hormone levels changes the way the body regulates glucose and lipid metabolism, which must be done in order to help the developing foetus.[12] Additionally, elevated levels of progesterone, estrogen, hPL, hPGH, inflammatory mediators etc induces insulin resistance because of the alteration in insulin signalling pathway. Increased Insulin resistance comes with a higher incidence of dyslipidemia.[13]

In our sample, after three months of pregnancy, there was a substantial increase in total cholesterol, triglyceride level, HDL, LDL, VLDL and TG/HDL ratio in the serum. This research confirms previous findings by Parchwani [1] and Patel [2]. (2011)[14] et al & Pusukuru R (2016)[15] et al. in a clinical research conducted by Lippi G (2007)[16] et al., a comprehensive lipid and lipoprotein profile was evaluated in 57 women at different gestational ages (20 in first, 20 in second and 17 in third trimesters, respectively). They found that all the lipid parameters during the second and third trimester were substantially different from the corresponding female non-pregnant controls, as well as the values in the first trimester which is in support of our study which showed significant increase in value of lipoproteins in second and third trimester.

In a clinical study by Jamil ATT (2013)[17] et al., a total of 115 pregnant women at different stages of pregnancy were included in the study, with 35 age-matched, healthy, non-pregnant women selected as control. They discovered that the concentrations of total cholesterol and triglycerides in pregnant and non-pregnant women were both largely the same and low-density lipoprotein was capable of lowering high-density lipoproteins. While the results seen in our study showed mean TG levels in one, second and third trimester were 142.2 mg/dl, 252.33 mg/dl and 309.97 mg/dl respectively, which is a significant increase as compared to non pregnant values, similar changes were seen with TC, while there is rising trend in value of LDL in subsequent trimester, values of HDL rises in 2nd trimester and there is seen a decline in 3rd trimester in our study.

A study was done on 160 women {120 pregnant women during normal gestation (40 women in each trimester) and 40 non-pregnant, healthy women as control} by Okojie FO (2011)[18] et al., to achieve a serum concentration of total cholesterol, HDL, LDL and triglycerides. During the first, second and third trimesters, the baseline levels of total cholesterol, high density lipoprotein and triglycerides were significantly higher than those of the control subjects which is in support of our study However, the decline in low density lipoprotein levels was substantial during the first trimester but not significant in the second or third trimester. Analysis of the serum concentrations of total cholesterol, triglycerides, and low density lipoproteins showed that during the second and third trimesters, the concentrations were higher than in the first trimester. Levels of high density lipoprotein (HDL) did not improve in the first trimester, but levels increased later on. While in our study mean value of HDL rises in 2nd trimester and there is a decline seen in 3rd trimester.

Conclusion

The present study was conducted to determine baseline lipid parameters in the first, second and third trimester among pregnant women in India. The findings of this research concluded that after three months of pregnancy, there was a substantial increase in total cholesterol, triglyceride level, HDL, LDL, VLDL and TG/HDL ratio in the serum. Values of HDL rises in 2nd trimester and there is seen a decline in 3rd trimester.

Recommendations

Measures should be taken to avoid lipid profiles in pregnant women and dyslipidemia. It is recommended that dyslipidemic mothers receive recommended nutritional, exercise, and lifestyle adjustments to help avoid complications in the mother and infant. Since hypertriglyceridemia is a risk factor for Pre-eclampsia, GDM and preterm, it is strongly recommended that patients have a

lipid profile during pregnancy so as to institute prompt management strategies to protect against the deleterious effects of hyperlipidemia associated with pregnancy.

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