Journal of Cardiovascular Disease Research

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 06, 2023

Original research article

Maternal lipid profile and adverse pregnancy outcome: A cohort study

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Abstract

Background: Elevated lipid levels during late pregnancy are associated with complications and adverse outcome for both mother and newborn. However, it is inconclusive whether a disturbed lipid profile during early pregnancy has similar negative associations.

Aim: To evaluate the association of altered lipid levels and development of adverse maternal and fetal outcomes.

Materials and methods: This is a Cohort study conducted in the Department of Obstetrics and Gynecology, in a Tertiary Care Teaching Hospital, Central India. Women attending outpatient department (OPD), antenatal care (ANC) and in patient department (IPD) in our hospital during the period of study were included. History clinical examination and all relevant investigation were done. All data were calculated and analyzed statistically.

Result: Mean age of pregnant women in the study group was 24.89 ± 3.12 years, whereas in the control group, it was 24.72 ± 3.76 years. The levels of total cholesterol, triglycerides (TG), low density lipoprotein (LDL) and VLDL were significantly high in women who developed gestational diabetes mellitus (GDM) and preeclampsia as compared to those who did not develop GDM and preeclampsia (p<0.001). The levels of total cholesterol, TG, LDL and VLDL in women who developed preterm labor were found to be significantly high in women who developed preterm labor (p<0.01) as compared to women who did not have PTL. Women who developed small for gestational age (SGA) had statistically significant high levels of total cholesterol, TG, LDL and VLDL (p<0.05). The levels of total cholesterol, TG, LDL, VLDL, in women who developed macrosomia were not statistically significant when the two groups were compared (p>0.05).

Conclusion: It was seen that third trimester maternal dyslipidemia is associated with various maternal and fetal complications such as gestational diabetes mellitus, preeclampsia, IHCP, preterm labor and SGA babies.

Keywords: Gestational diabetes mellitus, lipid profile, pregnancy outcome, preeclampsia, SGA babies

Introduction

Pregnancy is a physiological state in which there is an alteration in lipid levels. There is accumulation of TG-rich remnants in maternal circulation due to reduced lipolysis of TG-rich lipoproteins, reduced uptake by the placental tissue and concomitant decrease in lipoprotein lipolysis [1]. During pregnancy there is an increased levels of both TG and TC, which are essential for the development of fetus [2-5]; however, high levels are associated with adverse outcomes like gestational diabetes mellitus, preterm labor [6], pregnancy-induced hypertension (PIH) [7, 8], large for gestational age babies [9-11]. Conversely decreased level of total cholesterol is associated with SGA babies [12, 13]. These may have a long-term impact on the health of the baby and mother.

Adverse pregnancy outcomes have serious consequences (e.g. increased perinatal morbidity and mortality of mother and child) in the short term and also increase the manifestation of disease later in life. For instance, preterm delivery and being born small for gestational age (SGA) or large for gestational age (LGA) are associated with increased risk for type 2 diabetes cardiovascular diseases, and hypertension at adult age. Although obstetric care has improved, pregnancy complications and perinatal morbidity are still present in Western societies. Therefore, it is of clinical and economic importance to

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 06, 2023

prevent adverse pregnancy outcomes by exploring causal factors for these outcomes [14-15].
Previous researches have shown that pregnancy-induced hyperlipidemia contributes to increased occurrence of gestational diabetes mellitus and preeclampsia. Despite this, there are still controversies on the relationship between maternal lipid disturbances and pregnancy complications and perinatal outcomes. So, the present cohort study was undertaken to explore the association between dyslipidemia in pregnancy and its adverse pregnancy outcome.
In this study, we aim to evaluate the association of lipid profile and development of GDM, preeclampsia, preterm labor, IHCP, and adverse fetal outcome in the form of SGA, macrosomia, NICU admission, and stillbirth.

Material and Methods
The present study was conducted on women attending OPD, ANC, and IPD of the Department of Obstetrics and Gynecology, in a Tertiary Care Teaching Hospital, Central India. Informed consent was obtained from all the women. The study was prospective cohort type.

Inclusions criteria
- All pregnant females beyond 28weeks of pregnancy.
- Naturally conceived.
- Singleton pregnancy.

Exclusion criteria
- Multiple pregnancies.
- Diabetes mellitus.
- Inherited metabolic disease thyroid disease before pregnancy.
- Coronary artery disease.
- Chronic obstructive pulmonary disease.

Women were divided into two groups: Study group -100 women having deranged lipid profile; control group -100 women having normal lipid profile.
After informed consent, all women underwent routine investigations, GST with 75 gm glucose and lipid profile. Venous blood samples were taken after overnight fasting for the estimation of lipids. Normal lipid profile included total cholesterol <200 mg%, TG <150 mg%, high density lipoprotein (HDL) 30-70 mg%, LDL<100 mg% and VLDL 2-30 mg%.
To diagnose GDM, we followed Diabetes in Pregnancy Study Group of India (DIPSI) criteria where all pregnant women beyond 28 weeks of gestation were given 75 gm of glucose with 200-300 mL of water irrespective of last meal. Venous sugar level was recorded after 2 hours, a value of >140 mg% was assigned as GDM. Pregnancy-induced hypertension was diagnosed with a systolic BP of 140 mm Hg or more and diastolic BP of 90 mm Hg or more on two occasions 4 hours apart. Preterm labor was diagnosed with the onset of painful uterine contractions before 37 weeks of pregnancy with cervical dilatation and effacement.

Statistical analysis: All data were analyses by using SSPS version 20. Chi-square test and student t-test was done. P-value<0.05 considered as statistically significant.

Observation and Results
Total of 200 pregnant women fulfilling all inclusion criteria were enrolled in our study.
The mean age of pregnant women in the study group was 24.89 ± 3.12 years, whereas in the control group, it was 24.72 ± 3.76 years.
The increase in total cholesterol, TG, LDL, and VLDL was statistically significant (p <0.01) when the groups were compared while there was no statistically significant difference in HDL levels when the groups were compared (p>0.05) (Table 1).

Table 1: Comparison of lipid profile of women with GDM versus women without GDM in study group

		GDM			
Sl. No.		**Yes**	**No**	**t-value**	**p-value**
1.	Total Cholesterol	313.10 ± 27.77	281.11 ± 47.49	2.884	p<0.01
2.	Triglyceride	245.20 ± 19.77	205.37 ± 42.63	4.058	p<0.001
3.	HDL	39.50 ± 5.79	40.41 ± 5.91	−0.619	p>0.05
4.	LDL	128.40 ± 8.38	120.55 ± 12.33	2.689	p<0.01
5.	VLDL	59.15 ± 3.28	51.07 ± 11.40	3.123	p<0.01

GDM, gestational diabetes mellitus; HDL, high density lipoprotein; LDL, low density lipoprotein
The increase in HDL and LDL was statistically not significant when the two groups were compared (p>0.05). The increase in total cholesterol, TG and VLDL was statistically significant when the two

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 06, 2023

groups were compared (p<0.05) (Table 2).

Table 2: Comparison of lipid profile of women who developed preeclampsia vs who did not develop preeclampsia in the study group

Preeclampsia					
Sl. No.	**Lipid profile**	**Yes**	**No**	**t-value**	**p-value**
1	Total Cholesterol	320.15±33.95	282.63 ± 45.68	2.841	p <0.01
2	Triglyceride	243.23± 32.34	208.87 ± 41.83	2.833	p <0.01
3	HDL	42.30 ± 5.76	39.91 ± 5.86	1.373	p >0.05
4	LDL	127.76 ± 7.38	121.27 ± 7.38	1.836	p >0.05
5	VLDL	59.15 ± 5.41	51.72 ± 11.07	2.369	p <0.05

HDL, high density lipoprotein; LDL, low density lipoprotein

The increase in total cholesterol, TG, LDL and VLDL was statistically significant when the two groups were compared (p<0.01) while there was no statistically significant difference in HDL levels when the groups were compared (p<0.05) (Table 3).

Table 3: Comparison of lipid profile of women who developed preterm labor vs who did not develop preterm labor in study group

Preterm labour					
Sl. No.	**lipid profile**	**Yes**	**No**	**t-value**	**p-value**
1	Total Cholesterol	324.33 ± 21.48	282.48 ± 46.19	3.082	p <0.01
2	Triglyceride	251.25 ± 19.93	208.17 ± 41.85	3.5	p <0.01
3	HDL	40.75 ± 4.24	40.15 ± 6.08	0.325	p >0.05
4	LDL	131.08 ± 8.12	120.89 ± 11.99	2.847	p <0.01
5	VLDL	61.75 ± 2.76	51.45 ± 10.89	3.247	p <0.01

HDL, high density lipoprotein; LDL, low density lipoprotein

The increase in total cholesterol, TG, LDL, VLDL, and HDL, was statistically significant when the two groups were compared (p <0.001) (Table 4).

Table 4: Comparison of lipid profile of women who developed IHCP vs who did not develop IHCP in the study group

IHCP					
Sl. No.		**Yes**	**No**	**t-value**	**p-value**
1.	Total Cholesterol	321.03 ± 15.11	273.81 ± 47.34	5.248	p<0.001
2.	Triglyceride	238.24 ± 19.87	203.16 ± 44.72	4.054	p<0.001
3.	HDL	36.93 ± 5.24	41.57 ± 5.61	−3.87	p<0.001
4.	LDL	129.34 ± 9.57	119.16 ± 11.73	4.136	p<0.001
5.	VLDL	60.20 ± 3.12	49.61 ± 11.30	4.954	p<0.001

IHCP, intrahepatic cholestasis of pregnancy; LDL, low density lipoprotein

The increase in total cholesterol, TG, LDL, VLDL and HDL was not statistically significant when the two groups were compared (p>0.05) (Table 5).

Table 5: Comparison of lipid profile of women who developed macrosomia in fetus vs who did not develop macrosomia in the study group

Macrosomia					
Sl. No.		**Yes**	**No**	**t-value**	**p-value**
1.	Total Cholesterol	321.00 ± 18.38	286.82 ± 46.15	1.041	p >0.05
2.	Triglyceride	230.50 ± 10.60	212.98 ± 42.55	0.579	p >0.05
3.	HDL	43.50 ± 7.77	40.16 ± 5.86	0.793	p >0.05
4.	LDL	43.50 ± 7.77	121.93 ± 12.06	1.054	p >0.05
5.	VLDL	60.00 ± 4.24	52.54 ± 10.84	0.968	p >0.05

HDL, high density lipoprotein; LDL, low density lipoprotein

The increase in total cholesterol, LDL and VLDL as compared with women who did not develop SGA and the difference was found to be statistically significant (p<0.05) (Table 6).

Table 6: Comparison of lipid profile of women who developed SGA vs who did not develop SGA in study group

SGA					
Sl. No.		**Yes**	**No**	**t-value**	**p-value**
1.	Total Cholesterol	317.75 ± 22.03	284.88 ± 46.63	1.968	p <0.05

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 06, 2023

2.	Triglyceride	229.37 ± 30.64	211.94 ± 42.91	1.122	p >0.05
3.	HDL	43.62 ± 7.65	39.93 ± 5.65	1.72	p >0.05
4.	LDL	130.37 ± 7.72	121.40 ± 12.10	2.055	p <0.05
5.	VLDL	60.62 ± 1.76	52.00 ± 10.97	2.211	p <0.05

HDL, high density lipoprotein; LDL, low density lipoprotein; SGA, small for gestational age

Discussion

Certain physiological changes during pregnancy, including lipid metabolism, support fetal growth and development. The accumulation of adipose cells in the tissues and hepatic lipid synthesis increases and this physiological adaptation is associated with changes in lipid profile during pregnancy. There is increased concentration of TC, TG, LDL-C and decrease in HDL-C during normal pregnancy. Accumulation of lipids in maternal tissues and the development of maternal hyperlipidemia occur in pregnancy. In some cases, a maladaptation occurs and these levels increase over the physiological range leading to dyslipidemia which causes complications like preeclampsia, GDM and preterm labor.

Our study showed results in consistence with the studies done by Jin *et al*., Abdu Helmy *et al*., and Sharami *et al*. [16-18] where there was significant association between GDM, preeclampsia, preterm labor, and IHCP and deranged lipids. Studies done by Anuradha *et al*., Singh *et al*., and Shen *et al*. [19-20] have also shown the positive correlation between dyslipidemia and preeclampsia.

As regard to fetal outcome, studies done by Abdu Helmy *et al*., Sharami *et al*., and Jin *et al*. showed the positive correlation between the deranged lipids and the occurrence of macrosomia and SGA.

The observation that TG levels measured in the first trimester are associated with complications in pregnancy for both mother and child is intriguing. In fact, most reports mainly focused on maternal lipid profiles in late pregnancy, stating that circulating lipids exert a direct harmful effect on the endothelium of placental vasculature. Increasing evidence suggests that elevated plasma lipids, including TG or its related remnants, may induce endothelial dysfunction [21-22].

Conclusion

We conclude from this study that maternal dyslipidemia is associated with various maternal and fetal complications such as gestational diabetes mellitus, preeclampsia, IHCP, preterm labor, and SGA babies. So evaluation of lipid profile during second and third trimesters can predict these pregnancy-associated complications which helps in counseling the pregnant women to have a modified life style with increased physical activities, dietary modifications, and timely interventions when required as the treatment of hyperlipidemia is a challenging issue because most of the drugs used for the treatment of dyslipidemia belong to category C or X.

Conflicts of interest: None.

Source of funding: None.

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