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Original article

CORRELATION BETWEEN MATERNAL DYSLIPIDEMIA AND PRETERM DELIVERY IN TERTIARY CARE CENTRE- A CLINICAL STUDY.

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ABSTRACT

Background:

Pregnancy is the physiological process in a woman's reproductive life. Though all pregnancies carry a risk, almost all pregnancies go uneventfully. In normal pregnancy, as the gestation advances, there is a physiological rise in triglycerides and cholesterol. Hypertriglyceridemia and hypercholesterolemia are markers of preterm labor, as atherosis of uteroplacental spiral arteries can result in preterm labor.

Aims & objectives:

To evaluate the correlation of increased levels of fats in uncomplicated gestation with preterm delivery

Materials & methods:

An observational study was conducted prospectively in the Department of Obstetrics & Gynaecology in Sree Balaji Medical College & Hospital, Chennai from Jan 2021 to July 2022, which included all Antenatal women between 14 to 32 weeks with no complications and who are planning to deliver in SBMCH.

Results:

Out of 290 Pregnant Women, 90.7% delivered at full term, whereas 9.3% had preterm deliveries. 12% had high serum cholesterol levels & 7.5% of them had hypertriglyceridemia. In this study, women who had preterm deliveries had elevated levels of lipids such as LDL and triglycerides, which is statistically significant.

Conclusion:

Early births are connected with high neonatal and infant mortality. According to statistical analysis of this study, women with intermediate or higher total, LDL, and triglyceride levels were more likely to deliver before 37 weeks of gestation than those with normal lipid profiles. Pregnancy dyslipidemia was also linked to BMI > 25 kg/m2 and advanced age.

Recommendation:

Based on these observations, we could recommend routine lipid profile assessment and management of dyslipidemia during pregnancy and in those planning to conceive, especially in relatively older women and those with obesity.

Keywords: Hypertriglyceridemia, Hypercholesterolemia, Predictor, Preterm Delivery
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INTRODUCTION

Gestation is a unique physiological experience for every female. Although the majority of pregnancies are uneventful, all pregnancies carry a risk [1]. With advances in obstetrics rapid advancement in all specialties has occurred, but still, management of labor before the completion of the term is a complex situation for obstetricians.

As per the data of 2019 among the 15 million preterm births, 1 million newborns did not survive [2]. Over 10% of pregnancies result in preterm birth, which has increased the rates of morbidity and mortality among newborns [3]. The mothers who gave birth to preterm infants were found to have lifestyle disorders that affected their metabolism.

One of the main goals of antenatal care is to make sure that the mother completes the term before delivering and that the birth weight of the newborn is optimum as these have effects on the newborn, and mother [4]. Even after the advances in research, the biological cause of preterm birth remains unknown. In Normal pregnancy, the metabolic changes particularly carbohydrate and lipid metabolism increase the glucose and lipids in the blood circulation to nourish the fetus [5]. As the gestation increases the lipid levels in the blood circulation during gestation [6].

Increased lipid synthesis, Insulin Resistance, and estrogen Stimulation that occurs in early trimesters, cause an increase in maternal fat storage [7]. As term advances, the placental lipoprotein lipase typically increases, thereby resulting in hypertriglyceridemia in the later stages of pregnancy. The circulating lipids increase during gestation and an increase in the lipid breakdown of lipids causes enhanced availability of lipids to the fetus. [8]. Inflammation and stress, two major contributors to preterm birth, are induced by hyperlipidemia, which is also linked to endothelial dysfunction [9]. We have assessed increased levels of lipids and their correlation with the delivery before term, so elevated levels of cholesterol and lipids increase the chances of labor before the term.

Aim: **To assess the correlation of increased lipid levels in normal pregnancy with the risk of labor before the term.**

Objectives:

1. To find the prevalence of elevated lipid association (hypercholesterolemia, hypertriglyceridemia, high LDL & high HDL) between 14 to 32 weeks of gestation in uncomplicated pregnancy.
2. To find the incidence of preterm delivery with elevated lipid levels.
3. To study the correlation of raised serum cholesterol and triglycerides with preterm delivery.

MATERIAL AND METHODS

Study design*:*

Prospective observational study design

Study setting:

The present study was conducted between January 2021 and December 2022 at the Department of Obstetrics and Gynecology, Sree Balaji Medical College, Chennai, India.

Participants*:*

A total of 290 individuals participated in the study.
Formula used:
n = Z21-α/2pq
n = 1.96 x 1.96 x 25.3 x 25.3 / 3 x 3
where p is the observed incidence, q = 1 - p, d is the margin of error
Z21-α/2pq is the ordinate of standard normal distribution at α% level of significance

Inclusion criteria:

All antenatal women with uncomplicated pregnancies between 14-32 weeks of gestation who visited the OPD and ward at the Obstetrics and Gynecology department, Sree Balaji Medical College & Hospital, Chennai, were included in the study.

Exclusion criteria:

All complicated pregnancy including:

1. Gestational diabetes mellitus (GDM)
2. Pregnancy induced hypertension (PIH)
3. Previous preterm delivery
4. Multiple pregnancy
5. Abnormal cervix
6. Pre-existing medical diseases
7. Hydramnios
8. Congenital anomalies of fetus
9. Smoking

METHOD OF DATA COLLECTION

A thorough general and obstetric examination was performed after taking a detailed medical history from each of these antenatal mothers, paying particular attention to their diet and lifestyle. Every patient was given a brief

explanation of the reason for the questioning and investigation before giving her informed consent.

General Examination:

Height, weight & BMI, CVS, RS

Obstetric examination:

Per Abdomen Examination, fundal height

Method of sample collection:

After an overnight fast, blood was drawn from each of the antenatal mothers who participated in the study. Between 14 and 32 weeks of pregnancy, the levels of serum cholesterol, triglycerides, LDL, and HDL were measured. Antenatal mothers were then followed for pregnancy outcomes.

Statistical analysis:

The MS Excel 2019 version was used to double-enter the data, and the Epi info 7 and Medcalc programs were used for analysis. Percentages and proportions were used to describe the qualitative variables. Using the histogram and D'Agostino-Pearson test, quantitative data variables were first examined for data normal Quantitative variables are denoted by the term mean. The results were presented in the appropriate charts and tables.

Ethical consideration:

A study was initiated after clearance was taken from the Institutional Ethics Committee (Ref. no.002/SBMCH/IHEC/2020/1425).

RESULTS:

The total number of pregnant candidates engaged in the study was 290. Of these, the majority of women were between the ages of 20-29 years. The average age of the women in the study group was 26 years From the study population, 7.93% of pregnant women were between 14-20 weeks, 10.6% of pregnant women were between 20-24 weeks, majority 66.21% of pregnant women were between 24-28 weeks and 15% of them were between 28-32 weeks. 57.5% of the population was found to be pre-obese category. 3.79% of them in class III obesity 9.3% in class I obesity and 6.8 in class II obesity. Of the 290 study subjects, 80.34% were primigravida, and 19.66 % were multigravida.

88.28% of the pregnant women had <200 level cholesterol, 8.62% of pregnant women were between 200-239 level and 3.1% were above 239 value. 92.41% of the pregnant women were under 150 mg/dl triglycerides, 5.17% were between range of 150-200mg/dl and 2.41% were above 200 value. 90.68% of pregnant women had LDL less than 130, 6.55% were between 130-160 range and 2.76% were above value 160.

Table 1: Demographic Characteristics with Distribution Pattern

Demographic characters	No.(290)	Percentage (%)
AGE (years)		
<20	21	7.24
20-29	204	70.34
30-35	38	13.1
>35	27	9.31
GESTATIONAL AGE (Weeks)		
14-20	23	7.93
20-24	31	10.69
24-28	192	66.21
28-32	44	15.17
OBSTETRIC INDEX		
Primigravida	233	80.34
Multigravida	57	19.66
BMI		
Below 18.5 (Underweight)	7	2.41
18.5-24.9 (Normal)	58	20
25-29.9 (Pre-obesity)	167	57.59
30-34.9 (Obesity Class I)	27	9.31
35-39.9 (Obesity Class II)	20	6.89
Above 40 (Obesity Class III)	11	3.79

Table 2: Population distribution based on lipid level estimation

Lipid Levels (mg/dl)	Frequency (n – 290)	Percentage (%)
Total cholesterol		
<200	256	88.28
200-239	25	8.62
>239	9	3.1
Triglycerides		
<150	268	92.41
150-200	15	5.17
>200	7	2.41
LDL		
<130	263	90.68
130-160	19	6.55
>160	8	2.76

Table 3: Distribution of population based of gestational age at delivery.

	Gestational age (weeks)	n(%)
Preterm Delivery	<28	1 (0.3%)
	28-32	22 (7.6%)
	32-36	4(1.4%)
Term delivery	≥37	263 (90.7%)
	Total	290 (100)

263 (90.7%) of pregnant women had term delivery, 27(9%) had preterm delivery of which, 22 (7.6%) of women delivered between 28-32weeks and 4 (1.4%) of them had PRETERM delivery between 32-36weeks and 1 (0.3%) of them delivered before 28 weeks.

There is statistically significant association between serum cholesterol and outcome of delivery with p-value 0.001. 98% of pregnant women who had TERM delivery had cholesterol level <200 , 22.2% of pregnant women with values above 239 had preterm delivery and 59.25% with values between 200-239 had preterm delivery. Also,

there was significant association between TERM and PRETERM delivery when compared with population serum triglycerides with p-value <0.001. 51.8% of pregnant population with serum TGs 150-200mg/dl had preterm delivery, 22.2% with level above 200 mg/dl had preterm delivery. There was significant association between women delivering term and preterm with p-value 0.028 with raised LDL levels. 66.6% of pregnant women with LDL values between 130-160 had preterm delivery followed by 18.5% with LDL levels above 160 had preterm deliveries.

Table 4: Total Lipids levels and outcome of delivery

Total Lipids (mg/dl)	**Term Delivery n(%)**	**Preterm Delivery n(%)**
Serum Cholesterol		
<200	251(98)	5(18.51)
200-239	9(36)	16(59.25)
Above 239	3(33.33)	6(22.22)
Total	263	27
p-value	**<0.001**	
Serum Triglycerides		
<150	261(97.3)	7(24.13)
150-200	1(6.6)	14 (51.85)
Above 200	1(14.2)	6(22.22)
Total	263	27
p-value	**<0.001**	
LDL		
<130	259(98.4)	4(14.81)
130-160	3(14.2)	18(66.66)
>160	1(16.66))	5(18.5)
Total	263	27
p-value	**0.028**	

Among the 27 preterm neonates, 92.5% (25) required NICU admission, whereas only 3% of term neonates were admitted to NICU. This difference in outcome for neonates was statistically significant

DISCUSSION

Maternal physiology is highly influenced by the placental hormones that affect glucose and lipid metabolism due to increased insulin resistance and plasma lipolytic hormonal concentration. As gestation progresses, serum cholesterol and triglyceride concentrations increase markedly [10]. Triglyceride levels rise due to an increased hepatic lipase activity, leading to enhanced hepatic triglyceride synthesis and decreased lipoprotein lipase activity, resulting in decreased catabolism of adipose tissue. LDL Apolipoproteins A-I, A-II, and B also rise as the pregnancy progresses [11].

The present study was conducted between January 2021 and December 2022 at the Department of Obstetrics and Gynecology, Sree Balaji Medical College, Chennai, to evaluate the changes in serum cholesterol and triglyceride concentrations during pregnancy and to assess its correlation with the incidence of preterm delivery (<37 weeks). The present study was conducted on 290 pregnant women, with a mean age of 26 years and 57% belonged to the Pre-obese category & 20% belonged to the Obese category. 11.7 % had elevated cholesterol levels, 7.5 % had high triglycerides, and 9% had raised LDL levels. Of these, 9.3% had preterm delivery (27 preterm deliveries) and 92.5% (25 neonates) had NICU admissions, and the confidence was statistically significant [12]. This suggests that there may be a relationship between lipid levels during pregnancy and the risk of preterm delivery, highlighting the importance of further research in this area for better maternal and neonatal care.

The study revealed significant associations between serum cholesterol levels and delivery outcomes, with lower cholesterol levels (<200) linked to term deliveries and higher levels (>239) associated with preterm deliveries. A similar pattern was observed for triglyceride levels, where elevated triglycerides (>200 mg/dl) correlated with preterm deliveries. Elevated LDL levels (above 160) also showed a significant association with preterm deliveries.

Smith et al [2] recruited 9162 subjects, where the mean age was 32 years, 44% belonged to the obese category and 14.9% had a preterm delivery, concluding that hypercholesterolemia and hypertriglyceridemia were associated with an increased risk of preterm delivery. Mudd et al [3], a prospective cohort study, included 1309 subjects with a mean age of 20 -30 years, 26% belonged to the obese category & 24.5% had a preterm delivery, concluded high total cholesterol, LDL, Triglycerides increased the risk of preterm delivery. Sowmiya et al. [4] recruited 400 pregnant women, of which 5.75% had a preterm delivery, and concluded that increased cholesterol and triglycerides were associated with higher preterm deliveries. Sumathy et al [6]. included 300 subjects, of which 7.7% had a preterm delivery, concluded that raised total cholesterol had significantly higher preterm deliveries.

Table 5: Comparison of demographic characters with previously done research.

Study	**n**	**Age (years)**	**Obstetric Index**		**BMI**		
			Primi	**Multi**	**Underwt.**	**Pre-obese**	**Obese**
Smith et al. (2)	9162	32.4 (mean)	N/A	N/A	2.1%	27.1%	44%
Mudd et al. (3)	1309	20-30 (57.6%)	41%	59%	3.6%	23.3%	26.1%
Sowmiya et al. (4)	400	22.04	47.5%	52.5%	N/A	N/A	N/A
Present study	290	26;26.38 (median; mean)	80.34%	19.66%	2.4%	57.59%	20%

Table 6: Comparison of gestational parameters with previously done research.

Study	n	Gestational age at sampling (most frequent)	Time of delivery	
			Term	Preterm
Smith et al. (2)	9162	N/A	85.1%	14.9%
Mudd et al. (3)	1309	20-27 weeks (84.8%)	75.5%	24.5%
Sowmiya et al. (4)	400	24-28 weeks (49.25%)	94.25%	5.75%
Sumathy et al. (6)	300	14-24 weeks (100%)	92.3%	7.7%
Present study	290	20-28 weeks (66%)	90.7%	9.3%

CONCLUSION:

During pregnancy, various hormonal, immunologic and metabolic changes exert significant effects, including changes in lipid metabolism. Preterm births have been associated with significant morbidity and mortality in the neonatal and infantile periods. On the statistical analysis of data from this study, we could conclude that women having total serum cholesterol, LDL cholesterol and serum triglyceride levels in intermediate or higher ranges had a higher likelihood of delivering before the completion of 37 weeks of gestation, as compared to those with normal lipid profiles. Dyslipidemia in pregnancy was also significantly associated with BMI > 25 kg/m^2 and advanced age.

LIMITATION

Further large-scale, population-based, longitudinal research is required to assess the maternal and fetal risks associated with dyslipidemia.

RECOMMENDATION

Based on these observations, we could recommend routine lipid profile assessment and management of dyslipidemia during pregnancy and in those planning to conceive, especially in relatively older women and those with obesity.

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LIST OF ABBREVIATION

BMI- Body mass index
LDL- Low density lipid
HDL- High density lipid
NICU- Neonate intensive care unit
GDM- Gestational diabetes mellitus
PIH- Pregnancy induced hypertension

SOURCE OF FUNDING:

The study was not funded.

CONFLICT OF INTEREST:

No conflict of interest was declared by the author

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