

# Dyslipidemia at 12-14 Weeks of Gestation for Predicting Development of Preeclampsia: A Cohort Study

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## Abstract

**Introduction:** Pregnancy is an insulin resistant condition which allows physiological dyslipidemia to occur. This physiological dyslipidemia is essential for allowing fetal growth. However, when dyslipidemia crosses the physiological range, it predisposes the woman to preeclampsia development. Epigenetic reprogramming of the cells in the growing fetus increases the cardiovascular and metabolic complications in the adulthood.

**Material and methods:** 330 antenatal patients were included in the study after matching inclusion and exclusion criteria. Lipid values were tested at 12-14 weeks of gestation and the women were followed up till delivery. Preeclampsia development was noted in women having deranged lipid values.

**Results:** Of 330 antenatal patients enrolled in the study, 104 patients developed preeclampsia. All preeclampsia patients had hyperlipidemia in the 1st trimester.

**Conclusion:** Early, cost-effective detection methods, management and timely delivery by outweighing risks of prematurity in baby and multiorgan failure, eclampsia and ultimately maternal mortality attributed to preeclampsia.

**Keywords:** Preeclampsia, First Trimester Hyperlipidemia, Dyslipidemia, Predicting Preeclampsia.

## Introduction

Pregnancy can be considered as a 'Stress test' for the metabolic and cardiovascular system of the woman's body.<sup>1</sup> The lipid and lipoprotein profile of the mother reflects insulin resistance. Initially, there is an anabolic state which is followed by a catabolic state allowing proper nutrients for the growth of fetus.<sup>2</sup> However, when dyslipidemia crosses the physiological range, it enhances co-morbid intra-uterine conditions like pre-eclampsia (PE). It also has been shown that it contributes in the epigenetic programming of the fetus and the subsequent risk for atherogenesis in mother and her baby.

PE can prove a nightmare to the obstetrician if

not managed well, hence the emphasis is laid on prevention and early diagnosis. PE is known to be a part of the deadly triad along with infection and hemorrhage and accounts for large number of preventable maternal deaths. Uncontrolled PE is known to lead us to eclampsia, abruption, multiorgan failure, fetal growth restriction or even sudden intrauterine death.

Hence, the need of the hour is to detect it early in pregnancy by studying various risk factors responsible for it and try to reduce its complications in mother and fetus, thereby reducing the perinatal and neonatal morbidity and mortality with a hope to reduce its overall burden in the society.

## Materials And Methods

The study was conducted over a period of 2 years between October 2019 to 2021, at a tertiary care hospital, after the institute's ethics committee approval. It is a cohort study and included all ANC patients after matching the inclusion and exclusion criteria and were willing to deliver at this hospital. 330 patients were included in the study.

All ANC patients coming to OPD between 12-14 weeks irrespective of their gravidity and parity and willing to deliver in this hospital were included.

Whereas pregnant women known to have chronic hypertension, BMI >40 kg/m<sup>2</sup>, had undergone bariatric surgery, known to have dyslipidemia or diabetes mellitus were excluded.

Data was collected by interviewing the participants regarding the demographics, menstrual, obstetric history and family history. One step investigation for estimating serum lipid levels was done at 12-14 weeks of their gestation. All parameters like cholesterol, triglycerides, HDL, VLDL, LDL and LDL/HDL ratio were included.

Further these patients were followed up routinely at every visit for their subsequent weight gain, BP readings and USG reports. All the enrolled

patients were followed up till the delivery of baby and mode of delivery.

## Results

Out of 330 cases enrolled for study, 104 patients developed PE. The incidence of PE was 31.5%. Of 104 patients who were found to develop preeclampsia 84 were less than 30 years and 20 were more than 30 years of age. The mean BMI of all study participants were 24.62 ± 3.87 kg/m<sup>2</sup> and that of preeclamptic patients was 26.49 ± 4.35 kg/m<sup>2</sup>.

Of these 104 women, 34.6% (36/104) were primigravidas, 44.2% (46/104) were 2nd gravidas and 21.2% (22/104) were multigravidas. Their mean systolic blood pressure was 148 mmHg and diastolic blood pressure was 110 mmHg.

The lipid parameters in the study population and in the women found to develop preeclampsia has been demonstrated in the Table 1 and figure 2 below.

Cholesterol, Triglycerides, HDL, LDL, VLDL and LDL/HDL ratio have been found statistically significant in predicting PE.

Of 104 pre-eclamptics, 72 had vaginal delivery and 32 underwent caesarean section. Of this, 10

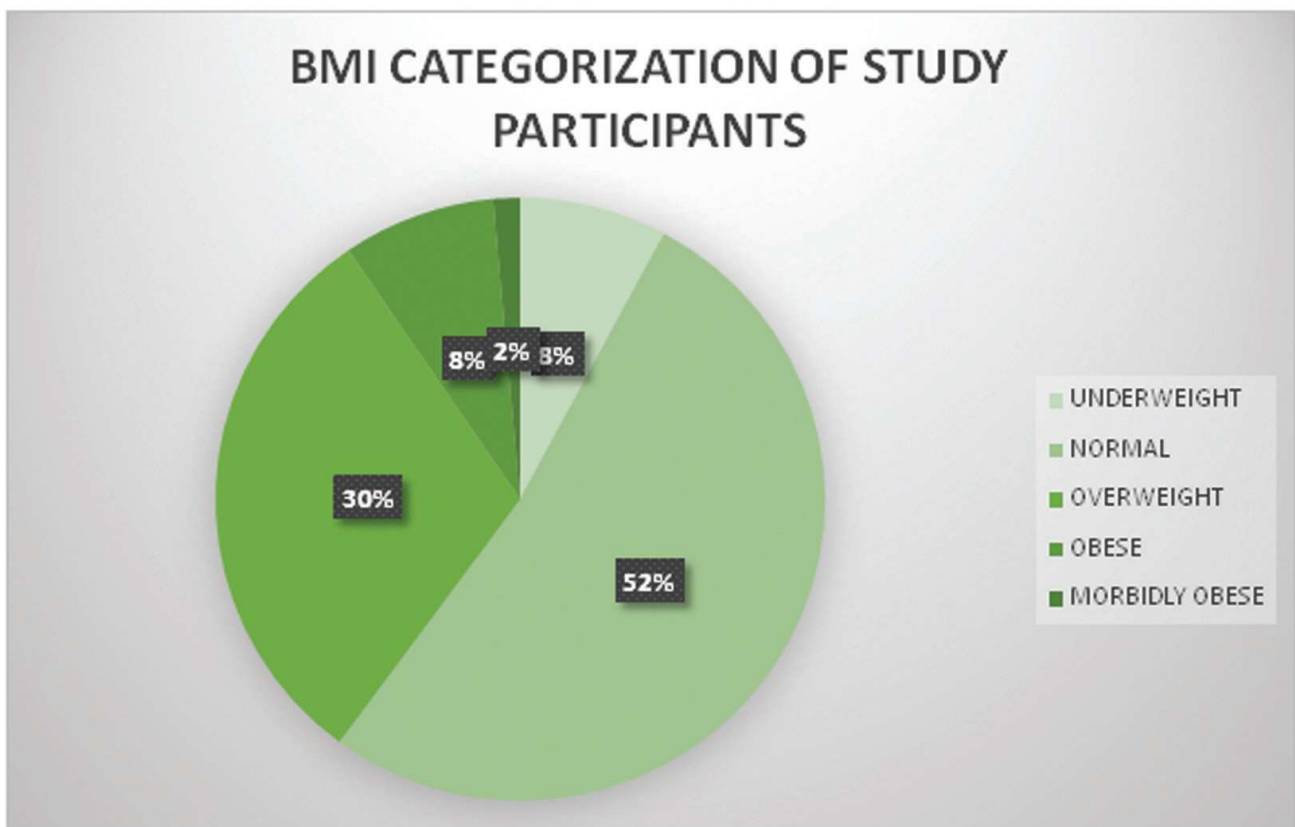
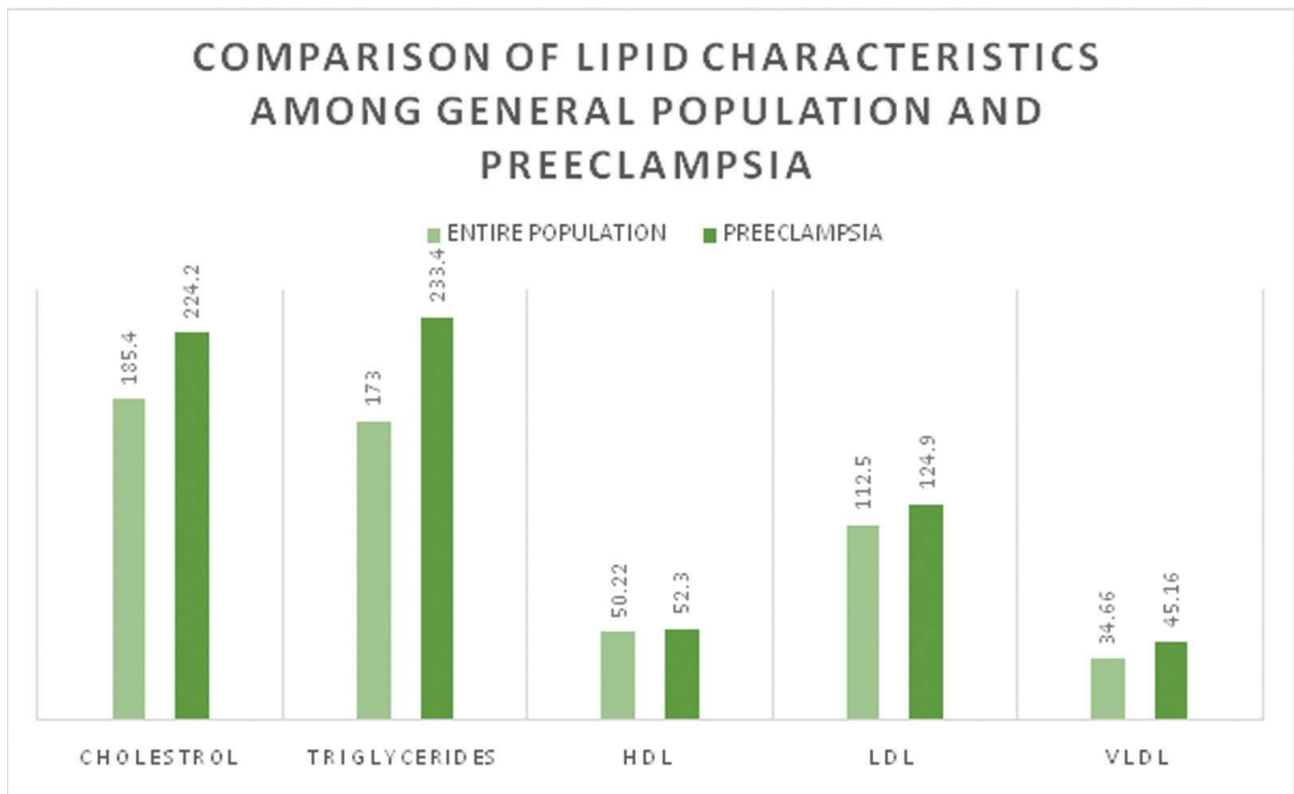


Fig. 1: Showing BMI categorization of study participants.

**Table 1:** Lipid Parameters of Study Population and Preeclamptic Patients

Lipid	Mean In Study Population	Mean In Pre-eclamptic Patients
Cholestrol	198	224.2
Triglyceride	173	233.4
HDL	50.22	52.3
LDL	112.5	124.94
VLDL	34.66	45.16
LDL/HDL	2.4	2.54



patients were delivered at gestational age <34 weeks, 41 patients between 34-37 weeks and 53 were delivered after 37 weeks of gestation. This has been shown in figure 3.

**Discussion**

In this study, we evaluated the value of hyperlipidemia in 1st trimester of pregnancy in prediction of future PE. Staff et al, Shen et al and Demicri et al<sup>3,4,5</sup> have shown that women developing PE were having advanced maternal age which was contrary to the present study findings.

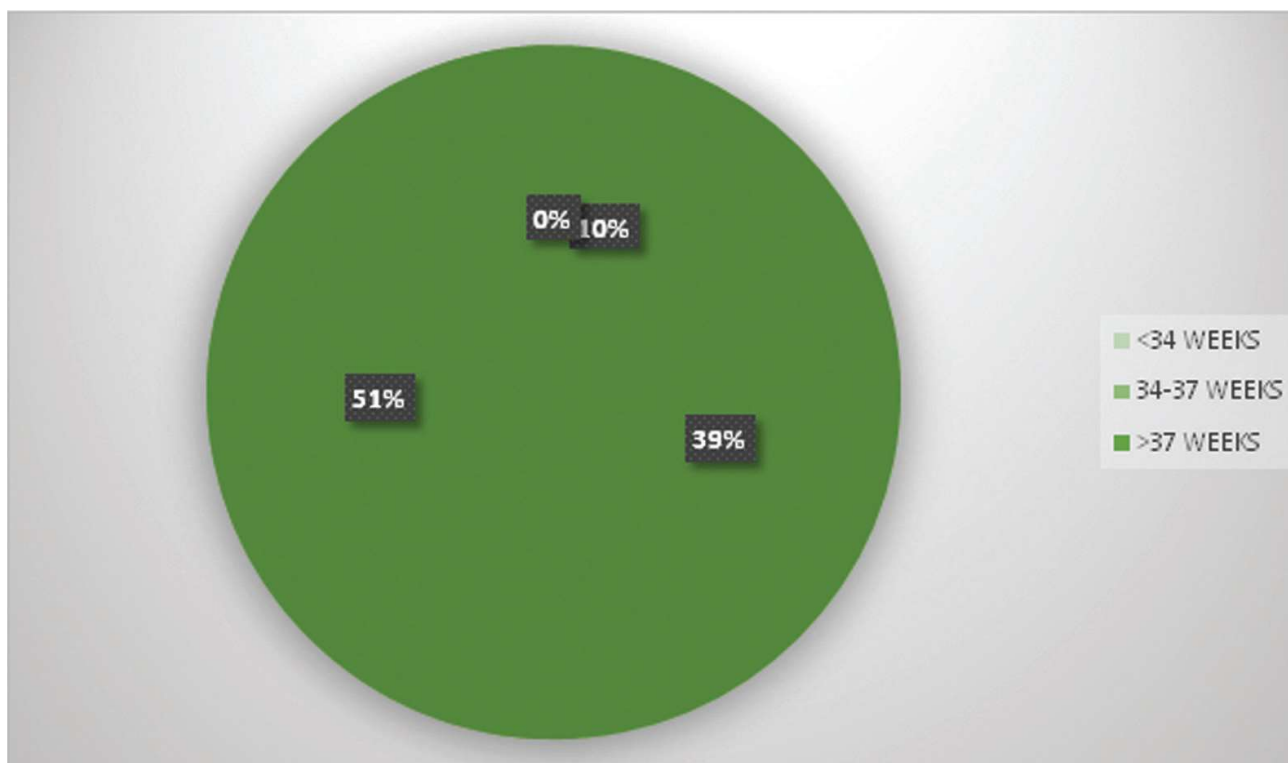
In the present study, raised BMI has been found statistically significant in predicting the likelihood of preeclampsia development.

This was in correspondence with studies

conducted by Shen et al, Demicri et al and Nabih et al confirming that women with higher pre-gravid BMI are prone to develop PE<sup>6,7,3</sup>. Women with BMI >25kg/m<sup>2</sup> had a predilection for PE development.<sup>81</sup> Contrary to this, Usharani and Padmini have not demonstrated any correction of BMI and PE development.<sup>8</sup>

The incidence of pre-eclampsia was 31.5% in our study. However, various studies<sup>9</sup> have shown that the incidence of pre-eclampsia is 6-8%. 34.66 mg/dl and mean LDL/HDL 2.4 in the normotensive and normoglycemic group.

The comparison of various lipid parameters between the normotensive and preeclamptic group has been shown in Table 1 and figure 2. Similar dyslipidaemia was observed in sera of preeclamptic women studied by Ryckmann et al, Shen et al, Nabih et al and Enquobahrie et al.<sup>3,4,6,7</sup>



**Fig. 3:** Gestational Age Prior To Delivery In Pe

Enquobahrie et al, have shown the relationship of increased triglycerides at 13 weeks of gestation as 4.15-fold increased risk for preeclampsia development. He also showed that total cholesterol >205mg/dl had a 3.6 fold increase in risk of PE.<sup>7</sup> Similarly, Gratacos et al has shown that as early as 10 weeks of gestation also predicts preeclampsia accurately.<sup>10</sup> Ogura et al, demonstrated that hypertriglyceridemia during pregnancy was associated with appearance of small, dense LDL and this LDL particle size further decreased in preeclamptic women.<sup>11</sup> Kumru et al in their cross-sectional study demonstrated that mean levels of total cholesterol, triglycerides and LDL were 4,5 and 9.8 % higher respectively and HDL were 9% lower than in healthy controls.<sup>12</sup> However, his sample size was too small.

In contrast to this, Baker et al have shown in their study that hypertriglyceridemia does not predict the risk for preeclampsia development.<sup>13</sup>

Lorentzen et al in 1994 demonstrated the presence of pro-atherogenic lipid profile in months preceding preeclampsia development.<sup>14</sup> In 1996, Waldimiroff confirmed that 1st trimester elevated cholesterol (>233 mg/dl) have a 5-fold increase in preeclampsia development after adjusting for confounders like maternal BMI and gestational age.<sup>15</sup> Williams et al in 2003, studied sub-Saharan African women and showed inverse association of HDL levels and risk

for preeclampsia development.<sup>16</sup>

Termination of pregnancy is the only cure for PE. When the fetus is preterm, the tendency is to temporize in the hope that additional weeks in utero will reduce the risk of neonatal death or serious morbidity from prematurity. Such a policy is justified in milder cases. Barton et al, in 2011 reported increased incidence of neonatal morbidity in women with mild PE if delivered prematurely.<sup>17</sup>

Broekhuijsen et al in 2015 studied Dutch women-HYPITAT-II and reported that premature delivery in mild PE patients had reduced adverse maternal outcomes by 3.1% but increased the risk of neonatal respiratory distress syndrome by 5.7%.<sup>18</sup>

Severe PE demands anticonvulsants, antihypertensives followed by delivery. Preterm birth is the major cause of perinatal morbidity and mortality and nearly 40% of premature babies can be attributed to hypertensive disorders of pregnancy.<sup>19</sup>

### Conclusion

PE continues to be the most intriguing and unsolved problem in pregnancy. Various immunological and angiogenic factors are in study to recognize the onset of PE development beforehand and manage it effectively. However, these tests are not universally available and still under process of study. In the

present study we made an attempt to evaluate the lipid parameters in pregnant women at 12-14 weeks of gestation. We observed that high lipid levels encountered at early weeks proves to be beneficial in predicting the risk of developing PE.

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