International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Kumari P et al. Int J Reprod Contracept Obstet Gynecol. 2023 Jul;12(7):2177-2184
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20231790

Original Research Article

A comparative study of serum lipid profile in preeclampsia and normotensive pregnancy in third trimester and their fetomaternal outcome

Pooja Kumari*, Madhubala Chouhan, Balveer Jakhar, Garima Sharma

Department of Obstetrics and Gynecology, RNT Medical College, Udaipur, Rajasthan, India

Received: 25 May 2023
Accepted: 09 June 2023

***Correspondence:**
Dr. Pooja Kumari,
E-mail: pk2214228@gmail.com

ABSTRACT

Background: Preeclampsia is a common medical complication in pregnancy in developing countries. It is one of the most common causes that lead to maternal and fetal morbidity and mortality. Incidence of preeclampsia in world is 3-5%.[1] In India preeclampsia complicates 5-15% of pregnancies. As a result of these changes serial alteration in lipid profile, mainly increase in serum triglycerides, cholesterol occurs in pregnant women.
Methods: After IEC clearance and taking informed written consent from the patients, present study was conducted at the Department of Obstetrics and Gynaecology in PDZH, RNT Medical College, Udaipur from December 2020 to June 2022.
Results: Study result based on 100 pregnant women with pre-eclampsia (BP >140/90 mm of Hg) as cases and 100 normotensive pregnant women (BP <140/90 mm of Hg) as controls. Cases had significantly higher total cholesterol (219.21±63.13 vs. 176.24±31.33, P<.0001), significantly higher triglycerides (mg/dL) (208.35±79.32 vs. 166.41±29.6, P<.0001), significantly higher LDL (mg/dL) (133.7±39.81 vs. 103.96±18.38, P<.0001), and significantly lower HDL (mg/dL) (43.29±7.09 vs. 50.18±8.15, P<.0001) in comparison to control.
Conclusions: Women with pre-eclampsia had significantly higher serum Cholesterol, LDL, TG and significantly lower HDL in comparison to healthy pregnant women. There was a significant increase in the serum Cholesterol, LDL, TG in patients from mild to severe pre-eclampsia.

Keywords: HDL, LDL, Total cholesterol

INTRODUCTION

Pregnancy is a state associated with changes in anatomy, physiology, biochemistry[1]. The characteristic of normal pregnancy is developing well tolerated allograft i.e. fetus, developed placenta and increase in circulating steroids.[2] As a result of these changes serial alteration in lipid profile, mainly increase in serum triglycerides, cholesterol occurs in pregnant women. Preeclampsia is specific to pregnancy, multi system involvement. It is hypertensive disorder includes new onset hypertension (BP>140/90) and proteinuria after 20 weeks of gestation and resolves after delivery.[3]

Preeclampsia is a common medical complication in pregnancy in developing countries. It is one of the most common cause that lead to maternal and fetal morbidity and mortality. Incidence of preeclampsia in world is 3-5%.[3] In India preeclampsia complicates 5-15% of pregnancies.[4] Even though etiopathogenesis of preeclampsia remain obscure and poorly understood, genetic component may play a major role.[5] It includes complex pathophysiological state in which regulatory systems of inflammation and endothelial function are altered beyond the normal physiological limits of pregnancy

Endothelial dysfunction may be due to the changes in metabolism of lipoproteins. The mechanism that lead to endothelial dysfunction is not well defined. The spectrum of endothelial changes are provoked by multiple circulating factors including altered lipoproteins. Endothelial dysfunction explains many of symptoms of preeclampsia including proteinuria.[6]

Even in normal pregnancy there is increase in plasma lipid seen, but in normal pregnancy it is not atherogenic, may be physiological, due to hormonal control.[8] Whenever this mechanism of adjusting physiologic hyperlipidemia is altered that lead to complications in pregnancy.[10] So, in pregnancy if serum lipid profiles are estimated it helps to identify high risk cases prone for preeclampsia.[11]

Pregnancies complicated by hypertension are associated with increased risk of adverse fetal, neonatal and maternal outcomes, including preterm birth, intrauterine growth restriction (IUGR), perinatal death, acute renal and hepatic failure, antepartum haemorrhage, postpartum haemorrhage and maternal death.[13] The aim of the study was to compare serum lipids in pre-eclamptic women and healthy pregnant women and to know their fetomaternal outcome.

METHODS

This was a case-control, study. After taking institutional ethical committee clearance and taking informed written consent from the patients for participation, present study was conducted at the Department of Obstetrics & Gynaecology in Pannadhay Zanana Hospital, RNT Medical College, Udaipur (Rajasthan).

Inclusion criteria

Inclusion criteria were the pregnant women in third trimester, blood pressure <140/90 mm of Hg, no medical disorder, singleton pregnancy for control group. Pregnant women in third trimester, BP >140/90 mm of Hg, noted first time after 20 weeks of pregnancy on 2 occasions at least 4 hours apart with proteinuria was considered as having preeclampsia, singleton pregnancy for study group.

Exclusion criteria

Exclusion criteria were history of chronic hypertension that was present before pregnancy, history of diabetes mellitus and/or who were on insulin therapy or hypoglycaemic drugs, obese women with pre pregnancy BMI >25, those who were taking antihypertensive or hypolipidemic drug, those with diagnosed liver, cardiac or renal diseases or any other major illness and twin pregnancy.

The study was conducted in the Department of Obstetrics and Gynaecology in Pannadhay Zanana Hospital, RNT Medical College, Udaipur (Rajasthan) from December 2020 to June 2022, after due approval from the institutional ethics committee and review board. After taking written informed consent from the patients, they were enrolled in the study. Total 200 patients were enrolled in the study. 100 pregnant women with pre-eclampsia (BP >140/90 mm of Hg) were included as cases and 100 pregnant women with normal blood pressure (BP <140/90 mm of Hg) were included as controls.

Detailed history was taken and physical examination was done. The detailed procedure was explained to the patient via patient information sheet. The information such as age, parity, booking status, and history of pregnancy-induced hypertensionwas recorded. The patients' details were recorded as per study proforma.

All pregnant women included in the study were subjected to detailed history taking, urine albumin and blood pressure measurement. 5 ml of venous blood was drawn for analysis. Detailed history about present pregnancy and previous pregnancy in case of multi and past history and family history of diabetes, hypertension, renal disease, thyroid disorder and any chronic drug intake was obtained. Height and weightduring first trimester were noted from antenatal card, weight gain also made from antenatal records.

Estimation of urine albumin by Dipstick method

Bottle with a tightly fitting cap contains reagent urine strips. It has several separate reagent areas affixed on plastic strip. Within 1 to 2 minutes, it produces colour change of standardized range, when analytes react with specific reagent area on the test strip. Fasting blood samples was taken in a plain red topped vacutainer without any anticoagulant from 100 pregnant patients with pre-eclampsia and 100 normal pregnantwomen, admitted in PDZH, RNT Medical College Udaipur and was sent to lab for lipid profile testing.

Sample size

The study of Kumar et al observed that compared to normotensive women, hypertensive women had significantly higher serum cholesterol (230.58±47.82 vs. 198.34±46.99), higher triglyceride (336.03±123.52 vs. 188.18±36.70), higher LDL (62.87±18.38 vs. 53.71±15.23) and lower HDL (45.12±15.06 vs. 52.64±14.09). Taking these values as reference, the minimum required sample size with 95% power of study and 5% level of significance is 98 patients in each study group. To reduce margin of error, total sample size taken is 200 (100 patients per group).

RESULTS

In our study 100 pregnant women with pre-eclampsia (BP >140/90 mm of Hg) were included as cases and 100 normotensive pregnant women (BP <140/90 mm of Hg) were included as controls. Detailed history about present

pregnancy and previous pregnancy was recorded, fetal and maternal outcome was noted and results are as follows.

Distribution of age (years) was comparable between cases and controls. (<=20 years:- 10% vs 8% respectively, 21-30 years:- 73% vs 82% respectively, 31-40 years:- 17% vs 10% respectively) (p value=0.278).

Median (25^{th}-75^{th} percentile) of age (years) in cases was 25 (22-29) and in controls was 26 (23.75-28.25) with no significant difference between them (p value=0.72) (Table 1).

Table 1: Comparison of age (years) between cases and controls.

Age (years)	Cases (n=100) (%)	Controls (n=100) (%)	P value
≤20	10 (10)	8 (8)	0.278
21-30	73 (73)	82 (82)	
31-40	17 (17)	10 (10)	
Mean±SD	25.93±4.73	25.95±3.98	0.72
Median (25^{th}-75^{th}%)	25 (22-29)	26 (23.75-28.25)	
Range	17-36	18-38	

Table 2: Comparison of gravida between cases and controls.

Gravida	Cases (n=100) (%)	Controls (n=100) (%)	P value
Primi	43 (43)	48 (48)	0.478
Multi	57 (57)	52 (52)	
Total	100 (100)	100 (100)	

As shown in Table 3, distribution of gravida was comparable between cases and controls. (Primi:- 43% vs 48% respectively, multi:- 57% vs 52% respectively) (p value=0.478).

Table 3: Comparison of history of pregnancy induced hypertension between cases and controls.

History of pregnancy induced hypertension	Cases (n=100) (%)	Controls (n=100) (%)	P value
No	82 (82)	87 (87)	0.329
Yes	18 (18)	13 (13)	
Total	100 (100)	100 (100)	

Significant positive correlation was seen between severity of preeclampsia with total cholesterol (mg/dL), Triglyceride (mg/dL), LDL (mg/dL) with correlation coefficient of 0.446, 0.455, 0.407 respectively. Significant negative correlation was seen between severity of preeclampsia with HDL (mg/dL) with correlation coefficient of -0.268 (Table 4).

According to Table 5, proportion of patients with maternal outcome:- normal was significantly lower in cases as compared to controls. (normal:- 50.00% vs 73.00% respectively (p value=0.0008)).

Proportion of patients with fetal outcome:- normal was significantly lower in cases as compared to controls. (Normal:- 61.00% vs 84.00% respectively (p value=0.0003)) (Table 6).

Distribution of asphyxia, IUGR, oligo, still birth was higher but comparable between cases and controls. (Asphyxia:- 5.00% vs 1.00% respectively (p value=0.212), IUGR:- 18.00% vs 9.00% respectively (p value=0.063), Oligo:- 10.00% vs 5.00% respectively (p value=0.179), Still birth:- 6.00% vs 1.00% respectively (p value=0.118)) prematurity :- 11% vs 6% respectively (p value = 0.205).

Table 4: Correlation of total cholesterol, triglyceride, LDL and HDL with severity of preeclampsia.

Variables	Total cholesterol(mg/dL)	Triglyceride(mg/dL)	LDL (mg/dL)	HDL (mg/dL)
Severity of preeclampsia				
Correlation coefficient	0.446	0.455	0.407	-0.268
value	<0.0001	<0.0001	<0.0001	0.007

Table 5: Comparison of maternal outcome between cases and controls.

Maternaloutcome	Cases (n=100) (%)	Control (n=100) (%)	Total (%)	P value
Normal	50 (50)	73 (73)	123 (61.50)	0.0008†
C section	31 (31)	20 (20)	51 (25.50)	0.074†
Abruptio	4 (4)	0 (0)	4 (2)	0.121*
Acute renalfailure	2 (2)	0 (0)	2 (1)	0.497*
HELLP syndrome	4 (4)	0 (0)	4 (2)	0.121*
ARDS	2 (2)	0 (0)	2 (1)	0.497
Death (Pulmonaryedema)	1 (1)	0 (0)	1 (0.50)	1
Chronic hypertension	4 (4)	0 (0)	4 (2)	0.121

Continued.

Maternaloutcome	Cases (n=100) (%)	Control (n=100) (%)	Total (%)	P value
Post partumeclampsia	3 (3)	0 (0)	3 (1.50)	0.246
PPH	4 (4)	3 (3)	7 (3.5)	1
Preterm delivery	11 (11)	6 (6)	17 (8.50)	0.205
Sepsis	1 (1)	0 (0)	1 (0.50)	1

Table 6: Comparison of fetal outcome between cases and controls.

Fetal outcome	Cases (n=100) (%)	Control (n=100) (%)	Total (%)	P value
Normal	61 (61)	84 (84)	145 (72.50)	0.0003
Asphyxia	5 (5)	1 (1)	6 (3)	0.212
IUGR	18 (18)	9 (9)	27 (13.50)	0.063
Oligo	10 (10)	5 (5)	15 (7.50)	0.179
Still birth	6 (6)	1 (1)	7 (3.50)	0.118
Prematurity	11 (11)	6 (6)	17 (8.50)	0.205

DISCUSSION

A case-control study was done among 100 cases of pre-eclampsia and 100 normal pregnant women, wherein we tried to determine the association of lipid profile parameters with pre-eclampsia and fetomaternal outcome.

The mean age of the cases of pre-eclampsia was 25.93±4.73 years. In comparison to controls, cases had comparable age (25.95±3.98 years) (P=0.72). Among the previous studies, similar age distribution was seen in women with pre-eclampsia and controls. In the study by Nidhi et al, most of the patients with preeclampsia and that of controls were in the age group of 26 to 30 years. Anuradha et al reported that preeclampsia and controls had similar age (26.85±2.32 vs. 25.7±3.54, p=0.0897). Adewara et al found that compared to normotensives, pre-eclapmtic patients had similar mean age as controls (32.2±5.9 vs. 31.0±4.2, P=0.190).[21] Attah et al reported that women with pre-eclampsia and controls had comparable mean age (years) (24.19±6.35 vs. 24.83±6.18, p=0.541).[18]

Table 7: Age distribution of patients in previous studies v/s our study.

Studies	Cases	Controls	P value
Our study age	25.93±4.73 years	25.95±3.98 years	P=0.72
Adewara et al[21] (2021) age	32.2±5.9	31.0±4.2	P=0.190
Nidhi et al[19] (2019) age (26-30 years)	16.66%	46.23%	P<0.05
Attah et al[18] (2018) age	24.19±6.35	24.83±6.18	P=0.541
Anuradha et al[16] (2016) age	26.85±2.32	25.7±3.54	P=0.0897

Gravida/parity distribution of patients

Pre-eclampsia has been connected to a number of factors, including diabetes, renal disease, obesity, primiparity, multiple pregnancies, age over 30, and a personal or familial history of pre-eclampsia, and chronic hypertension. An Indian study reported that multiple pregnancy increases the risk of pre-eclampsia by 5.7 times.[15] In another study, multiple pregnancy showed association with pre-eclampsia.[17] This is explained by the fact that large sized placentas in pregnant women with multiple obstetric conditions lead to reduced placental perfusion. “The excess of placenta tissues could not be perfused adequately”.

Booking status

In comparison to controls, cases had lower but comparable number of booked (71% vs. 81%) and higher but comparable unbooked (29% vs. 19%) (P=0.098) participants. However, Adewara et al found that compared to normotensives, pre-eclapmtics had significantly lesser number of booked (31.7% vs. 90%) and significantly more unbooked (68.3% vs. 10%) (P<0.001) women.[21] The advantages of antenatal care are well known, and numerous studies have found that it may help and protect mothers from pregnancy-related complications like pre-eclampsia.

History of pregnancy-induced hypertension

In comparison to controls, cases had higher but comparable history of pregnancy-induced hypertension (18% vs. 13%, P=0.329). The history of placental abruption or preeclampsia in a previous pregnancy is reported to be risk factor and predeterminant of preeclampsia, and that's why it was important to record it and the comparable characteristics with this respect helped in avoiding any confounding effect.[17]

Table 8: Studies showing correlation with severity of pre-eclampsia with lipid profile.

Studies	TC	TG	LDL	HDL
Present study **Mild PE severe PE**	r=0.446, P<0.0001 200.86±56.26 262.03±58 (P<0.0001)	r=0.455, P<0.0001 184.86±70.45 263.17±72.32 (P<0.0001)	r=0.407, P<0.0001 123.14±31.65 158.33±46.16 P=0.0003)	r=-0.268,P=0.007 40.4±5.79 44.53±7.27 (P=0.002)
Adewara et al[21] (2021) **Mild PE (mmol/L) Severe PE (mmol/L)**	(r=4.369, p<0.001) 6.4±3.5 6.8±2.2 (P=0.534)	(r=1.397,p=0.362) 1.8±0.5 2.3±1.4 (P=0.106)	(r=2.591, P=0.011) 3.4±3.0 3.8±2.1 (P=0.549)	(r=2.413,P=0.019) 2.2±1.0 1.8±0.4 (P=0.047)
Attah et al[18] (2018) **Mild PE (mmol/L) Severe PE (mmol/L)**	r=0.235, P=0.050 5.68±1.63 6.83±1.52 (P=0.012)	r= 0.278, P=0.019 2.11±1.33 2.99±1.14 (P=0.016)	r=0.057, p=0.637 3.52±0.98 3.79±1.08 (P=0.313)	r= -0.013, P =0.912 1.54±0.44 1.18±0.45 (P=0.005)
Ahmed et al[12] (2018) **Mild PE** **Severe PE**	229.47±12.61 217.00±10.49 (P<0.001)	195.33±14.38 210.57±14.09 (P<0.001)	138.93±12.23 152.13±11.03 (P<0.001)	40.10±5.39 36.33±6.21 (P<0.001)
Anuradha et al[16] (2016) **Mild PE** **Severe PE**	137.3±2.43 162.8±3.4 (P=0.0001)	193.4±6.8 223.6±9.42 (P=0.0001)	74.7±4.5 106.3±8.6 (P=0.0001)	38.43±7.2 39.12±5.6 (P=0.6337)
Deshpande et al[15] (2016) **Mild PE** **Severe PE**	203.0±7.46 215.8±13.47 (P>0.05)	200.9±10.23 204.57±12.0 (P>0.05)	139.7±11.64 141.4±6.45 (P>0.05)	38.53±3.09 36.4±2.57 (P>0.05)

We also tried to determine the severity of pre-eclampsia and the association of lipid profile with severity of pre-eclampsia. In present study, there were 30 cases of severe and 70 cases of mild pre-eclampsia. In comparison to mild pre-eclampsia, severe pre-eclampsia cases had significantly higher total cholesterol (262.03±58 vs. 200.86±56.26, P<.0001), significantly higher triglycerides (263.17±72.32 vs. 184.8±70.45, P<.0001), significantly higher LDL (158.33±46.16 vs. 123.14±31.65, P=0.0003), and significantly lower HDL (40.4±5.79 vs. 44.53±7.27, P=0.002). Overall, total cholesterol showed a significant positive correlation with severity of pre-eclampsia (r=0.446, P<0.0001), with TG (r=0.455, P<0.0001), with LDL (r=0.407, P<0.0001), and with HDL a significant negative correlation was seen (r=-0.268, P=0.007), indicating that when the severity of pre-eclampsia increased, there was significant increase in total cholesterols, TG, and LDL and a significant fall in HDL – overall leading to a higher derangement in the lipid profile. The findings are in line with other previous studies.

In line with our study, Ahmed et al reported that compared to normotensive and mild pre eclamptics, severe pre eclamptics had significantly higher triglycerides (210.57±14.09 vs. 195.33±14.38), higher cholesterol (229.47±12.61 vs. 217.00±10.49), higher LDL (152.13±11.03 vs. 138.93±12.23), and significantly lower HDL (36.33±6.21 vs. 40.10±5.39) (P<0.001).[12] Anuradha et al also reported that compared to mild pre-eclampsia cases, severe pre-eclampsia cases had significantly higher total cholesterol (162.8±3.4 vs. 137.3±2.43, P=0.0001),low density lipoprotein (106.3±8.6 vs. 74.7±4.5, P=0.0001), and triglycerides (223.6±9.42 vs. 193.4±6.8, P=0.0001), and similar high-density lipoprotein (39.12±5.6 vs. 38.43±7.2, p=0.6337). The difference in the findings may be because of differences in races and nutrition. Deshpande et al also found that cholesterol level (203.0±7.46 vs. 215.8±13.47 vs. 224.0±14.69), LDL levels (139.7±11.64 vs. 141.4±6.45 vs. 148.5±11.0), and triglyceride level (200.9±10.23 vs. 204.57±12.0 vs. 209.5±6.19) increased from mild PIH to severe PIH to eclampsia, whereas HDL levels

(38.53±3.09 vs. 36.4±2.57 vs. 34.75±2.98) reduced from mild PIH to severe PIH to eclampsia.[15] The cholesterol, LDL, and triglyceride showed positive correlation while HDL was negatively correlated.

Adewara et al conducted a study including 30 women with mild preeclampsia and 30 women with severe preeclampsia and found that compared to mild preeclampsia, severe preeclampsia cases had significantly lower HDL (1.8±0.4 vs. 2.2±1.0, P=0.047), and higher TC (mmol/L) (6.8±2.2 vs. 6.4±3.5, P=0.534), LDL (mmol/L) (3.8±2.1 vs. 3.4±3.0, P=0.549), and TG (mmol/L) (2.3±1.4 vs. 1.8±0.5, P=0.106), however difference was not significant.[21] Multivariate regression analysis showed that serum total cholesterol (r=4.369, p<0.001) and HDL (r=2.413, P=0.019) were independently associated with preeclampsia.

Table 9: Comparison of caesarean rates in studies done on patients with pre-eclampsia.

Study	Caesarean deliveries (%)
Present study	31
Gavali et al[23] (2021)	27.8
Ajah et al[25] (2016)	51.7
Sierra-Laguado et al[22] (2007)	64.1

Attah et al also reported that compared to women with mild pre- eclampsia, those with severe pre-eclampsia had significantly higher total cholesterol (mmol/L) (6.83±1.52 vs. 5.68±1.63, P=0.012), significantly higher triglyceride (mmol/L) (2.99±1.14 vs. 2.11±1.33, P=0.016), significantly lower HDL (mmol/L) (1.18±0.45 vs. 1.54±0.44, P=0.005), and similar LDL (mmol/L) (3.79±1.08 vs.3.52±0.98, P=0.313).[25] Triglycerides had significant positive correlation with pre- eclampsia (r= 0.278, P=0.019) respectively. There was a negative correlation between HDL and pre-eclampsia, although this was not statistically significant (r= - 0.013, P = 0.912). There was no significant correlation with LDL (r=0.057, p=0.637) and total cholesterol (r=0.235, P=0.050). The findings of present study and previous studies indicate that deranged lipid profile increases with increasing severity of pre-eclampsia.

Maternal outcomes

In our study, in comparison to controls, cases had significantly lesser normal vaginal deliveries (50% vs. 73%, P=0.0008), higher but statistically comparable caesarean section (31% vs. 20%, P=0.074), abruptio placentae (4% vs. 0%, P=0.121),acute renal failure (2% vs. 0%, P=0.497), HELLP syndrome (4% vs. 0%, P=0.121), ARDS (2% vs. 0%, P=0.497), deaths (due to pulmonary edema) (1% vs. 0%, P=1), chronic hypertension (4% vs. 0%, P=0.121), post-partum eclampsia (3% vs. 0%, P=0.246), PPH (4% vs. 3%, P=1), sepsis (1% vs. 0%, P=1).

Among other studies, Sierra-Laguado et al observed that the cases had significantly higher rate of cesarean delivery (%) (64.1% vs. 39.7%, p=0.013).[22] Ajah et al found that women with pre-eclampsia had significantly more caesarean section (51.7% vs. 10.6%, P<0.0001), and maternal mortality (12.1% vs. 1%, P<0.0001).[25] In the study by Gavali et al, emergency LSCS and elective LSCS were done in 19.91% and 7.87% patients respectively, vacuum delivery in 4.17% patients, and forceps delivery in 1.85% patients.[23] Other complications were eclampsia, postpartum haemorrhage, abruptio placentae, partial HELLP in 9.72%, 8.80%, 7.87%, and 6.94% patients, respectively. Severe eclampsia and DIC were present in 5 patients. Sultana et al also found that pre-eclamptic women had more complications than normotensives (440% vs. 12%, p<0.05), including eclampsia (4% vs. 0%), abruptio placenta (6% vs. 0%), PPH (14% vs. 10%), pulmonary oedema (6% vs. 2%), HELLP syndrome (4% vs. 0%), and oliguria (2% vs. 0%) (p<0.05).[24]

Fetal outcomes

In comparison to controls, cases had significantly lesser normal neonates (61%vs. 84%, P=0.0003), and higher but statistically comparable asphyxia (5% vs. 1%, P=0.212), IUGR (18% vs. 9%, P=0.063), oligohydramnios (10% vs. 5%, P=0.179), still birth (6% vs. 1%, P=0.118), premature babies (11% vs. 6%, P=0.205). Overall, it was observed that adverse fetal outcomes such as IUGR, asphyxia, IUGR, oligohydramnios, prematurity and still birth were more in pre-eclampsia than controls. This finding was supported by previous studies.

Table 10: Comparison of fetal outcomes in studies done on patients with pre-eclampsia.

Studies	Fetal outcomes
Present study	Asphyxia (5%), IUGR (18%), oligohydramnios (10%), and still birth (6%), prematurity (11%)
Gavali et al[23] (2021)	IUGR, prematurity, low birth weight babies, respiratory distress syndrome, meconium aspiration in 7.41%, 14.81%, 17.13%, 9.72%, and 6.02% patients, respectively. NICU admission: 20.83% neonates.intrauterine death: 1.85% neonates, still births: 3.24%, and neonatal death in 3.24% neonates.
Sultana et al (2018)[24]	Low-birth weight babies (<2.5 kg) (52.5%), APGAR score 4-6 at 1 minute (56%) and at 5 minutes (30%), neonatal care unit admission (80%), early neonatal death (10%), still births (20%)
Ajah et al (2016)[25]	Low birth weight babies (44.9%)perinatal mortality (22.7%)

Among other studies, Sierra-Laguado et al observed that the cases had significantly lower birth weight (3024 vs. 3342, p=0.006).[22] Ajah et al found that women with pre-eclampsia had significantly more low birth weight babies (44.9% vs. 1%, P<0.0001) and perinatal mortality (22.7% vs. 3.9%, P<0.0001).[25] In the study by Gavali et al, neonatal outcomes included IUGR, prematurity, low birth weight babies, respiratory distress syndrome, meconium aspiration in 7.41%, 14.81%, 17.13%, 9.72%, and 6.02% patients, respectively.[23] NICU admission was needed in 20.83% neonates. Intrauterine death was seen in 1.85% neonates, still birth in 3.24%, and neonatal death in 3.24% neonates.

Sultana et al observed that women with pre-eclampsia had significantly moreneonates with low birth weight (<2.5 kg) (52.5% vs. 8%, p<0.05); significantly more neonates with APGAR score 4-6 at 1 minute (56% vs. 24%) and at 5 minutes (30% vs. 6%) (p<0.05); more neonatal care unit admission (80% vs. 20%, p<0.05); more early neonatal death (10% vs. 0%, p<0.05) and still birth (20% vs. 0%, p<0.05).[24]

This study has some limitations. Our study was conducted in a setting which caters to patients belonging primarily to the lower or middle socio-economic strata and the data primarily reflects the situation in this cohort. The present study did not include parameters that may affect the lipid profile parameters in pre-eclampsia such as body mass index, smoking, and socioeconomic status.

CONCLUSION

Women with pre-eclampsia had significantly higher serum cholesterol, LDL, TG and significantly lower HDL in comparison to healthy pregnant women. There was a significant increase in the serum cholesterol, LDL, TG in patients from mild to severe pre-eclampsia. In conclusion, there is an elevation of serum lipids in women with preeclampsia as compared to normal healthy women during pregnancy. Moreover, the derangement in lipid profile parameters holds a direct correlation with increasing severity of preeclampsia. The fetomaternal outcomes also worsen with increasing derangement of lipid profile parameters.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Sengodan SS, Sreeprathi N. Prevalence of hypertensive disorders of pregnancy and its maternal outcome in a tertiary care hospital, Salem, Tamil Nadu, India. Int J Reprod Contracept Obstet Gynecol. 2020;9(1):236-9.
2. Say L, Chou D, Gemmill A, Moller AB, Daniels J, Temmerman M, et al. Global causes of maternal death: a WHO systematic analysis. Lancet Glob Health. 2014; (6):323-33.
3. Butwick AJ, Druzin ML, Shaw GM, Guo N. Evaluation of US state–level variation in hypertensive disorders of pregnancy. JAMA Netw Open. 2020;3(10):e2018741.
4. Armaly Z, Jadaon JE, Jabbour A, Abassi ZA. Preeclampsia: Novel mechanisms and potential therapeutic approaches. Front Physiol. 2018;9:973.
5. Uzan J, Carbonnel M, Piconne O, Asmar R, Ayoubi JM. Pre-eclampsia: pathophysiology, diagnosis, and management. Vasc Health Risk Manag. 2011;7:467-74.
6. Berry C, Atta MG. Hypertensive disorders in pregnancy. World J Nephrol. 2016;5(5):418-28.
7. Umesawa M, Kobashi G. Epidemiology of hypertensive disorders in pregnancy: prevalence, risk factors, predictors and prognosis. Hypert Res. 2017;40:213-20.
8. Bamfo JE, Kametas NA, Chambers JB, Nicolaides KH. Maternal cardiac function in normotensive and pre-eclamptic intrauterine growth restriction. Ultrasound Obstet Gynecol. 2008;32(5):682-6.
9. Singh U, Solanki V, Mehrotra S, Sharma R. An evaluation of applicability of salivary uric acid measurement in preeclampsia and normal pregnancy and its correlation with serum uric acid. J Obstet Gynaecol India. 2019;69(1):62-8.
10. Brown MA, Magee LA, Kenny LC, Karumanchi SA, McCarthy FP, Saito S, et al. Hypertensive Disorders of Pregnancy: ISSHP Classification, Diagnosis, and Management. Recommendations for International Practice. Hypert. 2018;72:24-43.
11. Timalsina S, Gyawali P, Bhattarai A. Comparison of lipid profile parameters and oxidized low-density lipoprotein between normal and preeclamptic pregnancies in a tertiary care hospital in Nepal. Int J Womens Health. 2016;8:627-31.
12. Ahmed AAM, El Omda FAA, Mousa MSM. Maternal lipid profile as a risk factor for preeclampsia. The Egypt J Hosp Med. 2018;71(6):3434–8.
13. Saha D, Roy P, Pal R, Ganguli TK, Maity S, Rakshit BM, et al. Serum lipid profile-how it alters in normotensive and hypertensive pregnant women. J Evol Med Dental Sci. 2013;2(31):5895–903.
14. Vani I, Gayathri A, Nagamani T. Lipid profile parameters in normal and preeclampsia complicating pregnancies - A prospective observational study. Am J Sci Med Res. 2015;1(1):61-6.
15. Deshpande H, Madkar C, Vishnoi P. Study of serum lipid profile in pregnancy induced hypertension. Indian J Appl Res. 2016;6:546-8.
16. Anuradha R, Durga T. Estimation of lipid profile among preeclampsia woman by comparing with normal pregnancy. Int J Contemp Med Res. 2016;3(7):1958-61.
17. Yadav S, Agrawal M, Hariharan C, Dewani D, Vadera K, Krishna N. A comparative study of serum lipid profile of women with preeclampsia and

normotensive pregnancy. J Datta Meghe Inst Med Sci Univ. 2018;13(2):83-6.
18. Attah RA, Monsur AT, Galadanchi H, Omole OA. A comparative study of serum lipid levels in pre-eclamptic and normotensive pregnant women in a tertiary hospital, Northwest Nigeria. Biomed J Sci Tech Res. 2018;3(1):3003-11.
19. Nidhi, Kaur S, Fayyaz S. Study of serum lipid profile in pregnancy and its correlation with preeclampsia. Obst Gyn Int J. 2019;10(3):169-74.
20. Mohammed GK, Ayad WA, El-Gazzar UB, Eid SM. Maternal plasma lipid concentration in third trimester of women with preeclampsia and normotensive pregnancy. IJMA. 2020;2(2):405-11.
21. Adewara OE, Ogundolire AN, Adeniyi AA, Ghazali SM, Awoyinka SB, Adebara I, et al. Maternal serum lipids in pre-eclamptic and normotensive pregnant women: a case-control study. Open J Obstet Gynecol. 2021;11:1619-28.
22. Sierra-Laguado J, Garcıa RG, Celedón J, Arenas-Mantilla M, Pradilla LP, Camacho PA, et al. Determination of insulin resistance using the Homeostatic Model Assessment (HOMA) and its relation with the risk of developing pregnancy-induced hypertension. AJH. 2007;20:437-42.
23. Gavali S, Patil A, Gavali U. Study of fetomaternal outcome in patients with pregnancy induced hypertension at Sangli district. Med Pulse Int J Gynaecol. 2021;20(2):65-9.
24. Sultana A, Koil LN, Sayeeda S. Clinical study on risk factors and fetomaternal outcome of severe preeclampsia in Bangabandhu Sheikh Mujib Medical University. Chattagram Maa-O-Shishu Hospital Med Coll J. 2018;17(1):23-8.
25. Ajah LO, Ozonu NC, Ezeonu PO, Lawani LO, Obuna JA, Onwe EO. The feto-maternal outcome of preeclampsia with severe features and eclampsia in Abakaliki, South-East Nigeria. J Clin Diagn Res. 2016;10(9):QC18-QC21.

Cite this article as: Kumari P, Chouhan M, Jakhar B, Sharma G. A comparative study of serum lipid profile in preeclampsia and normotensive pregnancy in third trimester and their fetomaternal outcome. Int J Reprod Contracept Obstet Gynecol 2023;12:2177-84.