

## Association between Lipid Profile and Preeclampsia

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### ABSTRACT

**Background & objectives:** Preeclampsia remains an established risk factors for adverse maternal and perinatal outcome. Despite many active researches for years, the exact aetiology of this fatal disorder remains unknown. Many theories and concepts have been put forward regarding its aetiology, pathogenesis and complications but commendable success has not so far been achieved to prevent this age-old disorder. The association between alteration of serum lipid and morbidity and mortality in preeclampsia is a newer one. The present study was conducted to find the association between preeclampsia and lipid profiles.

**Methodology:** The present cross-sectional case-control study was carried out at the Department of Obstetrics & Gynaecology, Dhaka Medical College Hospital over a period 6 months between September 2009 to February 2010 to find the status of serum lipids in pregnant women with preeclampsia. A total of 150 pregnant women - 75 with preeclampsia (cases) and 75 with normal pregnancy (controls) were selected consecutively for the purpose of study.

**Result:** The result shows that mean ages of cases and controls were almost alike (23.7 vs. 24.2 years,  $p = 0.493$ ). Over two-third (68%) of the cases and 75% of the controls were from lower socioeconomic class. The BMI and obstetric variables like gravidity and gestational age all were homogeneously distributed between groups. No significant difference between the groups was observed in terms total serum cholesterol, LDL cholesterol and triglyceride ( $p = 0.621$ ,  $p = 0.179$  and  $p = 0.419$  respectively). However, HDL cholesterol was observed to be significantly lower in the case group than that in the control group ( $29.5 \pm 2.8$  vs.  $40.7 \pm 4.7$  mg/dl,  $< 0.001$ ). The mean total cholesterol HDL ratio and triglyceride HDL ratio were observed to be significantly higher in the preeclamptic group than those in the normal pregnant women ( $p < 0.001$  and  $p = 0.003$  respectively). The risk of altered TC:HDL ratio and TG:HDL are estimated to be 19.3(95% CI = 4.4 - 85.3) and 7.6(95% CI = 1.7 - 35.2) times higher respectively in the preeclamptic group than those in the normal pregnant women.

**Conclusion:** The cholesterol: HDL ratio and triglyceride HDL ratio increases significantly in the preeclamptic women compared to those in the normal pregnant women. However, the alteration is apparently due to significant lowering of HDL cholesterol, the total cholesterol and triglyceride do not experience significant change.

### Introduction

Preeclampsia (PET) is a pregnancy specific disorder that presents major health problems for both mothers and babies. It is a major cause of maternal mortality, especially in developing countries.<sup>1</sup> Nearly 7-10% of pregnancies are complicated with PET in developing countries.<sup>2</sup> In a recent survey preeclampsia was found to be the second leading cause (24.2%) of maternal death in Gombe, Nigeria.<sup>3</sup> Around 11% of maternal death is attributed to preeclampsia in Bangladesh.<sup>4</sup> Preeclampsia is defined as pregnancy-specific syndrome observed usually after 20th week of gestation with systolic blood pressure  $\geq 140$  mmHg and diastolic blood pressure  $\geq 90$  mmHg accompanied by significant proteinuria with or without oedema.<sup>1</sup> It is not only the cause of maternal mortality but it is a leading cause of premature delivery and foetal growth retardation.<sup>5</sup> It is associated with increased risk of adverse maternal outcome including abruptio placentae, HELLP syndrome eclampsia, and perinatal death.<sup>6,7</sup>

Despite many active researches for years, the exact aetiology of this fatal disorder remains unknown. Many

theories and concepts have been put forward regarding its aetiology, pathogenesis and complications but commendable success has not so far been achieved to prevent this age-old disorder. The association between alteration of serum lipid and morbidity and mortality in preeclampsia is a newer one. An abnormal lipid profile is known to be strongly associated with atherosclerotic cardiovascular diseases and has direct effect on endothelial dysfunction. Normal human pregnancy results in a pronounced physiologic hyperlipidemia involving gestational rise in blood triglycerides and cholesterol. Women with preeclampsia display additional alterations in blood lipids, reflecting a disordered lipid and lipoprotein metabolism.<sup>8</sup>

A study conducted in Spain demonstrated that pregnant women with elevated free fatty acids and triglycerols in the early pregnancy mostly developed preeclampsia in the later pregnancy. In another study conducted on Peruvian women, HDL-cholesterol concentration was 9% lower in women with preeclampsia than that in normal pregnant women.<sup>8</sup> De *et al.*<sup>9</sup> also reported a significant decrease in HDL-C in preeclamptic and eclamptic

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pregnant women. Several studies, on the other hand, showed that the most dramatic change in the lipid profile in normal pregnancy is serum hypertriglyceridaemia, which may be as high as 2 - 3 folds in the third trimester compared to the levels in non-pregnant women,<sup>9</sup> while the same lipid concentration was found to rise much more significantly in toxemia of pregnancy.<sup>10,11</sup> Increased triglyceride found in pregnancy induced hypertension is likely to be deposited in predisposed vessels, such as the uterine spiral arteries and contributes to the endothelial dysfunction.<sup>12</sup> However, much controversy prevails as regard to changes in total cholesterol. While Hubel and his associates<sup>13</sup> have found significant increase in total cholesterol level in PET of pregnancy, De *et al.*<sup>9</sup> did not observe any alteration in total cholesterol level in the same condition.

Most of the studies regarding association between changes in serum lipids and preeclampsia reported changes in individual lipids. Very few studies have so far been conducted as regard to changes in all the lipid components of lipid profile and more importantly to see the total cholesterol to HDL ratio. As chance of developing atherosclerosis increases only when total cholesterol:HDL ratio is abnormally high ( $> 4.5$ ), it is rather important to know the changes in total cholesterol:HDL ratio during preeclampsia.<sup>14</sup> De *et al.*<sup>9</sup> also observed a significant elevation of total cholesterol to HDL ratio in pregnancy induced hypertension. Similarly triglyceride to HDL is more important than to see their individual level. By far no such investigations have yet been conducted in the context of our country. The above background information, therefore, demands investigation of all the components lipid profile as well as total cholesterol to HDL ratio and triglyceride to HDL ratio in pregnancies with preeclampsia.

### Methodology

The present cross-sectional case-control study was carried out at the Department of Obstetrics & Gynaecology, Dhaka Medical College Hospital over a period 6 months between September 2009 to February 2010 to find the status of serum lipids in pregnant women with preeclampsia. A total of 150 pregnant women - 75 with preeclampsia (cases) and 75 with normal pregnancy (controls) were selected consecutively for the purpose of study. Pregnant women with systolic blood pressure  $\geq 140$  mmHg and/or diastolic blood pressure  $\geq 90$  mmHg, proteinuria with or without oedema were the enrollment criteria for the cases, while pregnant women with both systolic and diastolic blood pressures within normal range without any evidence of proteinuria were selected as controls. Pregnancy with other complications diabetes, renal insufficiency, hepatitis and hydramnios were

excluded from the study. The main outcome measures were total cholesterol:HDL ratio and triglyceride:HDL ratio which were defined as values  $> 4.5$  and  $> 3.5$  respectively. Data were processed and analyzed using SPSS (Statistical Package for Social Sciences) version 11.5. The test statistics used to analyse the data were descriptive statistics, Chi-square ( $\chi^2$ ) Probability Test and Odds Ratio. For all analytical tests the level of significance was set at 0.05 and  $p < 0.05$  was considered significant.

### Results

The results show that majority of the cases (62.7%) and controls (74.7%) were in the age range 20 - 30 years with mean ages of cases and controls were 23.7 and 24.2 years respectively. Over two-third (68%) of the cases and 75% of the controls were from lower socioeconomic class. The BMI and obstetric variables like gravidity and gestational age all were homogeneously distributed between groups.

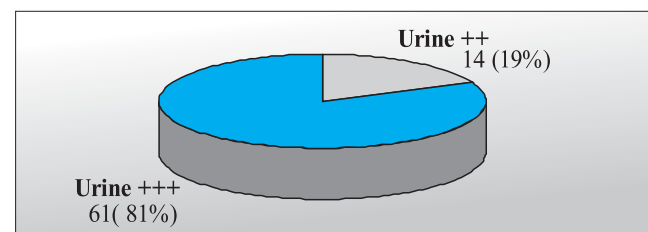
No significant difference between the groups was observed in terms total serum cholesterol, LDL cholesterol and triglyceride ( $p = 0.621$ ,  $p = 0.179$  and  $p = 0.419$  respectively). However, HDL cholesterol was observed to be significantly less in the case group than that in the control group ( $29.5 \pm 2.8$  vs.  $40.7 \pm 4.7$  mg/dl,  $< 0.001$ ). The mean total cholesterol HDL ratio and triglyceride HDL ratio were observed to be significantly higher in the preeclamptic group than those in the normal pregnant women ( $p < 0.001$  and  $p = 0.003$  respectively). The risk of having altered TC:HDL ratio and TG:HDL were estimated to be 19.3(95% CI = 4.4 - 85.3) and 7.6(95% CI = 1.7 - 35.2) times higher in the preeclamptic women than those in the normal pregnant women.

**Table I. Comparison of age between cases and controls**

Age (yrs) <sup>#</sup>	Group		p-value
	Case(n = 75)	Control(n = 75)	
< 20	19(25.3)	12(16.0)	
20 - 30	47(62.7)	56(74.7)	
> 30	9(12.0)	7(9.3)	
<b>Mean <math>\pm</math> SD</b>	<b>23.7 <math>\pm</math> 4.9</b>	<b>24.2 <math>\pm</math> 5.4</b>	<b>0.493</b>

\* Figures in the parentheses indicate corresponding percentage;

# Data were analysed using Student's t-Test.



**Fig. 1: Distribution preeclamptic women by degree of proteinuri**

**Table II. Comparison of serum lipids between cases and controls**

Serum lipids (mg/dl)	Group		p-value <sup>#</sup>
	Case (n=75)	Control (n=75)	
Total cholesterol	199.5±45.7	202.8±36.0	0.621
HDL cholesterol	29.5±2.8	40.7±4.7	< 0.001
LDL cholesterol	127.1±40.51	18.9±32.5	0.179
Triglyceride	203.7±78.3	213.8±74.7	0.419

\* Figures in the parentheses indicate corresponding percentage;

# Data were analysed using Student's t-Test and were presented as mean ± SD.

**Table III. Comparison of total cholesterol : HDL between groups**

Total cholesterol:HDL	Group		OR(95% CI)	p-value <sup>#</sup>
	Case(n=75)	Control(n=75)		
> 4.5	73(97.3)	49(65.3)	19.3(4.4-85.3)	<0.001
≤ 4.5	2(2.7)	26(34.7)		

Figures in the parentheses denote corresponding percentage;

# Data were analysed using  $\chi^2$  Test.

**Table IV. Comparison of total triglycerides:HDL between groups**

Triglycerides:HDL	Group		OR(95% CI)	p-value <sup>#</sup>
	Case(n=75)	Control(n=75)		
> 3.5	73(97.3)	62(82.7)	7.6(1.7-35.2)	0.003
≤ 3.5	2(2.7)	13(17.3)		

Figures in the parentheses denote corresponding percentage;

#Data were analysed using  $\chi^2$  Test.

## Discussion

The association between preeclampsia and atherosclerosis, presently, has become a much talked-about issue among the medical community. Many studies have been conducted on the status of different lipids in the serum during pregnancy. Several of them have documented association of preeclampsia with dyslipidemia. Reduced HDL,<sup>15</sup> increased triglycerides,<sup>16</sup> LDL cholesterol<sup>17</sup> and small dense LDL<sup>18</sup> have consistently been reported in the preeclamptic population.

In the present study the cases and the controls were almost identical in terms age, gravidity, and gestational age. Almost half of the study subjects in either group was overweight and obese with no significant intergroup difference ( $p = 0.514$ ). Majority (81%) of the cases had severe proteinuria (urine albumin ++++) and the rest (19%) had moderate proteinuria (urine albumin ++). The present study demonstrated that mean HDL cholesterol of the cases was significantly lower (29 mg/dl) than that in the control group (40.7 mg/dl) ( $p < 0.001$ ). Dorothy et

al<sup>3</sup> reported a 9% lower HDL-cholesterol concentrations in women with preeclampsia than that in control. De *et al.*<sup>9</sup> also reported a significant decrease in HDL-C in preeclamptic pregnant women.

Dyslipidemia is considered atherogenic and it increases the risk of coronary heart disease.<sup>19</sup> This atherogenicity is mainly caused by the low density lipoprotein (LDL) fraction, whereas HDL cholesterol is considered antiatherogenic.<sup>19</sup> During pregnancy, both LDL and HDL fractions have been reported to be elevated.<sup>20</sup> In the present study a decrease in the level of HDL cholesterol was observed, although other components of lipids did not experience any significant deviation from the normal level. Studies relating to changes in total cholesterol and HDL ratio Triglyceride and HDL ratio in preeclamptic population are rare. The present study demonstrated elevation of total cholesterol:HDL ratio and triglyceride and HDL ratio in women with preeclampsia than those in normal pregnant women and the elevation was apparently due to significant lowering of HDL in preeclamptic population. Kokia and his Associates (1990)<sup>33</sup> showed a slight decrease in TC: HDL-C during normal pregnancy but increased significantly in both preeclampsia and eclampsia.

The cholesterol:HDL ratio and triglyceride HDL ratio increases significantly in the preeclamptic women compared to that in the normal pregnant women. The alteration seems to be due to significant lowering of HDL cholesterol, the total cholesterol and triglyceride do not experience significant change. However, the alteration of TC:HDL-C ratio and TG:HDL-C ratio in preeclampsia are yet to be established with help of large-scale multi-center study.

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