Comparative Study of Serum Lipid Concentrations in Preeclampsia and Normal Pregnancy

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Objective: *To compare serum lipids in mild, severe preeclamptic women and normal pregnant women.*
Study design: *Cross-sectional study.*
Setting: *Section of Obstetrics and Gynecology, Taksin Hospital.*
Material and Method: *The data was collected from 65 normal pregnant women, 40 mild preeclamptic women, and 48 severe preeclamptic women. The blood samples were collected and analyzed for cholesterol, triglyceride, high-density lipoprotein (HDL), and low-density lipoprotein (LDL). The data was analyzed using Analysis of Variances (ANOVA).*
Results: *There was no significant difference in serum cholesterol, triglyceride, HDL, and LDL between normal, mild, and severe preeclamptic women.*
Conclusion: *There was no correlation between serum lipids in normal pregnancy and preeclampsia.*

Keywords: *Serum lipids, Preeclampsia, Normal pregnancy*

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Preeclampsia is one of the most common causes of maternal and fetal morbidities and mortalities[1]. Its incidence is 4-8% of pregnancies[2-4]. It is associated with proteinuria, pathological edema, coagulation abnormalities, reduced uteroplacental blood flow, and intrauterine growth restriction. The pathophysiological mechanism is characterized by a failure of the trophoblastic invasion of the spiral arteries, leading to maladaptation of maternal spiral arterioles, which may be associated with an increased vascular resistance of the uterine arteries and a decreased perfusion of the placenta[4-7]. However, the exact etiology of preeclampsia is still unknown. The results from many clinical studies show the relationship between the aggravation of the hypertensive complication and the change in concentration of various chemistries in mother's serum[4,6,8-12]. Interestingly, variable serum lipids are found in preeclamptic mothers[13-18]. Some authors reported that high serum cholesterol, triglyceride, low-density lipoprotein (LDL) and low serum high-density lipoprotein (HDL) were associated with preeclampsia[10-13]. But some authors reported that low serum cholesterol[19] or no difference in serum cholesterol[11,12,16,20], triglyceride, LDL, HDL in preeclampsia compared to normal pregnancy[11,15,20,21]. The role and status of serum lipids in pregnant women are still being discussed. The aims of the present study are to measure serum levels of cholesterol, triglyceride, HDL and LDL in mild and severe preeclamptic pregnancy and to compare with normal pregnancy.

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Material and Method

The cross-sectional study was conducted at the section of Obstetrics and Gynecology, Taksin Hospital from July 2006 to March 2007. The present study was approved by the Ethics Committee for Researches Involving Human Subjects, the Bangkok Metropolitan Administration. The studied population consists of 65 normal pregnant women, 40 pregnant women with diagnosis of mild preeclampsia and 48

pregnant women with diagnosis of severe preeclampsia. All pregnant participants were ≥ 28 weeks of pregnancy. Mild preeclampsia is defined as a blood pressure of at least 140/90 mmHg measured on two occasions each 6 hours apart, accompanied by proteinuria of at least 300 mg per 24 hours, or at least 1+ on dipstick testing[1]. Severe preeclampsia is defined as having one or more of the following criteria: blood pressure of at least 160/110 mmHg measured on two occasions each 6 hours apart, proteinuria of at least 5 g per 24 hours, or at least 3+ on dipstick testing, oliguria of less than 500 ml per 24 hours, cerebral or visual disturbances, pulmonary edema or cyanosis, epigastric or right upper quadrant pain, impaired liver function, thrombocytopenia, fetal growth restriction[1]. Fetal growth restriction is defined as the condition in which the newborn has birth weight less than 10% for gestational age[22]. Patients with history of chronic or transient hypertension, history of renal disease or cardiovascular disease, thyrotoxicosis, hemophilia, diabetes mellitus class ≥ C were all excluded.

On admission, venous serum samples were collected when the patients were in the supine position, prior to their commencement to intravenous therapy. The venous blood was aspirated from the participant's antecubital vein, placed in a plain vacuum tube. At the time of blood collection, urine protein, edema, and deep tendon reflexes were assessed. Urine protein was measured by dipstick from a random urine sample and was graded on a scale of 0 to 4+ (0, none; 1+, 30 mg/dl; 2, 100 mg/dl; 3+, 300–1,999 mg/dl; 4+, at least 2,000 mg/dl). Deep tendon reflexes were assessed by striking the patellar tendon and grading the response on a scale of 1+ to 4+ (1+, slightly movement of the foot; 2+, mild leg withdrawal; 3+, marked leg and foot movement; 4+, abrupt leg jerk and extension). The blood sample obtained on admission was also sent for complete blood count, serum cholesterol, triglyceride, HDL, LDL, prothrombin time, and partial thromboplastin time.

Blood samples were allowed to clot at room temperature and then centrifuged at 2,000 rpm for 7 minutes. Serum aliquots were stored at 2-8 degree Celsius until analysis. Serum cholesterol, triglyceride, HDL were measured by enzymatic color test with Olympus OSR6116, OSR60118, and OSR6187 respectively. The coefficient of variance within run and between run of serum cholesterol, triglyceride, HDL were 0.91% and 1.06%; 1.06% and 1.76%; 0.85% and 1.92% respectively. Serum LDL was calculated by using Friedewald's formula.

The data was analyzed with the SPSS software package version 15.0 and expressed in terms of mean, standard deviation (SD). Continuous variables of serum lipid concentrations of three groups were compared by F test from Analysis of Variances (ANOVA). A p-value < 0.05 was considered to be statistically significant.

The sample size was calculated by using serum cholesterol, HDL and LDL from the study of Uzun et al,[23] serum triglyceride from the study of Winkler K et al[19], alpha = 0.05 and beta = 0.10. The calculated sample size was 30 cases/group.

Results

The present study enrolled 153 pregnant women. The clinical characteristics of the participants are shown in Table 1. Hematocrit and APGAR scores at 5 minutes among normal pregnant women, mild and severe preeclamptic women were not significantly different. Mild preeclamptic women had average age more than normal pregnant women significantly (28.45 ± 7.67 vs. 24.37 ± 6.58, $p = 0.017$), but there was no difference between severe preeclamptic women and normal or mild preeclamptic women. Both mild and severe preeclamptic women had gestational age at sampling less than normal pregnant women significantly (36.03 ± 3.28 and 36.17 ± 3.29 vs. 37.97 ± 2.45, $p = 0.006$ and 0.007 respectively), but there was no difference between mild and severe preeclamptic women. Severe preeclamptic women had average platelet count, birth weight and APGAR scores at 1 minute less than normal pregnant women significantly (218.54 ± 71.43 vs. 262.39 ± 83.12, $p = 0.016$; 2606.63 ± 722.72 vs. 3018.19 ± 476.28, $p = 0.002$; and 8.4 ± 1.5 vs. 8.9 ± 0.36, $p = 0.04$ respectively) but there was no difference between mild preeclamptic women and normal or severe preeclamptic women. The BMI of mild and severe preeclamptic women at the onset of diagnosis were more than normal pregnant women significantly (33.95 ± 6.28 and 30.51 ± 7.5 vs. 26.91 ± 4.84, $p \leq 0.001$ and 0.013 respectively) and the BMI of mild preeclamptic women at the onset of diagnosis was more than severe preeclamptic women significantly (33.95 ± 6.28 vs. 30.51 ± 7.5, $p = 0.042$).

In Table 2, the mean serum cholesterol, triglyceride, HDL and LDL in normal pregnant women, mild and severe preeclamptic women from the present study were not significantly different.

Discussion

The average age of mild preeclamptic women were more than normal pregnancy. Both mild and severe

Table 1. Comparisons of the clinical characteristics for the three groups of participants

Characteristics	Normal pregnancy (n = 65)	Mild preeclampsia (n = 40)	Severe preeclampsia (n = 48)
Age (years)	24.37 ± 6.58	28.45 ± 7.67*	27.06 ± 6.99
Gestational age (weeks)	37.97 ± 2.45	36.03 ± 3.28**	36.17 ± 3.29**
BMI (kg/m^2)	26.91 ± 4.84	33.95 ± 6.28***	30.51 ± 7.5*,$^+$
Hematocrit (%)	35.1 ± 5.41	36.03 ± 4.14	36.46 ± 4.23
Platelet count (thsd/cumm)	262.39 ± 83.12	254.28 ± 79.53	218.54 ± 71.43*
Birth weight (g)	3018.19± 476.28	2966.19 ± 423.8	2606.63 ± 722.72**
APGAR scores			
1 minute	8.90 ± 0.36	8.90 ± 0.3	8.40 ± 1.5*
5 minutes	9.90 ± 0.26	9.90 ± 0.3	9.43 ± 1.67

Values are given as mean ± SD; n: number
Significance different by Scheffe
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ compared with normal pregnancy
$^+$ $p < 0.05$, $^{++}$ $p < 0.01$ compared between mild and sereve preeclampsia

Table 2. Comparisons of serum cholesterol, triglyceride, HDL and LDL for the three groups of participants by ANOVA

	Normal pregnancy (n = 65)	Mild preeclampsia (n = 40)	Severe preeclampsia (n = 48)
Serum cholesterol (mg/dl)	265.1 ± 51.8	254.5 ± 46.5	258.5 ± 58.2
Serum triglyceride (mg/dl)	257.7 ± 67.5	271.0 ± 70.4	269.5 ± 68.1
Serum HDL (mg/dl)	64.9 ± 13.9	67.9 ± 14.2	65.8 ± 15.9
Serum LDL (mg/dl)	148.6 ± 45.6	131.9 ± 39.6	142.9 ± 45.1

Values are given as mean ± SD; n: number

preeclamptic women had gestational age at sampling less than normal pregnant women, which may be due to treatment for preeclamptic pregnancy. Both mild and severe preeclamptic women had BMI at the onset of diagnosis more than normal pregnant women. Severe preeclamptic women had average platelet count, birth weight less than normal pregnant women which may be due to the complications of the disease.

In the previous studies, the authors reported that high serum cholesterol, triglyceride, LDL, and low serum HDL were associated with preeclampsia[10-16,18,19,21,23-26]. Plasma lipoprotein levels are major modifiable risk factors for cardiovascular disease. Increased levels of atherogenic lipoproteins, especially LDL, contribute to the development of atherosclerosis. Lowering LDL cholesterol reduces fatal and nonfatal heart attacks. When the larger triglyceride-rich lipoproteins are present in high concentration, plasma can appear turbid or milky to the naked eye. The major lipids of the lipoproteins are cholesterol, triglyceride, and phospholipids. Increased plasma concentration and reduced diameter favor subendothelial accumulation of these lipoproteins. Following chemical modifications such as oxidation, the lipoproteins are no longer cleared by normal mechanisms. They trigger a self-perpetuating inflammatory response during which they are taken up by macrophages to form foam cells-a hallmark of the atherogenic process. Atherogenic lipoproteins also have an adverse effect on endothelial function. HDL may also counteract some components of the inflammatory response, low HDL cholesterol levels also predispose to atherosclerosis[27]. The hyperlipidemia of pregnancy may have a similar effect on the endothelial cells[7,27-30]. Serum cholesterol, triglyceride, and LDL were significantly higher in preeclampsia compared with normotensive pregnancy[10,23-25]. While serum HDL was significantly lower in preeclampsia compared with normotensive pregnancy[10-12,24,25].

In the present study, there was no significant difference in serum levels of cholesterol, triglyceride, HDL and LDL between mild and severe preeclamptic pregnancies and between both groups of preeclampsia

compared to normal pregnancy (Table 2). These findings may be due to differences in races and nutrition. The maximum level of triglyceride in the present study was 399 mg/dl. Serum LDL was calculated by using Friedewald's formula and was reliable if serum triglyceride was not more than 400 mg/dl[31]. Some studies reported that serum cholesterol[11,12,16,20,26], serum triglyceride, serum LDL and HDL[11,15,19-21] were not different between preeclampsia and normal pregnancy, which were correlated with the present study. Winkler K et al reported that serum cholesterol was significantly lower in preeclampsia[19].The BMI of mild preeclampsia was more than severe preeclampsia and both were more than normal pregnancy significantly (Table 1). These findings may be due to the accumulation of fluid in the body in preeclamptic patients. However, other factors such as nutrition, exercise etc. can affect on BMI. The associations of serum lipids, exercise, and nutrition have not been identified in the present study. Therefore, they need to be studied in the future.

In the present study, there was no correlation between serum lipids and preeclampsia.

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การศึกษาเปรียบเทียบระดับความเข้มข้นของไขมันในซีรัมของผู้ป่วยโรคพิษแห่งครรภ์กับสตรีตั้งครรภ์ปกติ

ชาญวิทย์ พันธุมะผล, บุญศรี กิตติโชติพาณิชย์

วัตถุประสงค์*: เพื่อศึกษาเปรียบเทียบระดับไขมันในซีรัมของผู้ป่วยโรคพิษแห่งครรภ์ชนิดไม่รุนแรงและชนิดรุนแรงกับสตรีตั้งครรภ์ปกติ*

ประเภทงานวิจัย*: Cross-sectional study*

สถานที่ทำการวิจัย*: กลุ่มงานสูติ-นรีเวชกรรม โรงพยาบาลตากสิน*

วัสดุและวิธีการ*: โดยการเก็บข้อมูลจากสตรีตั้งครรภ์ปกติ 65 ราย ผู้ป่วยโรคพิษแห่งครรภ์ชนิดไม่รุนแรง 40 ราย และผู้ป่วยโรคพิษแห่งครรภ์ชนิดรุนแรง 48 ราย เก็บตัวอย่างเลือดจากหลอดเลือดดำและนำไปวิเคราะห์หาระดับคอเลสเตอรอล ไตรกลีเซอไรด์ high-density lipoprotein (HDL) และ low-density lipoprotein (LDL) ในซีรัม นำข้อมูลมาวิเคราะห์ความแปรปรวน (ANOVA)*

ผลการศึกษา*: ไม่พบความแตกต่างอย่างมีนัยสำคัญของระดับคอเลสเตอรอล ไตรกลีเซอไรด์ high-density lipoprotein (HDL) และ low-density lipoprotein (LDL) ในซีรัมระหว่างสตรีตั้งครรภ์ปกติและผู้ป่วยโรคพิษแห่งครรภ์ชนิดไม่รุนแรงและชนิดรุนแรง*

สรุป*: ไม่พบความสัมพันธ์ระหว่างระดับไขมันในซีรัมของสตรีตั้งครรภ์ปกติและผู้ป่วยโรคพิษแห่งครรภ์*