Evaluation and Comparison of Lipid Profile in Pregnancy and Preeclampsia

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Abstract

Objective: The objective of the study is to evaluate and compare the lipid profile in normo-tensive pregnancy and in pre-eclamptic pregnant women.

Methods: The study was a case-control study, conducted from January 2018 to June 2018. The sample size was 90. Participants were recruited after fulfilling the selection criteria out of which, 45 were normal pregnant females and 45 were pregnant females with Preeclampsia (PE). Participants were placed in two groups namely A and B. Group A were 45 healthy pregnant females and group B were 45 preeclamptic pregnant women. The biophysical parameters included age, weight, height and BMI. Blood pressure was recorded through standard protocols. Blood was taken for lipid profile which includes Cholesterol, Triglyceride and HDL-C, measured through enzymatic colorimetric (CHOD-PAP) method, Glycerol-3-Phosphate Oxidase Phenol Aminophenanzone (GPO-PAP) method and Cholesterol Oxidase-Phenol Aminophenazone (CHOD-PAP) method respectively, however; LDL-cholesterol was calculated through Friedewald's formula. Urinary protein was measured through URS Strips through semi-automated analyser CYBOW reader 300. Data was statistically analysed through IBMSPSS software version 20 with the help of one-way analysis of variance (ANOVA) analysis, Tukey'sHSD test, independent sample t-test and Pearson correlation analysis by considering p-values 0.05 as a significant.

Results: The results of the study revealed significant raise in lipid profile of pregnant women with preeclampsia than in normotensive pregnant women including cholesterol, Triglyceride, HDL-C and LDL-C.

Conclusion: The study concluded that dyslipidaemia or hyperlipidaemiain early pregnancy could be one of the reasons of developing preeclampsiain late pregnancy and risk of being hypertensive in advanced age.

Keywords: dyslipidaemia, preeclampsia, lipid profile

IRB: Approved by Institutional Review Committee of Jinnah Postgraduate Medical Centre. Dated: 22nd March 2018

Citation: Jan NA, Mahmood R, Wasi N, Jan NA, Anjum N, Salahuddin H. Evaluation and Comparison of Lipid Profile in Pregnancy and Preeclampsia [Online]. Annals of ASH & KMDC 2020;25:.

(ASH & KMDC 24(4):191;2019)

Introduction

Preeclampsia is termed when a pregnant woman has high blood pressure, protein in her urine, and swelling in her legs, feet, and hands.Increased blood pressure (B.P) in second trimester of pregnancy, after 20 weeks of gestation is diagnosed as preeclampsia. It ranges from mild to severe. It usually happens late in pregnancy, though it can come after delivery when it is termed as postpartum preeclampsia. Preeclampsia is potentially a major concern of pregnancy that contributes to the mortality and morbidity of both mother and the foetus. It complicates around 8-10% of pregnancies[1]. It has been estimated that approximately 50,000 women die annually from preeclampsia around the world[2]. It has severe impact on maternal and fetal lives, indicative of high frequency of around 19% in a Pakistani women community[1]. Around 01 in 89 women dies just due to maternal

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Date of Submission: 20th November 2019
Date of Acceptance: 8th January 2020

comorbidities during pregnancy, either with preeclampsia or eclampsia[3]. The country ranked third globally due to having a burden of child and maternal mortality[4]. The most effective treatment of preeclampsia is to deliver the baby or expedite delivery. After delivery symptoms of preeclampsia persist for 1 to 6 weeks or more after delivery. Detection of preeclampsia early may decrease the chances or risks of long-term complication of mother and baby both.

It is an altered physiological response of pregnancy in which B.P is ≥140 / 90 mm Hg combined withproteinuria ≥300 mg/24 hours, as defined by the American Congress of Obstetricians and Gynaecologists (ACOG)[5].

Preeclampsia mostly occurs in the last trimester of the pregnancy however; it appears to be emerging in the mid of the second trimester i.e. between 14 to 20 weeks. Women with strong family history of hypertension or preeclampsia in mother are at the high risk of developing the disease[1].

In the absence proper treatment preeclampsia may progress to eclampsia with kidney and liver involvement, pulmonary edema, cardiovascular accident CVA (stroke) or even mortality. However, growing fetus can be at a risk of intrauterine growth restriction, prematurity to still birth[5]. Preeclampsia can also lead to cardiovascular disease in mother in her later life[6].

Disturbed lipid profile in early pregnancy increases the likelihood of having preeclampsia. This tendency of hyperlipidemia could be one of the reasons of developing preeclampsia. Dyslipidemia or hyperlipidemia is termed when an abnormal amount of lipids (e.g. triglycerides, cholesterol and/or fat phospholipids) are raised in the blood. Total cholesterol (TC) and triglycerides (TG) are important as these values tell the total circulating lipoproteins (low density lipoprotein LDL, intermediate density lipoproteins IDL, very low density lipoprotein VLDL, high density lipoprotein HDL and chylomicrons) in the blood, total cholesterol (TC) and HDL cholesterol can be measured in the non-fasting state, but most patients should have all lipids measured while fasting (usually for 12 hours) for maximum accuracy and consistency. Preeclamptic women usually have significant variations in lipid parameters in early pregnancy and are more susceptible to lipoprotein oxidation as compared to other women[7]. These variations might occur as a result of hormonal imbalance during pregnancy, which usually revert back soon after delivery[8].

Changes in maternal endothelium is a classical hallmark of pregnancy induced hypertension or preeclampsia[9]. The endometrial changes in preeclampsia are due to alteration of factors, responsible for endothelial function, these are anticoagulation and procoagulation factors, fibronectin levels and lipid contents within endothelial cells leads to decrease release of prostacyclin andincreased oxidative stress. It is a proposed pathophysiological mechanism in preeclampsia[5].

Obesity or increased gain of weight in pregnancy is an independent risk factor for the development of placental endothelial dysfunction and preeclampsia. The probability of developing preeclampsia in pregnancy increases, when BMI is 21, whereas it is approximately doubled at a BMI of 26, and tripled at a BMI of 30[9].

However, the lipidslevels alternation in pregnant women is also one of the characteristic features of preeclampsia[10]. So it could be suggested that hyperlipidemia and obesity are inter-related to cause preeclampsia and predisposes it. Therefore hyperlipidemia and elevated BMI are the major risk factors for preeclampsia[9].

Among hyperlipidemic women, mothers with hypertriglyceridemia are more prone to develop severe cases of preeclampsia. A meta-analysis study also highlighted that women with preeclampsia had significantly higher levels of triglycerides than pregnant women with normal blood pressure (BP)[11].

Many studies have indicated a dyslipidemic pattern of increased triglycerides; cholesterol and low density lipoprotein (LDL) along with decreased

high density lipoprotein (HDL) concentrations in preeclampsia[12].

Although many studies have shown a shift toward a hyperlipidemic profile, but results are not consistent. Therefore, the present study will investigate the association of plasma lipid levels including cholesterol, triglycerides, low density lipoprotein (LDL-C) and high density lipoprotein (HDL-C) levels among normal pregnant and preeclamptic pregnant women and compare the results among these groups. Hyperlipidemia in preeclampsia could be one of the factor causing basis of increased risk of being hypertensive in advanced age. It needs further research for establishing and revealing facts.

Subjects & Methods

The study was a case control study, conducted in Physiology Dept. of BMSI in collaboration with Gynae & Obstetrics Unit I, Jinnah Post graduate Medical Centre (JPMC) Karachi. The study was conducted from January 2018 to June 2018. Participants of the study were selected from the OPD of Unit II, Gynae & Obstetrics. Sample size was calculated through online software (http://openepi.com/Menu/OE_Menu.htm), after taking prevalence 5.6% and 95% confidence interval with bond of error 5%. The sample size was 90 out of which 45 were normal pregnant females and 45 were Preeclamptic pregnant women. A written consent was taken from each participating subject. The acquired data was recorded as per designed format on the prescribed questionnaire. Inclusion criteria for cases included, gestational age more than 20 weeks which were diagnosed as pre-eclamptics and for controls; normal healthy pregnant females of more than 20 weeks of gestation without any medical problems. Likewise known hypertensive, patients with type 1 and type 2 diabetes mellitus, thyroid problems and any systemic diseases like renal or hepatic diseases were excluded from the study. The participants were placed in two groups, group A included 45 normal pregnant women and group B consisted of 45 pregnant women with preeclampsia. The biophysical parameters including age in years, weight was measured in kilograms through digital platform whereas the height was measured bare footed by stadiometer, which was further converted intometers. The BMI was then calculated by dividing the individual's weight in kilograms (kg) with the square of her height in meters (m). BMI 18.5 - 24.9 is considered as normal weight, 25 - 29.9 as over weight (non-obese) and BMI 30 and above was considered as obese (ACOG, 2013). The blood pressure was measured by mercury sphygmomanometer (Certeza CR-2002L). Cholesterol was measured by enzymatic colorimetric (CHOD-PAP) method using kit Cat. No. A 10085, manufactured by Merck, France. Triglyceride was determined by using Glycerol-3-Phosphate Oxidase Phenol Aminophenanzone (GPO-PAP) method, Kit Cat No. A 130016, by Merck, France. HDL-cholesterol was determined by using Cholesterol Oxidase-Phenol Aminophenazone (CHOD-PAP) method by photometric system, kit Cat. No. CH 203 manufactured by Randox Laboratories, UK. LDL-cholesterol was calculated according to Friedewald's formula and urinary protein was measured through URS Strips, manufactured by Cortez Diagnostics Urine Reagent Strips (URS) for urinalysis, through semi-automated analyser CYBOW reader 300.

Data was statistically analysed through IBMSPSS software version 20 with the help of one-way analysis of variance (ANOVA) analysis, Tukey's HSD test, independent sample t-test and Pearson correlation analysis by considering p-values 0.05 as a significant.

Results

In Table 1, the baseline characteristics of the 90 study participants both group A and B were depicted as mean and SD. The age of participants has non-significant difference in both the groups (group A = 28.70 ± 5.45, group B = 29.93 ± 2.61). In weight of two groups there was significant (p-values 0.05) difference in group A and B (in group A = 56.70 ± 5.83 and in group B = 65.10 ± 3.13). There was non-significant difference regarding height of two groups (in group A 2.60 ± 0.14 and ingroup B

2.56 ± 0.09). BodyMass Index showed significant difference in two groups (in group A= 21.60 ± 1.28, in group B= 30.03 ± 1.10). Regarding gestational period, there was significant (p-values 0.05) difference in two groups (in group A= 23.07 ± 1.01 and in group B= 14.90 ± 1.09).

In Table 2, the lipid parameters of both the groups were depicted as mean and SD. The cholesterol of the participants across the groups was significantly raised (in group A= 204.23 ± 8.61 and group B= 217.47 ± 11.17). The triglyceride levels were also having significant difference (in group A= 223.60 ± 13.80 and in group B= 372.03 ± 41.62). The low-density lipoprotein cholesterol (LDL - C) levels also showed significant differences among the groups (in group A= 142.37 ± 10.39 and in group B =173.33 ± 9.90). The high density lipoprotein cholesterol (HDL - C) levels showed non-significant differences across the groups. (group A= 36.10±1.40 and group B= 37.47 ± 1.74). The results of one-way ANOVA showed significant (P-value <0.05) differences for all lipid parameters among the two groups.

Discussion

The preeclampsia is the major cause of adverse neonatal and maternal outcomes including growth restrictions, low neonatal birth weight and preterm deliveries[13]. Therefore, BMI was considered as one of the measure to evaluate obesity and the related health risks. It mainly depends on the presence of the fat percentage in the body, which could result in insulin resistance, heart problems and increase blood pressure in long run[14,15]. Preeclampsia is a multisystem disorder which can result in life threatening eclampsia if left untreated[16].

The present study revealed that the increased values in lipid profile parameters in pre-eclamptic pregnant females were perceived to be associated or can result in the occurrence of preeclampsia.

It has been estimated in a study that preeclampsia is one of the cause of early terminations and occurrence of maternal hypertension on long run[17]. The findings were also supported in another study which stated that in early age and family history was found to be positively associated with preeclampsia[18].

It was found that BMI has significant association with preeclampsia. A study estimated high incidence of having preeclampsia in women with obesity in contrast to others[19]. The fact that higher grade of obesity tends to result in more severe form of preeclampsia was also highlighted by Sohlberget al[20]. A study also highlighted the likelihood of having preeclampsia and stated that women with lower BMI than normal, had 28% lower risk of developing the disease while a unit increase in the pre-pregnancy BMI, can increase the likelihood of acquiring a disease by 0.43%[16].

In terms of mean gestational weeks Zaman et al identified in a study that progression in the gestational weeks enhances the severity of preeclampsia particularly in obese women than the lean ones[21]. The results are also helpful in the early diagnosis of the severity of preeclampsia and prevention from the adverse perinatal outcomes. The preeclampsia in second trimester was considered as the severe one and in late third trimester or 37 weeks termed as mild preeclampsia. On the basis of the number of gestational weeks and the severity of preeclampsia, delivery can be planned to minimize the maternal risks and maximize the good outcomes[22].

Table 2 showed greater variations (p value<0.05) in the lipid parameters among the groups. In group B the significant difference was observed in the cholesterol and LDL concentrations while highly significant difference was observed in triglyceride concentration in comparison with group A. However, non-significant changes were identified in HDL concentrations in the both groups of present study. Group B has the higher value for triglyceride, cholesterol and LDL than group A. Previously increased serum cholesterol, TG, LDL & decreased high density lipoprotein concentrations particularly in the 3rd trimester of pregnancy were observed by many studies, suggested abnormal metabolism dur-

ing pregnancy[23]. A study found significant association between increased BMI and dyslipidemia as well and stated that women with increased BMI and older age had raised levels of serum cholesterol, TG and LDL and declined HDL levels. This was also proved in another study which stated that obesity has positive association with increased cholesterol, TG and LDL and decreased HDL levels[24].

A study estimated different parameters of lipid profile and found significant rise in serum cholesterol, triglyceride and low-density lipoprotein concentrations in preeclamptic pregnancies[8]. However, Aziz & Mahboob found raised triglyceride and declined HDL concentrations associated with preeclampsia[7]. The raised concentrations of serum cholesterol and low-density lipoprotein and declined concentrations of high density lipoprotein were also highlighted by Aljaffar[25]. It has also been highlighted that the increase in total cholesterol >205mg/dl and increase in triglyceride >133mg/dl can lead to the 3.6 and 4.1 folds increase in the likelihood of having preeclampsia respectively[26,28]. Consistent higher TG concentrations in association with hypertension are also a major contributing factor in preeclampsia[27,29]. Further studies are required to revealed the basis of changes on molecular level.

Conclusion

The study concluded that hyperlipidemia or dyslipidemia has association with preeclampsia as the preeclamptic women had variations among total lipids in early pregnancy, Cholesterol, Triglyceride (TG), and HDL-Cholesterol and LDL-Cholesterol levels in contrast to pregnant women with normal blood pressure. This tendency also shows the reason of increased chances to become hypertensive in advanced age.

Conflict of Interest

Authors have no conflict of interests and received no grant/funding from any organization.

Table 1. Baseline Characteristics of Studied Samples (n=90)

Parameters	Group			
	A		B	
	Mean	SD	Mean	SD
Age (years)	28.70	5.45	29.93	2.61
Weight (kg)	56.70	5.83	65.10*	3.13
Height (m)	2.60	0.14	2.56	0.09
Body Mass Index (kg/m^2)	21.60	1.28	30.03*	1.10
Gestational Period (weeks)	23.07	1.01	14.90*	1.09

* (p value<0.05) significant difference among the two groups.

Table 2. Comparison of Lipid Parameters within Groups

Parameters	Group			
	A		B	
	Mean	SD	Mean	SD
Cholesterol (mg/dl)	204.23	8.61	217.47*	11.17
TG (mg/dl)	223.60	13.80	372.03**	41.62
LDL (mg/dl)	142.37	10.39	173.33*	9.90
HDL (mg/dl)	36.10	1.40	35.47	1.74

* (p value<0.05) significant difference among the two groups.
** (p value<0.05) highly significant difference among the two groups.

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