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The effects of first trimester cholesterol levels on pregnancy outcomes

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Abstract

The purpose of this study was to determine whether changes in lipid profile in pregnant women might have any effect on the perinatal outcomes. This retrospective study was conducted between January 2020 and December 2020 by evaluating data drawn from the hospital database. The total serum cholesterol(C), HDL-C, LDL-C, VLDL-C and triglycerides levels were measured in 587 women during the first trimester of pregnancy and confounding factors were analyzed. The mean age was 27 years. The mean gravida and parity were 2 and 1 respectively. The mean birth weight of newborn was 3280 g. The mean Apgar score was 9 at 0 and 5 minutes respectively. The vaginal delivery rate was 68.3% whereas caeserian delivery rate was 31.7%. Neonatal intensive care unit (NICU) was needed in 0.5% of newborns. There was no significant statistical difference between the rates of caeserian section and vaginal delivery in patients with respect to lipid profile levels. The total serum cholesterol(C), triglycerides, LDL-C and VLDL-C levels were significantly higher in mothers of babies hospitalized in NICU.HDL-C level was similar between two groups. Adequate lipid levels in the first trimester of pregnancy are crucial for the health of pregnant women and newborn. High levels of lipids can increase NICU need but not effect way of delivery.

Keywords: pregnancy, total cholesterol, HDL-C, LDL-C, VLDL-C, triglycerides

1. Introduction

In a normal pregnancy, lipid parameters including total cholesterol (TC), triglycerides (TG), low-density lipoprotein-cholesterol (LDL-C), high-density lipoprotein-cholesterol (HDL-C) and phospholipids gradually increase starting in the 12th week of gestation and continue through the second and third trimesters (1, 2). Increased metabolic demands of the maternal organism and fetal growth can be reflected as changes in lipid profile of pregnant women. The two principal changes in lipid metabolism during pregnancy are hyperlipidemia and the accumulation of maternal fat depots (3). Many studies have shown that maternal dyslipidemia can predict the occurrence of adverse perinatal outcomes and some pregnancy complications. Herrera et al. reported that impaired maternal fatty acid metabolism was correlated with excessive fetal growth (3). Also, the Amsterdam born children and their development cohort study showed that maternal triglyceride concentrations in early pregnancy were linearly related with the prevalence of pregnancy-induced hypertension, induced preterm birth and large for gestational age (LGA) (4). The purpose of this study was to determine whether changes in lipid profile in pregnant women might have any effect on the way of delivery and neonatal intensive care unit (NICU)need.

2. Materials and Methods

The study group consisted of 587 pregnant women between 18-46 years age in the first trimester of pregnancy, followed in Samsun Eğitim Araştırma Hospital from January 2020 to December 2020.The data was drawn from the hospital database of patients who underwent routine antenatal visit in our hospital. This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Samsun Research and Training Hospital (2021/10/1-26.05.2021). Informed consent was obtained from all individual participants included in the study. The total serum cholesterol (C), HDL-C, LDL-C, VLDL-C and triglycerides levels were measured in 587 women during the first trimester of pregnancy and confounding factors were analyzed. Age, gravida, parity, birth weight, delivery by vaginal or caeserian section, neonatal intensive care unit (NICU) demand, and apgar scores were recorded. Gestational age was calculated according to the last menstrual period and also confirmed by ultrasonography in all women. Venous blood samples for lipid assessment were

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taken after overnight fasting from all the participants at the first trimester of pregnancy. The eligibility criteria for study enrollment were: 1) pregnancy ≥ 37wk 2) age 18–46 years; 3) without previous history of chronic illnesses (diabetes mellitus, thyroid problems, hypertension, autoimmune diseases); 4) without previous cesarian section history; 5) no alcohol or drug abuse; 6) singleton viable pregnancy. The total cholesterol (TC), HDL-C, VLDL-C and triglycerides levels were measured with the appropriate reagents. Total cholesterol and triglycerides were assayed with the cholesterol oxidase-phenol aminophenazone method, and glycerol-3-phosphatase oxidase-phenol aminophenazone method, respectively. HDL-C and LDL-C were measured by homogeneous enzymatic colorimetric assays. All the lipid measurements were performed on an automatic biochemical analyser (Abbott Architect C16000, Abbott Laboratories, USA) respectively with TC, TG, HDL-C and LDL-C detection kits (Abbott Diagnostic Kit, Abbott Laboratories, USA).

3. Results

We enrolled a total of 587 pregnant women in this study. Demographic characteristics and pregnancy results were described in Table 1. The mean age was 27 years. The mean gravida and parity were 2 and 1 respectively. The mean birth weight of newborn was 3280 g. The mean Apgar score was 9 at 0 and 5 minutes respectively. The vaginal delivery rate was 68.3% whereas caesarian delivery rate was 31.7%. Neonatal intensive care unit (NICU) was needed in 0.5% of newborns.

The lipid profile of women was presented in Table 2. The mean TC level was 178 mg/dl, triglyceride 134 mg/dl, HDL-C 60 mg/dl, LDL-C 106.7 mg/ml and VLDL-C 70 mg/dl respectively. In Table 3 we compared delivery way and lipid profile levels. There was no significant statistical difference between the rates of caesarian section and vaginal delivery in patients with respect to lipid profile levels ($p<0.05$). In Table 4 we presented the relationship between lipid profile and NICU need. The TC, triglycerides, LDL-C and VLDL-C levels were significantly higher in mothers of babies hospitalized in NICU ($p=0.003$, $p=0.02$, $p=0.0025$, and $p=0.01$ respectively). HDL-C level was similar between two groups ($p=0.279$).

We performed correlation analysis to show if there was a relationship between lipid profile and pregnancy results. There was a positive correlation between total cholesterol levels and age ($p=0.006$ $r=0.113$), gravidity ($p<0.001$ $r=0.216$) and parity ($p<0.001$ $r=0.216$). On the other hand, there was a negative correlation between total cholesterol levels and apgar scores ($p=0.006$ $r=-0.112$). There was also positive correlation between triglyceride levels and gravidity ($p<0.001$ $r=0.168$) parity ($p<0.001$ $r=0.168$). LDL-C levels also positively correlated with gravidity ($p=0.002$ $r=0.130$) and parity ($p=0.002$ $r=0.129$) LDL-C levels negatively correlated with apgar scores ($p=0.023$ $r=-0.094$). VLDL-C levels also positively correlated with gravidity ($p=0.002$ $r=0.126$) and parity ($p=0.002$ $r=0.126$). VLDL-C levels also negatively correlated with apgar scores ($p=0.01$ $r=0.107$). There was no correlation between HDL-C and other parameters.

Table 1. Demographic characteristics of patients

	Patient (n=587)
Age(y)	27 (18-46) [a]
Gravida(n)	2 (1-7) [a]
Parity(n)	1 (0-6) [a]
Birth weight(g)	3280 (1000-5200) [a]
Apgar score	9 (7-9) [a]
Delivery Caeserian Section(n)	186 (31.7%) [b]
Vaginal(n)	401 (68.3%) [b]
Neonatal Intensive Care Unit Need	
No	584 (99.5%) [b]
Yes	3 (0.5%) [b]

a: median (min-max), b: n (%)

Data analysis was performed in the SPSS 25 (Statistical Package for Social Sciences) package program. Results for P <0.05 were considered statistically significant. Descriptive statistics were shown as median (minimum-maximum) for numerical variables and as number of observations and (%) for nominal variables. The normality of the distribution of numerical variables was investigated by Kolmogorov Smirnov test. Whether there was a statistically significant difference between the two groups in terms of numerical variables was evaluated using the Mann-Whitney U test. The correlation between vitamin levels and variables was evaluated by determining Spearman's "rho" coefficient and significance level (p).

Table 2. The lipid profile of the patients

	Patient (n:587)
Total cholesterol (mg/dl)	178 (55-389)
Triglicerides (mg/dl)	134 (33-577)
HDL-C (mg/dl)	60 (33.7-119)
LDL-C (mg/dl)	106.7 (30-400)
VLDL-C (mg/dl)	70 (16-244)

Table 3. Comparison of delivery way with respect to lipid profile

	C/S (n=186)	Vaginal (n=401)	p
Total cholesterol (mg/dl)	177.15 (67-331.2)	178 (55-389)	0.438
Triglicerides (mg/dl)	127 (34-439)	136 (33-577)	0.230
HDL-C (mg/dl)	60 (34-96.1)	60 (33.7-119)	0.417
LDL-C (mg/dl)	103.65 (34-400)	110 (30-400)	0.113
VLDL-C (mg/dl)	70 (20-145.77)	70 (16-244)	0.257

C/S:caeserian delivery

Table 4. The relationship between lipid profile and NICU need

	NICU (+) (n=3)	NICU (-) (n=584)	p
Total cholesterol (mg/dl)	345 (344-348)	178 (55-389)	0.003
Triglicerides (mg/dl)	248 (218-378)	134 (33-577)	0.02
HDL-C(mg/dl)	69 (55-88.9)	60 (33.7-119)	0.279
LDL-C (mg/dl)	144 (138-145)	106 (30-400)	0.025
VLDL-C (mg/dl)	118 (117-125)	69.95 (16-244)	0.01

4. Discussion

During pregnancy, intestinal absorption capability of fat increased and is controlled by hormonal changes. As the pregnancy progresses, serum levels of triglycerides, TC, LDL-C were increased to store more fat required for maintaining pregnancy, fetal growth, and lactation. Placental trophoblast and endothelial cells can effectively transfer maternal cholesterol to the fetus throughout pregnancy, thus helping fetal growth and birth weight of infant. Chen et al. shown that elevated maternal HDL-C and LDL-C levels measured during third trimester are risk factor for small for gestational age (SGA), and high TC level during third trimester is inversely associated with SGA (5). In our study the mean birth weight of babies was in normal limits in contrast to Chen et al study. Like our study, many studies in the literature regarding lipid metabolism also are in accordance with the finding that lipid levels increase significantly during pregnancy (6-10). In contrast to Emet et al study the caeserian rate was higher in our study group. It may be due to increased request of patients (11). The mean birth weight of newborn in our study was like Zheng et al study results which was performed in 5089 pregnant women (12). As in our study, triglyceride levels did not predict fetal size in early pregnancy in Mossayebi et al study (13). Compared to the previous studies, we have a homogenous sample without diabetes mellitus, hypertension, and preterm labor. This homogenous population in our study excludes discrepancies due to different diseases such as diabetes and hypertension, and different strategies for treatment of such diseases and makes our sample as homogenous as possible. Retrospective nature of the study and possible selection bias could be accepted as limitations of the study.

Adequate lipid levels in the first trimester of pregnancy are crucial for the health of pregnant women and newborn. High levels of lipids can increase NICU need but not effect way of delivery. A healthy balanced diet is the best source of adequate supply for pregnant women.

Conflict of interest

None to declare.

Acknowledgments

None to declare.

References

1. Bartels Ä, Egan N, DI, AS, Joyce C, Stapleton M et al. Maternal serum cholesterol levels are elevated from the 1st trimester of pregnancy: A cross-sectional study. J. Obstet. Gynaecol. 2012;32(8):747–52.
2. Ghio A, Bertolotto A, Resi V, Volpe L, Di Cianni G. Triglyceride metabolism in pregnancy. Adv. Clin. Chem. 2012; 55: 133–153.
3. Herrera E, Ortega-Senovilla H. Lipid metabolism during pregnancy and its implications for fetal growth. Curr. Pharm. Biotechnol. 2014: 15(1), 24–31.
4. Vrijkotte TGM, Krukziener N, Hutten BA, Vollebregt KC, Eijsden M, Twickler MB, Maternal lipid profile during early pregnancy and pregnancy complications and outcomes: The ABCD study. J. Clin. Endocrinol. Metab.2012: 97(11), 3917-25 .
5. Chen Q, Chen H, Xi F, Sagnelli M, Zhao B, Chen Y, et al. Association between maternal blood lipids levels during pregnancy and risk of small-for-gestational-age infants. Sci Rep. 2020 Nov 16;10(1):19865.
6. Salameh WA, Mastrogiannis DS.Maternal hyperlipidemia in pregnancy. Clin Obstet Gynecol 1994;37(1):66–77.
7. Desoye G, Schweditsch MO, Pfeiffer KP, Zechner R, Kostner GM. Correlation of hormones with lipid and lipoprotein levels during normal pregnancy and postpartum. J Clin Endocrinol Metab.1987; 64:704–12.
8. Franz H, Wendler D. A controlled study of maternal serum concentrations of lipoproteins in pregnancy-induced hypertension. Arch Gynecol Obstet 1992; 252(2): 81-86.
9. Montelongo A, Lasuncion MA, Pallardo LF, Herrera E. Longitudinal study of plasma lipoproteins and hormones during pregnancy in normal and diabetic women. Diabetes 1992; 41(12): 1651-59.
10. Zheng W, Huang W, Zhang L, Tian Z, Wang T, Zhang T, et al. Changes in serum lipid levels during pregnancy and association with neonatal outcomes: a large cohort study. Reprod Sci. 2018;25(9):1406-12.
11. Emet T, Ustüner I, Güven SG, Balık G, Ural UM, Tekin YB, et al. Plasma lipids and lipoproteins during pregnancy and related pregnancy outcomes. Arch Gynecol Obstet. 2013 Jul;288(1):49-55.
12. Zheng W, Zhang L, Tian Z, Zhang L, Liang X, Li G. Establishing reference ranges of serum lipid level during pregnancy and evaluating its association with perinatal outcomes: A cohort study. Int J Gynaecol Obstet. 2021 Feb 5.
13. Mossayebi E, Arab Z, Rahmaniyan M, Almassinokiani F, Kabir A. Prediction of neonates' macrosomia with maternal lipid profile of healthy mothers. Pediatr Neonatol. 2014 Feb;55(1):28-34.