

The Effect of Maternal Body Composition and Triglyceride Levels on Newborn Weight in Non-Diabetic Women with Positive Diabetic Screens

Cüneyt Eftal TANER¹, Seçil KURTULMUŞ¹, Ümit NAYKİ¹, Ayşen KIZILYAR¹, Yasemin BASKIN²

İzmir, Turkey

OBJECTIVE: To determine the effect of maternal body composition and triglyceride levels on newborn weight in nondiabetic women with positive diabetic screening.

STUDY DESIGN : 40 pregnant women with positive diabetic screenings and negative glucose tolerance tests were enrolled as the study group. 72 pregnant women with negative diabetic screenings were enrolled as the control group. 50-gram glucose challenge tests were performed at 24-32 weeks of gestations and serum lipid levels were measured. The association between maternal serum triglyceride (TG) levels, maternal pre-pregnant body mass index (BMI), maternal weight gain during pregnancy and newborn weight in both groups were compared.

RESULTS: The incidence of the infants with >75 percentile newborn weight and the incidence of maternal hypertriglyceridemia were significantly higher in the study group ($p<0.05$). In this group maternal weight gain during pregnancy was significantly correlated with newborn weight and mean serum triglyceride levels were higher than the control group ($p<0.05$).

CONCLUSION: In non-diabetic pregnant women with positive diabetic screens maternal weight gain during pregnancy was significantly correlated with newborn weight and incidences of infants with >75 percentile newborn weights were significantly higher than control group.

Key Words: Maternal BMI, Positive diabetic screening, Serum triglyceride, Newborn weight

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Introduction

Fetal growth is affected by genetic, demographic and metabolic factors of the mother.¹ Maternal glucose concentration has an important relation with fetal growth. Pregnancies complicated by diabetes mellitus are at increased risk for maternal and fetal complications.^{2,3} Fetal macrosomia occurs in 25% to 42% of pregnancies in diabetic women as compared with 8% to 14% in nondiabetic populations.⁴

According to Pedersen's hypothesis maternal hyperglycemia stimulates the fetal pancreas to secrete excess insulin which promotes adiposity and macrosomia.⁵ In diabetic mothers a relationship between large for gestational age infants and fasting glucose concentration at 27 and 32 weeks gestation has been shown.⁶ These reports show us that diabetic macrosomia may be associated with maternal metabolic conditions at certain gestational ages.

The exact degree of maternal glucose intolerance associated with macrosomia is not well defined. Even a minor de-

gree of maternal glucose intolerance can cause increased risk of macrosomia. Some authors showed a similar association between glucose concentration and newborn weight in women with positive diabetic screening but normal glucose tolerance test.⁷⁻⁹

Fetal growth is also affected by maternal body composition, weight gain and metabolic factors other than glucose such as lipids and amino acids.^{10,11} Maternal obesity and excessive weight gain during pregnancy intensifies the insulin resistance already present in late pregnancy and probably exaggerates the metabolic abnormalities attending gestational diabetes mellitus (GDM) that impact on fetal growth. Maternal body mass index (BMI) has a positive association with newborn weight.^{12,13} and increased BMI is associated with higher maternal glucose levels.^{14,15}

Maternal serum lipid levels increase during late gestation which is believed to be beneficial to mother and fetus in terms of lactation and nutrition. Recent studies reported an association between maternal serum triglycerides and newborn weight.^{16,17} However the relative influence of elevated triglyceride levels or fetal birth weight remains controversial and requires more detailed investigations.

In this prospective study our objective was to determine the effect of maternal body composition and triglyceride levels on newborn weight in nondiabetic women with positive diabetic screens.

¹ Aegean Women's and Maternity Hospital, İzmir

² Regional Institute of Hygiene, Ministry of Health, İzmir

Address of Correspondence: Seçil Kurtulmuş
Aegean Women's and Maternity Hospital
İzmir

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Material and Method

This study involved 112 healthy pregnant women at 24-32 weeks of their gestations. Subjects were divided into two groups according to the results of their glucose screening and glucose tolerance tests performed at 24 to 32nd weeks of their gestations. Those with abnormal glucose screening tests and normal glucose tolerance tests were enrolled as the study group (n=40), the other pregnant women with normal glucose screening tests were enrolled as the control group (n=72).

Standard 50 g glucose load performed after an overnight fast and blood samples were taken to determine serum glucose levels. All pregnant women with serum glucose levels 140 mg/dL or higher after 50 g glucose challenge test were accepted as an abnormal result and were scheduled for a 3-hour oral glucose tolerance test. Results more than 110 mg/dL for fasting, 180 mg/dL for 1-hour, 155 mg/dL for 2-hour, and 140 mg/dL for 3-hour were accepted as positive. Two or more positive results were accepted as gestational diabetes.

Women with hypertensive disorders, thyroid disease, connective tissue disease, intrauterine growth restriction, fetal anomalies or multiple gestations were excluded. Because of these conditions may restrict fetal growth. Women who delivered before 37 weeks and women with gestational diabetes or diabetes mellitus were also excluded from the study.

Serum lipid concentrations were evaluated at the same visit. Hypertriglyceridemia was defined as a value higher than 200 mg/dL.

Clinical characteristics of the cases such as maternal age, parity, height, pre-pregnant weight, pre-pregnant BMI, weight gain during pregnancy, body mass index (kg/m²) were all noted. Obesity was defined as a pre-pregnant BMI above 27

kg/m². Maternal weight gain during pregnancy was defined as an increase in weight from pre-pregnant weight to weight at the last visit.

The gestational age at delivery was estimated by last menstrual period and confirmed or corrected by ultrasonographic examinations. All subjects were followed up until their delivery.

Neonatal data included newborn weight and neonatal gender. The birth weight percentile was calculated precisely for each newborn according to gender specific Turkish birth weight curve.¹⁸ Infants were classified into three percentile (P) birth weight groups. Group I; <25 P, Group II \geq 25 P and <75 P, and Group III is \geq 75 P.

The study was approved by our hospital's ethic committee. Approvals of the patients were taken.

Data were presented as percentage as mean and Standard deviation (SD). Statistical analyses were performed by using the student's t-test chi-square test and Pearson correlation tests.

Results

Our study group included 40 pregnant women with positive diabetes screening tests and negative glucose tolerance tests and the control group included 72 pregnant women with negative diabetes screening tests.

Clinical characteristics of the groups were shown in Table I. There was no significant difference between groups with regard to age, parity, pre-pregnant BMI, maternal obesity, weight gain during pregnancy, gestational age at recruitment, gestational age at delivery, birth weight and neonatal gender.

Table 1: Clinical characteristics of 112 mother and their neonates

Characteristics	Study Group (n=40)		Control Group (n=72)		p value
	Mean \pm SD	Range	Mean \pm SD	Range	
Age (year)	26 \pm 4.2	19-35	24,6 \pm 4,4	17-38	NS
Parity	1,97 \pm 0,94	1-5	1,84 \pm 1,0	1-5	NS
Pre-pregnancy BMI (kg/m ²)	23,6 \pm 3,4	18-33	23,1 \pm 4,1	17-36	NS
Maternal obesity (BMI>27)	8 (20%)		19 (26,4%)		NS
Weight gain during pregnancy (kg)	13,0 \pm 3,7	4-20	12,8 \pm 5,2	3-27	NS
Gestational age at recruitment (wks)	29 \pm 2,4	24-32	27,4 \pm 2,8	24-32	NS
Gestational age at delivery (wks)	39,3 \pm 0,88	37-41	39,6 \pm 1,0	37-41	NS
Birth weight (g)	3438 \pm 478	2700 - 4700	3376 \pm 417	2300 - 4300	NS
Neonatal Gender	F: 25, M:15		F: 34, M: 38		NS
Serum triglyceride (mg/dL)	204 \pm 87	85 - 495	171 \pm 58	57 - 302	S
Maternal Hypertriglyceridemia (>200 mg/dL)	18 (45%)		19 (26%)		S

p<0.05:Significant, *S*:Significant, *NS*:Non-significant, *F*: Female, *M*: Male, *SD*: Standard deviation

The incidence of women who had hypertriglyceridemia was significantly higher in the study group than the control group ($p<0.05$) and also serum triglyceride concentrations were significantly higher in the study group when compared with the control group ($p<0.05$). Newborn weight and the incidence of newborn weight above 75 percentile did not differ significantly between women with hypertriglyceridemia and those with normal triglyceride levels in both study and control groups.

The incidence of the infants with newborn weight 75 percentile and above was significantly higher in the study group than the control group (40% versus 27.7%) (Table 2).

Table 2: Number of infants in each birth weight percentile values

Percentile	Study group		Control group		P
	No	%	No	%	
<25	17	42,5	30	41,7	NS
≥25 and <75	5	17,5	22	30,6	NS
≥75	18	40	20	27,7	S

S:Significant, NS: Non-significant

In the study group maternal weight gain during pregnancy was significantly correlated with newborn weight whereas maternal pre-pregnant BMI and maternal triglyceride levels were not. In the control group maternal pre-pregnant BMI correlated significantly with newborn weight whereas maternal weight gain during pregnancy and maternal triglyceride levels did not.

Discussion

Maternal glucose concentration and hyperlipidemia during pregnancy has an important relation with fetal growth.^{2,3,6,17-19} Uvena-Celebrezze reported that neonatal fat mass was best correlated with maternal fasting glucose levels in women with gestational diabetes.²⁰ Increased risk of macrosomia is also reported in pregnant women with a minor degree of maternal glucose intolerance.²¹ A significantly higher incidence of large for gestational age (LGA) infants were observed in women with abnormal diabetic screening but normal oral glucose tolerance test in comparison with those who had negative diabetic screening.^{7,22}

Maternal serum lipid levels increase during mid to late gestation which is believed to be beneficial to mother and fetus in terms of lactation and nutrition. Knopp et al²³ reported that postprandial triglyceride but not postprandial glucose levels at diabetic screen at 24-28 weeks gestation were significantly associated with relative birth weight. In a study investigating serum lipids and lipoproteins in newborns and their mothers the authors found that maternal obesity and fetal macrosomia were associated with lipoprotein abnormalities.

They reported that hypertriglyceridemia and reduced HDL-cholesterol level were the major lipoprotein changes found in obese mothers and their macrosomic offspring.²⁴

In our study we found that mean maternal serum triglyceride levels and incidence of women with hypertriglyceridemia and incidence of infants with 75 percentile weight values were significantly higher in pregnant with positive diabetic screens. We could not find any significant difference in prepregnant BMI, incidence of obesity and birth weights between the study and control groups.

In a similar study Kitajimo¹⁷ reported that they found positive correlation with fasting triglyceride levels at 24-28 weeks and newborn weight at term independent of maternal glucose levels and obesity. And they suggested that maternal fasting serum triglyceride levels in midpregnancy might be an independent predictor of fetal macrosomia in women with positive diabetic screens. In our study we could not find similar correlations, we only found significant correlation between maternal weight gain and newborn weight in pregnant with positive diabetic screens.

Hypertriglyceridemia is one of the major characteristics of insulin resistance in nonpregnant adults.²⁵ Some authors,^{26,27} reported that they found hypertriglyceridemia in women with gestational diabetes and some²⁸ suggested an association with hypertriglyceridemia and fetal macrosomia and decreased insulin sensitivity during pregnancy when compared with normal pregnancy. Catalana and Caruso^{29,30} also reported that maternal insulin sensitivity was negatively associated with newborn birth weight

As a conclusion we found that weight gain during pregnancy was significantly correlated with newborn weight in nondiabetic women with positive diabetic screens and they had higher triglyceride levels and higher incidence of infants with 75 percent weight values when compared with normal pregnant.

Pozitif Diyabetik Tarama Sonuçları Olan Non-Diyabetik Kadınlarda Maternal Vücut Kompozisyonu ve Trigliserid Seviyelerinin Yenidoğan Doğum Ağırlığı Üzerine Etkisi

Cüneyt Eftal TANER¹, Seçil KURTULMUŞ¹,
Ümit NAYKİ¹, Ayşen KIZILYAR¹, Yasemin BASKIN²
İzmir, Türkiye

Bu çalışmanın amacı pozitif diyabetik tarama sonuçları olan non-diyabetik kadınlarda maternal vücut kompozisyonu ve trigliserid seviyelerinin yenidoğan doğum ağırlıklarına etkisini araştırmaktır.

Çalışma grubuna pozitif diyabetik tarama sonuçları olan fakat glukoz tolerans testi negatif bulunmuş 40 gebe kadın dahil edil-

di. Diyabetik tarama testleri negatif bulunmuş 72 kadın da kontrol grubu olarak alındı. 50 gramlık glukozla yapılan tarama testi gebeliğin 24-32. haftaları arasında yapıldı ve bu esnada serum lipid seviyeleri de ölçüldü. Her iki grupta Maternal serum trigliserid (TG) seviyeleri, maternal gebelik öncesi vücut kitle indeksleri (BMI - VKİ), gebelik süresince maternal ağırlık artışı ve yenidoğan doğum ağırlıkları arasındaki ilişki karşılaştırıldı.

75 persantilden daha büyük yenidoğan doğum ağırlığı insidansı ve maternal hipertrigliseridemi insidansı çalışma grubunda anlamlı olarak yüksek bulundu. ($p<0.05$). Bu grupta gebelik süresince maternal ağırlık artışı yenidoğan doğum ağırlığı ile anlamlı olarak ilişkili idi ve ortalama maternal serum trigliserid seviyeleri kontrol grubundan anlamlı olarak daha yükseti. ($p<0.05$).

Pozitif diyabetik tarama sonuçları saptanan non-diyabetik gebelerde, gebelik süresince maternal ağırlık artışı yenidoğan doğum ağırlığı ile anlamlı derecede ilişkili bulunmuştur ve bu grupta 75 persantilden daha büyük yenidoğan ağırlığı insidansı kontrol grubuna göre anlamlı derecede daha fazladır.

Anahtar Kelimeler: Maternal VKİ, Pozitif diyabetik tarama sonuçları, Serum trigliserid, Yenidoğan doğum ağırlığı

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