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The factors effective on the macrosomic deliveries of non-diabetic pregnant women

Alpaslan Akyol[1], Hasan Talay[2], Ali Gedikbaşı[3], Cemal Ark[2], Volkan Ülker[2], Çağdaş Özdemir[2]

[1]Department of Obstetrics & Gynecology, Faculty of Medicine, Fırat University, Elazığ, Turkey
[2]Clinics of Obstetrics & Gynecology, İstanbul Kanuni Sultan Süleyman Training and Research Hospital, Istanbul, Turkey
[3]Division of Perinatology, Clinics of Obstetrics & Gynecology, İstanbul Kanuni Sultan Süleyman Training and Research Hospital, Istanbul, Turkey

Abstract

Objective: The aim of our study was to analyze the characteristics of maternal and fetal variables in babies born 4000 g and above.

Methods: A study group was created with 572 pregnant women who delivered babies 4000 g and above between 37 and 42 weeks of gestation, and a control group was created with 614 pregnant women who delivered babies between 2500 and 4000 g at the same weeks of gestation, all who delivered at our hospital between January 2009 and April 2012. In the study, maternal age, gravida, parity, week of gestation, body mass index, maternal height, weight gained during pregnancy, hemoglobin A1c (HbA1c) levels, presence of polyhydramnios, macrosomia history at previous pregnancies and fetal sex were evaluated.

Results: When the pregnant women delivered babies 4000 g and above and the pregnant women delivered babies below 4000 g were compared and maternal age being higher than 35 years (p=0.02), mean parity (p=0.03), week of gestation (p=0.01), mean maternal height (p<0.001), maternal HbA1c levels (p<0.001), polyhydramnios (p<0.001) and history of delivering baby with macrosomia (p<0.001) were found significantly higher in the study group (birth weight higher than 4000 g). There was no significant difference between the groups in terms of gravida, body mass index and weight gained during pregnancy.

Conclusion: Pregnancy at over 35 years old, parity, mean maternal height being high, weight gained during pregnancy being over 12 kg, high HbA1c, presence of polyhydramnios during current pregnancy and the history of delivering baby with macrosomia increase the risk of macrosomia in fetus.

Keywords: Macrosomia, hemoglobin A1c, gestational diabetes mellitus.

Özet: Diyabetik olmayan gebelerin makrozomik doğumlarında etkili faktörler

Amaç: Çalışmanın amacı 4000 gram ve üzerinde doğan bebeklerde maternal ve fetal değişkenlere ait özelliklerin araştırılmasıdır.

Yöntem: Ocak 2009 - Nisan 2012 tarihleri arasında hastanemizde 37-42. gebelik haftalarında doğum yapan 4000 gram ve üzeri bebek doğurmuş 572 gebe ile çalışma grubu, aynı dönemde 2500-4000 gram arası bebek doğurmuş 614 gebe ile de kontrol grubu oluşturuldu. Çalışmada anne yaşı, gravidası, paritesi, gebelik haftası, vücut kitle indeksi, anne boyu, gebelikte alınan kilo, hemoglobin A1c (HbA1c) düzeyleri, polihidramnios varlığı, önceki gebeliklerde makrozomi öyküsü ve fetal cinsiyet değerlendirildi.

Bulgular: Dört bin gram ve üzerinde doğum yapan gebelerle 4000 gramın altında doğum yapan gebeler karşılaştırıldığında anne yaşının 35 yaşından büyük olması (p=0.02), parite ortalaması (p=0.03), gebelik haftası (p=0.01), maternal boy ortalaması (p<0.001), maternal HbA1c düzeyleri (p<0.001), polihidramnios (p<0.001) ve makrozomili bebek doğurma hikayesi (p<0.001) çalışma grubunda (>4000 gram doğum ağırlığı) anlamlı olarak daha yüksek bulundu. Gravida, vücut kitle indeksi, gebelikte alınan kilo açısından ise gruplar arasında anlamlı bir fark bulunamadı.

Sonuç: Otuz beş yaş üzeri gebelik, parite, gebelik haftası, maternal boy ortalamasının yüksek olması, gebelikte alınan kilonun >12 kg olması, HbA1c yüksekliği, mevcut gebelikte polihidramnios olması ve makrosomili bebek hikayesi fetüste makrozomi riskini arttırmaktadır.

Anahtar sözcükler: Makrozomi, hemoglobin A1c, gestasyonel diabetes mellitus.

Correspondence: Alpaslan Akyol, MD. Fırat Üniversitesi Tıp Fakültesi, Kadın Hastalıkları ve Doğum Anabilim Dalı, Elazığ, Turkey.
e-mail: alpakyol@yahoo.com

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Introduction

Macrosomia is defined as the estimated fetal weight being 4000 g and above or over 90% according to week of gestation. It is seen in 1-10% of all deliveries. Fetal macrosomia is a significant problem in terms of maternal (postpartum hemorrhage, cervicovaginal and anal sphincter laceration, postpartum infection, and increased elective cesarean rate etc.) and fetal (prolonged labor, increased instrumental delivery possibility, shoulder dystocia, brachial plexus injury, meconium aspiration) morbidities and even its association with fetal mortalities.[1] The most significant risk factor for the fetal macrosomia is diabetic mother. This study distinctively aims to determine the characteristics causing fetal macrosomia and the risk factors in macrosomic babies whose mothers are non-diabetics during or before gestation.

Methods

A study group consisting of 572 pregnant women who delivered babies 4000 g and above between 37 and 42 weeks of gestation, and a control group consisting of 614 pregnant women who delivered babies between 2500 and 4000 g at the same weeks of gestation, all who delivered at our hospital between January 2009 and April 2012 were included in our study. Pregnant women who had maternal systemic diseases, those with the diseases that may affect fetal development such as preeclampsia and diabetes, pregnants who had corrupted 50 g glucose tolerance test, deliveries before 37 weeks of gestation, postterm pregnancy, multiple pregnancies, fetuses found to have anomalies and fetuses died in uterine were excluded from the study.

Hospital records and patient files were investigated retrospectively. In the study, maternal age, gravida, parity, week of gestation, body mass index (BMI), maternal height, weight gained during pregnancy, hemoglobin A1c (HbA1c) levels, presence of polyhydramnios, and macrosomia history at previous pregnancies were evaluated. For macrosomia history, deliveries at and above 4000 g were accepted.

For statistical analyses, SPSS v16.0 software (SPSS Inc., Chicago, IL, USA) was used. Statistical significance was accepted as $p<0.05$.

Results

The cases were first compared in terms of maternal demographic characteristics that may affect fetal weight (**Table 1**). The cases above 35 years in terms of maternal age were significantly higher in the study group (19% vs. 14%; p=0.02). While the mean age was 26.5±11.6 in the study group, it was 25.6±8.8. There was statistically no significant difference between the mean maternal ages (p=0.13). Also, there were 29 cases (5%) in the study group and 11 cases (1.7%) in the control group who delivered after 40 years old.

In terms of maternal heights, 117 cases (20.4%) were 159 cm and below, 374 cases (65.3%) were between 160 and 170 cm, and 81 cases (14.1%) were over 170 cm in the study group. In the control group, 233 cases (37.9%) were 159 cm and below, 331 cases (53.9%) were between 160 and 170 cm, and 50 cases (8.1%) were over 170 cm. When mean heights were compared, it was found as 164±8.6 cm in pregnant women who delivered 4000 g and above while it was 161.8±9.1 in the pregnant women who delivered below 4000 g. The difference was statistically significant ($p<0.001$).

When maternal BMI distribution was analyzed in the study group, it was seen that 367 cases (64.1%) were between 19 and 24 (normal), 154 cases (26.9%) were between 25 and 30 (overweight), and 51 cases (8.9%) were above 31 (obese). In the control group, 380 cases (61.8%) were between 19 and 24 (normal), 187 cases (30.4%) were between 25 and 30 (overweight) and 47 cases (7.6%) were above 31 (obese).

The study group was analyzed in terms of the weight gained during pregnancy, and it was found that 334

Table 1. Maternal and fetal characteristics in deliveries above and below 4000 g.

	Birth weight >4000 g	Birth weight 2500-3999 g	p value
Maternal age >35	109/572 (19%)	86/614 (14%)	0.02
Median gravid	3	2	0.58
Median parity	1	1	0.03
Week of gestation	38.6±1.9	38.2±3.4	0.01
Mean maternal height (cm)	164±8.6	161.8±9.1	<0.001
Mean maternal BMI	26.6±9.5	27.5±8.8	0.09
Weight gained during pregnancy >12 kg	238 (%41.6)	217 (%35.4)	0.03
High maternal HbA1c value	30 (%5.2)	7 (%1.1)	0.0001
Polyhydramnios	43 (%7.5)	4 (%0.6)	<0.001
History of baby with macrosomia	148 (%25.8)	41 (%6.6)	<0.001
Fetal sex (male/female)	320/252	312/302	0.08

cases (58.3%) gained 0-12 kg, 192 cases (33.5%) gained 13-19 kg, and 46 cases (8%) gained over 20 kg. In the control group, 397 cases (64.6%) gained 0-12 kg, 194 cases (31.6%) gained 13-19 kg, and 23 cases (3.7%) gained over 20 kg. When maternal weight gains of both groups were compared, a statistically significant difference was found (p=0.03). While median gravida was 3 in the study group, it was 2 in the control group (p=0.58). Median parity number was 1 in both groups (p=0.03).

Mean week of gestation was 38.6±1.9 in the study group while it was 38.2±3.4 in the control group (p=0.01).

When maternal HbA1c levels were evaluated, it was found out that 30 cases (5.2%) in the study group and 7 cases (1.1%) in the control group had high HbA1c values (>6). There was a significant difference between two groups in terms of the case number with high HbA1c level (p=0.0001).

While the polyhydramnios was present in 43 cases (7.5) in the study group, it was seen in 4 cases (0.6%) in the control group (p<0.0001). In the comparison of the history of delivering baby with macrosomia (>4000 g), it was observed that 148 cases (25.8%) in the study group and 41 cases (6.6%) in the control group had such histories. There were also significant difference between the groups in terms the history of delivering baby with macrosomia (p<0.0001).

Discussion

Macrosomic fetus is described as the fetuses above 4000-4500 g regardless of gestational age, or as the fetuses over 90th percentile according to week of gestation.[1] On the other hand, when birth weight exceeds 4500 g, the risks associated with fetal macrosomia increases prominently. Newborn birth weight has maternal and fetal risks. The rates for prolonged labor, shoulder dystocia, perinatal asphyxia, brachial plexus injury, fetal and maternal injuries, meconium aspiration, respiratory distress syndrome, postpartum atonia, and neonatal hypoglycemia increase.[2]

Many factors may increase fetal macrosomia risk. The most common factors effective in the macrosomia formation are maternal diabetes, maternal obesity or weight gained during pregnancy. Besides, the factors such as fetal macrosomia history, being male fetus, number of previous pregnancies, postterm pregnancy and maternal age are also the risk factors for macrosomic fetus.[3]

While some of these factors changeable, some of them cannot be changed. If changeable risk factors can be avoided or fixed, the risks associated with fetal and maternal morbidity may be decreased and even eliminated. Fetal macrosomia has a distinct association with diabetes. In our study, we aimed to investigate the factors effective in the formation of fetal macrosomia in non-diabetic pregnant women. We analyzed maternal and fetal characteristics seen in macrosomic deliveries.

In our study, there was statistically no significant difference between the groups in terms of mean maternal age while there was statistically significant difference in favor of the group delivered above 4000 g by cases above 35 years old (p=0.02). In the literature, the study of Najafian et al. which analyzed the outcomes of 1800 babies born above 4000 g reported that the rate of the cases above 35 years old was 60% while it was 21% in the control group.[4] In our study, 19.1% of the group consisting of the cases delivered above 4000 g was the pregnant women who were above 35 years old while this rate was 14% in the control group. It was also reported in the literature that macrosomia may be seen in cases younger than 17 years old who have negative result in glucose tolerance test although the result of 50 g test is positive.[1]

High maternal height is also among the risk factors of fetal macrosomia. Hence, maternal height is listed among the risk factors of fetal macrosomia in the American College of Obstetrics and Gynecology Guidelines.[5] In our study, maternal height rate in pregnancies over 170 cm was found two times higher than the control group (>4000 g), and the group above 4000 g was statistically higher for maternal heights where all cases were included in the comparison (p=0.001). Similarly, BMI and weights gained during pregnancy were also higher in the fetal macrosomia group. In a case-control study consisting of 1800 cases where maternal risk factors for fetal macrosomia were analyzed, maternal obesity (BMI >24) rate was found to be significantly higher in the macrosomia group (75% vs. 16%; p=0.0001). While insulin sensitivity is closely associated with maternal weight, fetal weight gain occurs by adipose tissue accumulation in the second half of pregnancy. Height contributes fetal macrosomia genetically and high level of BMI decreases insulin sensitivity while developing secondary to hyperinsulinemia and the increase of growth factors.

At early embryological period, uncontrolled hyperglycemic blood glucose profile increases abortus risk. If

such a pregnancy overcomes abortus risk and reaches the term, it has macrosomic fetus risk this time. Therefore, when women who deliver macrosomic baby are evaluated retrospectively, it is seen that they have a high number of gravida associated with their abortus histories.[6] In evident diabetic cases, it is already known that abortions and stillbirths are common. In our study, the mean values of both gravida and parity were significantly higher in the macrosomic group (p=0.001 and p=0.01). It is also specified in the American College of Obstetrics and Gynecology Guidelines that there is a direct proportion between parity and fetal weight, and there is an increase about 100-150 g per birth.[1]

It is known that fetal weight increases as week of gestation increases. It was found that mean week of gestation in macrosomic babies is higher than the babies with normal birth weight.[6] Birth weight prominently increases especially in the babies delivered by postterm pregnancies. However, in our study, we excluded the postterm pregnancies. Yet, mean weeks of gestation were significantly different between study and control groups, in favor of the group delivering over 4000 g.

It is considered that maternal hyperglycemic medium also creates hyperglycemic medium in fetus and causes glycosuria and therefore leads to polyhydramnios. Hence, the incidence of polyhydramnios in diabetic pregnant women increased 30 times compared to non-diabetic pregnant women.[7] In our study, presence of polyhydramnios being high in the women who delivered macrosomic fetus, even non-diabetic ones, might be caused by hyperglycemic medium and having HbA1c value higher than the control group. In the diabetic pregnancies, polyhydramnios is explained by the increased fetal urination caused by hyperglycemia. In fact, it was found that macrosomia will develop at a rate of 80% together with polyhydramnios cases developing at second trimester.[8] In a study evaluating the relationship between polyhydramnios and macrosomia, it was found that polyhydramnios was approximately 2 times higher (17% vs. 8%) in the macrosomia group.[9] In a study of 3115 cases including term pregnancies, it was found that the risk to observe macrosomia was 71% when seeing amniotic fluid index by ultrasound being >20 cm and fetal weight measurement were combined.[10] In the literature, it is stated that macrosomia being in fetuses is associated with fetal sex and macrosomic babies are mainly male, and this is especially common in babies born above 4500 g.[11] In our study, the rate of male babies was higher than female babies in the group above 4000 g, and this difference was statistically not significant when compared to the control group.

Since HbA1c is associated with glucose levels at last 3-4 weeks, it is also closely associated with glycemic medium and insulin level. Since maternal insulin levels are also associated with fetal development and weight, even the mother is not apparently diabetic, high level of HbA1c is associated with macrosomia.[12,13] In our study, HbA1c levels were found to be almost 5 times higher (>6) in favor of macrosomia group when both groups were compared (5.2% vs. 1.1%; p<0.01). In the study performed by Gezer et al., glucose metabolism was analyzed in macrosomic deliveries and HbA1c level being 6 and above was found in 55.6% of the cases in the macrosomic group while it was 37.5% in the control group.

Conclusion

Macrosomic fetus may also be observed in non-diabetic pregnancies from time to time. By determining risk factors, incidental maternal and fetal complications associated with macrosomic babies unpredictable at birth may be avoided. In our study, we have found that maternal age, parity, week of gestation, maternal height, weight gained during pregnancy being above 12 kg, HbA1c level, presence of polyhydramnios, and macrosomia history are the factors effective on the formation of fetus with macrosomia.

Conflicts of Interest: No conflicts declared.

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