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ARAŞTIRMA / RESEARCH

Evaluation of the factors affecting newborn weight

Yenidoğan ağırlığını etkileyen faktörlerin değerlendirilmesi

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Abstract

Purpose: There is a trend that causes an increase in newborn weights and macrosomy rates in many countries around the world. The aim of our study is to compare the mean newborn weights in 2012 and 2016, to investigate whether there is a tendency to increase in the mean newborn weight and macrosomia rates, and to evaluate the effects of neonatal gender, mode of birth, maternal age and the season of birth on newborn weight.

Materials and Methods: The data of a total of 1573 newborns 2012 (n:687) and 2016 (n=886) between 37-40 weeks of gestation were evaluated retrospectively. The data of the newborns' birth weight, gender, gestationel age, maternal age, mode of birth and season of birth were evaluated statistically.

Results: It was found that there was an increase in the rate of macrosomia (birth weight ≥4000 g) from 4.9% in 2012 to 8.1% in 2016. There is a weak positive correlation between maternal age and newborn weight for both years. There was a significant increase in terms of birth weight between babies delivered by cesarean section and babies delivered by normal route 2016. It was observed that the season of birth had no effect on birth weight.

Conclusion: There was an increase macrosomia rates in 2016. It was observed that maternal age and neonatal gender affected the weight of the newborn, but the seasons have no effect on neonatal weight. Maternal age, sex of newborn and gestational age were considered as independent risk factors for macrosomia.

Keywords: Newborn, birth weight, macrosomia

Öz

Amaç: Dünyada pek çok ülkede yenidoğan ağırlıklarında ve makrozomi oranlarında artış trendi söz konusudur. Çalışmamızın amacı 2012 ve 2016 yıllarındaki ortalama yenidoğan ağırlıklarının karşılaştırılması, yenidoğan ağırlık ortalaması ile makrozomi oranlarında artış eğiliminin olup olmadığının araştırılması ve yenidoğan cinsiyetinin, doğum şeklinin, anne yaşı ve doğumun gerçekleştiği mevsimin yenidoğan ağırlığı üzerine etkilerinin değerlendirilmesidir.

Gereç ve Yöntem: Çalışmada gebeliğin 37 - 40. haftası arasında doğan toplam 1573 yenidoğana 2012 (n:687) ve 2016 (n=886)) ait veri retrospektif olarak değerlendirildi. Yenidoğanların doğum ağırlığı, cinsiyeti, gestasyon yaşı, anne yaşı, doğum şekli ve doğumun gerçekleştiği mevsime ait veriler istatistiksel olarak değerlendirildi.

Bulgular: Makrozomi oranında (doğum ağırlığı ≥ 4000 g) 2012'de %4.9' dan 2016' da %8.1'e artış olduğu tespit edildi Her iki yıl için de anne yaşı ile yenidoğan ağırlığı arasında zayıf pozitif korelasyon olduğu saptandı. Sezaryen ile doğan bebeklerin ortalama yenidoğan ağırlığının 2016 yılında normal yolla doğanlardan daha fazla olduğu tespit edildi. Doğumun gerçekleştiği mevsimin doğum ağırlığı üzerinde etkisinin olmadığı bulundu.

Sonuç: Makrozomi oranlarında 2016 yılında 2012 yılına göre bir artış olduğu tespit edildi. Anne yaşı ve yenidoğanın cinsiyetinin yenidoğan ağırlığını etkilediği fakat doğumun gerçekleştiği mevsimin yenidoğan ağırlığı üzerinde etkisinin olmadığı tespit edildi. Anne yaşı, yenidoğanın cinsiyeti ve gebelik yaşı makrozomi için bağımsız risk faktörleri olarak kabul edildi.

Anahtar kelimeler: Yenidoğan, doğum ağırlığı, makrozomi

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INTRODUCTION

Birth weight is one of the important measurements reflecting the intrauterine environment[1]. Furthermore, there is growing evidence that the high or low birth weight of a baby relative to gestational age is associated with poor perinatal outcomes and an increased cardio-metabolic risk later in life[2]. Macrosomia refers to growth beyond a specific threshold, regardless of gestational age. The most commonly used threshold is weight above 4500 g but weight above 4000 g is also commonly used[3-5]. The prevalence of macrosomia, which causes adverse effects on the mother and newborn, has increased markedly over the past 10 years. Moreover, the prevalence of macrosomia differs in different races and different ethnic groups, and affects about 6-10% of newborns[6]. Macrosomia can cause shoulder dystocia, perinatal asphyxia, brachial plexus injury, congenital anomalies and increase in intensive care admissions[7-9]. Maternally, this situation can also cause postpartum bleeding, prolonged labor, perineal tears, thromboembolic events, increased cesarean delivery and anesthetic complications[4]. In addition to gestational diabetes mellitus, the most important causes that increase the risk of macrosomia in the newborn include maternal obesity, excess weight gain during pregnancy, advanced maternal age, multiparity, postterm pregnancy, racial and ethnic factors, and the gender of the baby is male.

The aim of our study is to compare the mean newborn weights in 2012 and 2016, and to investigate whether there is an increasing trend in the mean newborn weight and macrosomia rates between these years. In addition, the relationship between newborn gender, mode of delivery, maternal age, and the season of birth with newborn weight is evaluated. There is no previous study on the effect of seasons on newborn weight and macrosomia rates in the south of Turkey. In this respect, our study will contribute to the literature.

MATERIALS AND METHODS

Study design

This investigation was carried out in Çukurova University Balcalı Hospital Obstetrics and Gynecology Service Between 1January-31 December 2012 and 1 January-31 December 2016.

Ethical approval for the study was obtained from the Ethics Committee of Non-Interventional Research Cukurova University Faculty of Medicine (Date: 13.04.2018, Decision No: 96; Number of Meetings: 76). Newborn birth weights (g) according to gestational age were recorded and data for 2012 and 2016 were statistically compared in this retrospective study. Newborn weights were measured with a sensitive digital scale (Plusmed, Pm-BS01) up to 5 grams within the first hour after birth, before feeding the baby and while naked. The gender of the newborn, maternal age (year), gestasional age (week), mode of birth and the season in which the birth took place also evulated for 2012 and 2016.

Participants

All birth records for 2012 and 2016 were examined. Retrospective data obtained from newborns born to mothers aged 18-40 years and with a gestational age 37-40 weeks were evaluated. There were 1680 births in 2012, 1838 births in 2016, of which 687 in 2012 and 886 in 2016 were included in the study (Figure 1).

The research did not include patients with major maternal disease, which may affect the baby's health and neonatal birth weight measurements. Like diabetes mellitus, hypertension, congenital heart disease, maternal hypoxemia, which is the cause of chronic pulmonary diseases (COPD, cystic fibrosis, asthma), hematological diseases (severe anemia, sickle cell anemia, thalassemia), the causes of maternal malnutrition (Chron's disease, ulcerative colitis, gastric bypass requiring surgery), rheumatologic diseases (SLE, rheumatoid arthritis), newborns born to mothers who had TORCH group infection and newborns with placental anomaly were not included. Morover multiple pregnancies, newborns with chromosomal abnormalities or congenital anomalies were not included in the study. Multiple pregnancies were not included in this paper because they involve several risks for the mothers and the newborns like prematurity, low birthweight, pre-eclampsia, postpartum haemorrhage, intrauterine growth restriction, neonatal morbidity and high neonatal mortality[10-13].

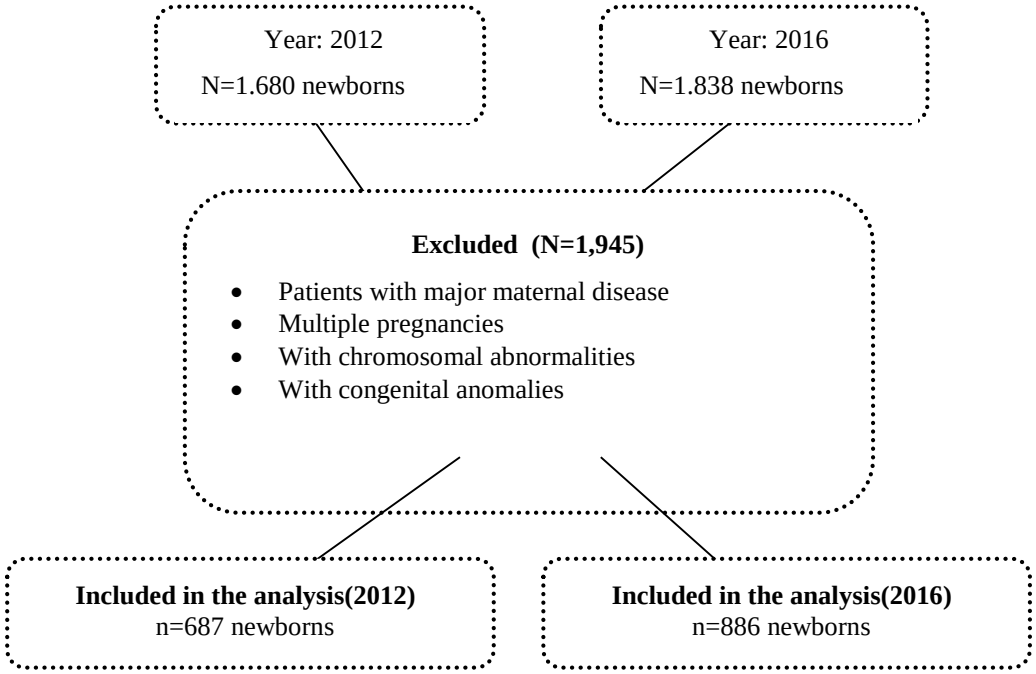

Figure 1. Flowchart illustrating the inclusion/exclusion of samples in the study.

Statistical analysis

Categorical variables were expressed as numbers and percentages, n (%), whereas continuous variables were summarized as mean ± sd (standard deviation). Chi-square test was used to compare year groups and categories of newborn weight. The Student's t test was used to compare the newborn weight between the categories of gender and method of delivery variables, separately for 2012 and 2016. Oneway ANOVA was used to determine whether there was a difference in terms of newborn weight mean for maternal age and season variables with more than two categories. Regarding the homogenity of variances, Scheffe tests were used for multiple comparisons of groups. Logistic regression analysis was performed to determine significant predictors of macrosomia variable. Risk factors that could potentially affect macrosomia (maternal age, gender, year, gestational age, season) were evaluated with univariate analysis. Afterwards, according to the $p < 0.25$ level, maternal age, gender, gestational age variables included in the multiple logistic regression analysis[14]. The statistical level of significance for all tests was considered to be 0.05. All analyses were performed using Statistical Package for the Social Sciences software version 20 (SPSS, Version 20.0).

RESULTS

In our study, the average weight of newborns in 2016 (3324.3±490.1) was found to be higher than in 2012 (3263.7±3250.0) newborns ($p=0.010$) (Figure 2).

In 2016 births occurred at the further week of gestation and there was a statistically significant difference between 2012 while the median gestational age in 2016 was 39, it was 38 in 2012 ($p<0.001$). However, there were no statistically significant differences in neonatal weights in 2012 and 2016 compared between them within the same week of gestation ($p>0.05$). For 2012 and 2016, weights of male newborns were higher than that of female newborns ($p<0.001$) (Table 1).

Table 1. Comparison of relevant factors in terms of newborn weight averages in 2012 and 2016

Variables	Year			
	2012 (n=687)	P	2016 (n=886)	P
	Weight(g)		Weight(g)	
Maternal age(year)				
18-19	3159.8±472.1 3210(2250-4030)	0.001*	3109.1±565.1§ 3142.5(1850-4525)	0.001*
20-24	3161.8±412.1†‡ 3170(2180-4560)		3255.9±453.5‡ 3245(2110-5110)	
25-29	3236.7±437.2 3230(2090-4620)		3318.4±463.9 3290(1730-4770)	
30-34	3332.3±417.7 3315(2000-4340)		3352.9±485.2 3325(1870-5415)	
35-40	3336.2±480.8 3350(2310-4980)		3431.7±530.6 3475(2030-4750)	
Gender				
Male	3338.8±438.3	<0.001*	3409.6±504.5	<0.001*
Female	3178.1±426.4		3235.1±458.6	
Method of delivery				
C-section	3243.9±455.5	0.213	3361.5±510.3	0.013*
Regular	3285.8±421.2		3280.2±461.6	
Season				
Spring	3214.0±447.0	0.219	3291.0±487.0	0.434
Summer	3307.0±433.0		3348.0±527.0	
Autumn	3236.0±424.0		3296.0±454.0	
Winter	3275.0±452.0		3349.0±479.0	

Values are given as mean±standard deviation and median(min-max) are added where appropriate.; *These values indicate statistical significance(p<0.05).; †p<0.05 between 20-24 and 30-34.; ‡p<0.05 between 20-24 and 35-40.; §p<0.05 between 18-19 and 35-40

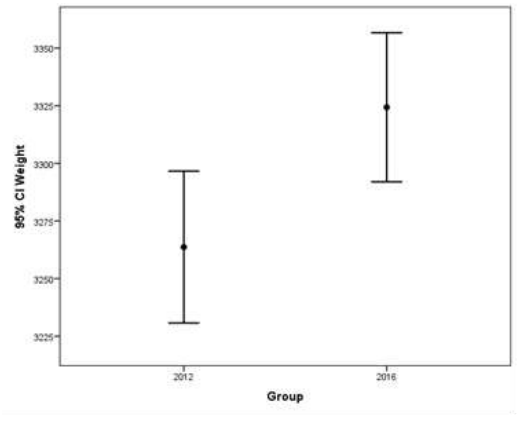

Figure 2. Comparison of newborn weight by years

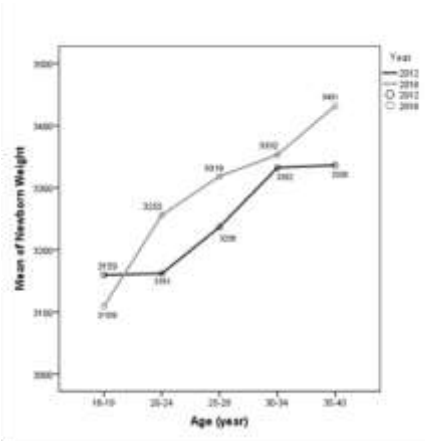

Figure 3. Average newborn weight of maternal age in 2012 and 2016.

Average maternal age is 28.8±5.3 for 2012 and 28.7±5.6 for 2016, there is no statistical difference for average maternal age (p=0.762). In both 2012 and 2016, it was observed that there was an increase in newborn birth weight as maternal age increased (Figure 3). There is a weak positive correlation between maternal age and newborn weight in 2012 and 2016 (p<0.001, respectively r= 0.157, r=0.151). When we compared to the gestational week at birth and the weight of the newborn, it was found that the weight of the babies increased significantly with the subsequent gestational week (p<0.001) (Table 1).

Low birth weight is defined as live birth weight occurring below 2500 grams. The most commonly used threshold for macrosomy is weights above 4000 grams or weights above 4500 grams. Normal birth weight is that the birth weight is between 2500-4000 grams. In our study, birth weight of 4000 grams and more were evaluated as macrosomics newborn. Low birth weight newborn rate was 3.6%, normal birth weight newborn rate was 91.5%, and macrosomic birth rate was 4.9% in 2012. Low birth weight newborn rate was 4.3%, normal birth weight newborn rate was 87.6%, and macrosomic birth rate was 8.1% in 2016. A statistically significant increase in the rate of macrosomy was observed in 2016 (p=0.033) (Table 2). In 2012, there were a total of 687 births, of which 363 (52.8%) were delivered by caesarean section and 324 (47,2%) were delivered by normal vaginal route. In 2016, there were a total of 885 births, of which 485 (54.7%) were by caesarean section and 400 (45.1%) were by normal vaginal route (In 2016, the record of the birth route of a one baby was incomplete and could not be reached). In 2012, there was no statistically significant difference in birth weight between babies delivered by cesarean section and babies delivered by normal route (p=0.213) (Table 1). But in 2016, babies delivered by cesarean section were heavier than babies delivered by normal vaginal route, and the difference was statistically significant (p=0.013) (Table 1). It was observed that the effect of seasons on newborn weight in both years was not statistically significant (p>0.05) (Table 1).

.**Table 2. Distributions of low birth weight, normal birth weight and macrosomic birth weight in 2012 and 2016**

		Year n(%)		p
		2012	2016	
Weight(g)	<2500	25(3.6)	38(4.3)	0.033*
	2500-3999	628(91.4)	776(87.6)	
	≥4000	34(4.9)	72(8.1)	

*This value indicates statistical significance(p<0.05)

Table 3. Logistic regression analysis results for factors affecting macrosomia

Parameters	Univariate analysis for macrosomia		Multiple analysis for macrosomia	
	OR(95% CI)	P	OR(95% CI)	P
Maternal Age(year)	1.09(1.08-1.13)	<0.001*	1.09(1.05-1.14)	<0.001*
Gender				
Female	Ref.	0.003*	Ref.	
Male	1.86(1.23-2.82)		1.95(1.28-2.97)	0.002*
Year				
2012	Ref.	0.014*	Ref.	
2016	1.70(1.12-2.59)		1.62(1.05-2.49)	0.030*
Gestational age				
37th	Ref.	0.034*	Ref.	
38th	1.65 (0.75-3.64)		1.61(0.73-3.58)	0.240
39th	2.62 (1.20-5.72)		2.61(1.18-5.76)	0.018*
40th	2.55(1.14-5.70)		2.92(1.29-6.58)	0.010*
Season			-	-
Spring	Ref.	0.295		
Summer	1.12(0.64-1.96)			
Autumn	0.66(0.35-1.24)			
Winter	1.06(0.59-1.89)			

*These values indicate statistical significance (p<0.05)

Upon multiple logistic regression analysis, independent predictors of macrosomia were determined to be maternal age (odds ratio [OR]=1.09; 95% confidence interval [CI], 1.05-1.14, gender (OR=1.95; 95%CI, 1.28-2.97; P=0.002), year (OR=1.62; 95%CI, 1.05-2.49; P=0.030), 39th gestational week (OR=261; 95%CI, 1.18-5.76; P=0.018), 40th gestational week (OR=2.92; 95%CI, 1.29-6.58; P=0.010) (Table 3).

DISCUSSION

In studies conducted in North America, Europe, Australia and China over the last 10 years, it was observed that there was an increase in newborn birth weight[15-19]. In our paper, the average birth weight of babies born in 2016 was found to be heavier than those born in 2012. Moreover, births in 2016 occurred at a further gestation week than in 2012, and we think that the difference in birth weight may be due to this. However, there were no statistically significant differences in neonatal weights in 2012 and 2016 compared between them in the same gestational week. Our investigation shows an increase in macrosomia rates. In order to investigate potential risk factors that related to macrosomia, logistic regression analysis was applied, and indicated that maternal age, gender of newborn and gestational age were risk factors for macrosomia. The gestational period is the most important factor affecting the birth weight in singleton term infants, which is compliant with the present research. An investigation from China conducted by Yi and his colleagues concluded that maternal age, weight gain in pregnancy and gestational age are risk factors for macrosomia[20]. Many studies have shown that there is an upward trend in macrosomy rates[17,18,21]. Some studies show that this increase is due to an increase in the mother's body mass index (BMI)[15-19]. Babies with high birth weight also have an increase in BMI later in life and an increase in some cancers[22-24]. In this paper, there is no data on the maternal weight gain during pregnency and maternal BMI therefore, the effect of these on macrosomia could not be evaluated.

Female participants had lower birthweights than male participants and birthweight tended to be lower in the youngest and oldest maternal age groups. The ideal age group for childbirth is between the ages of 20-34, preterm birth rate rises in babies born to mothers under 17 and in pregnancies after the age of 40, there is an increase in neonatal intensive care unit admissions and fetal abnormalities[25]. An investigation showed that the risk of perinatal death is 2.7 times higher in pregnancies after the age of 40[26]. It was reported that maternal age above 35 years triples the risk of fetal macrosomia[27]. In our paper mothers between the ages of 18-40 were included, and the maternal age of newborns who were macrosomic was found to be more advanced than that of newborns with normal weight.

In a study by Lawlor et al in 2015, conducted with 12.150 newborns in Aberdeen (in Scotland) birthweight was seasonally patterned, with lowest birthweights among those born in the winter months (December–February) and highest birthweights among those born in the autumn months (September–November)[28]. In a research from Israel concluded that increased sunlight exposure in the last weeks of pregnancy may be related to increased birth weight[29]. In contrast to these studies, our research showed that the seasons had no effect on birth weight when looking at the seasonal average birth weight of newborns born in 2012 and 2016. Since our study was conducted in a region that is sunny in all seasons in the south of Turkey, the effect of the seasons may not have been fully observed.

Present study has some limitations. Since we had problems accessing digital data before 2012. The main limitation was a retrospective nature of the study. Data that will affect newborn weight and macrosomia rates like mothers body mass index, weight gain during pregnancy, mother's marital status, education level, regular pregnancy examination, job status, smoking, alcohol and substance abuse, could not obtained from the digital database registry.

As a result, when we compare the data in 2016 with those in 2012 in our study, it was observed that there was an increase in newborn weights and macrosomia rates in 2016. In addition, it has been observed that maternal age and neonatal gender affect neonatal weight, but the seasons have no effect on neonatal weight. Our findings identify that maternal age, sex of newborn and gestational age should be considered as risk factors for macrosomia.

We believe that the data obtained in our investigation will contribute to antenatal follow-up in gynecology and obstetrics clinic and public health.

Yazar Katkıları: Çalışma konsepti/Tasarımı: DV, MS; Veri toplama: DV, NTD; Veri analizi ve yorumlama: DV, NTD; Yazı taslağı: DV, MS;

İçeriğin eleştirel incelenmesi: DV, MS, NTD; Son onay ve sorumluluk: DV, MS, NTD; Teknik ve malzeme desteği:MS; Süpervizyon: DV, MS; Fon sağlama (mevcut ise): yok.
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