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# Placental and newborn birth weight in term pregnancy

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## Abstract

**Objective:** To obtain nomograms of placental and birth weight in uncomplicated pregnancies resulting vaginal birth between 37 and 42 weeks of gestation.

**Methods:** This prospective study included 317 normal (without any maternal or fetal complication) pregnancies between 37-42 weeks of gestation. Detailed history of pregnants has been taken. Their heights and weights have been measured and body mass indexes (BMI) have been calculated. Newborn gestational ages at delivery, birth weights, and placental weights have been recorded. Percentiles of placental weight and newborn birth weight between 37-42 weeks have been obtained.

**Results:** In 317 pregnancies of study, 174 of newborns were female (55%) and 146 of newborns were male (45%). There was no significant difference among male and female newborns for placental weight, gestational age at delivery, but birth weight of males was higher than of female newborns (p=0.004). Fiftieth percentiles of newborn birth weight between 37-42 weeks were 560, 620, 649, 631, 620, and 610 g, respectively. It has been observed that placental weight has increased until 39 weeks of gestation and then decreased. 50th percentile of 37-42 weeks newborn birth weight were; 2970, 3220, 3380, 3385, 3400, 3540 g, respectively. Placental weight/newborn birth weight ratio was 0.19±0.03 and it has been identified that this ratio showed no difference between 37 and 42 weeks of gestation.

**Conclusion:** The nomograms of placental weight and newborn birth weight obtained between 37 and 42 weeks of gestation could be used at evaluation of pregnants and diagnosis of intrauterine growth restriction in our country.

**Key words:** Newborn birth weight, nomogram, placental weight.

## Term gebelikte plasenta ve yenidoğan doğum ağırlığı

**Amaç:** Normal doğum ile sonuçlanan komplike olmayan gebeliklerde, plasenta ve yenidoğan ağırlıklarının 37-42. gebelik haftaları arasındaki nomogramının elde edilmesi.

**Yöntem:** Bu prospektif çalışmada 37-42. gebelik haftalarında yapısal olarak normal olan 317 gebe çalışmaya dahil edildi. Gebelerin ayrıntılı anemnezleri alındı, boyları ölçülerek kiloları tartıldı. Vücut kitle indeksleri (VKİ) hesaplandı. Yenidoğanların doğum haftası ile birlikte doğum ağırlıkları ve plasenta ağırlıkları ölçülerek kayıt edildi. Plasenta ağırlığının ve yenidoğan doğum ağırlığının 37-42. gebelik haftaları arasında persentil dağılımları elde edildi.

**Bulgular:** Çalışmaya dahil edilen 317 gebelikte, yenidoğanların 174'ü (%55) kız ve 146'sı (%45) erkek bebek idi. Kız ve erkek yenidoğanlar arasında doğum haftası ve plasenta ağırlığı açısından anlamlı farklılık saptanmadı ancak doğum kilolarının erkek bebeklerde daha fazla olduğu tespit edildi (p=0.004). 37-42. gebelik haftaları arasında plasenta ağırlığının 50. persentil değerleri sırasıyla 560,620, 649, 631, 620 ve 610 g olarak saptandı. Plasenta ağırlığının 39. gebelik haftasına kadar arttığı sonrasında da azaldığı tespit edildi. 37-42. gebelik haftaları arasında yenidoğan doğum ağırlığının 50. persentil değerleri sırasıyla 2970, 3220, 3380, 3385, 3400 ve 3540 g olarak saptandı. Plasenta ağırlığı/yenidoğan ağırlığı 0.19±0.03 olarak tespit edilmiş olup bu oranın 37-42. gebelik haftaları arasında anlamlı değişkenlik göstermediği tespit edilmiştir.

**Sonuç:** 37-42. gebelik haftaları arasında elde edilen plasenta ve yenidoğan nomogramlarının ülkemizdeki gebeliklerin değerlendirilmesinde ve intrauterin gelişim kısıtlılığı tanısında kullanılabileceği düşünülmektedir.

**Anahtar sözcükler:** Plasenta ağırlığı, yenidoğan doğum ağırlığı, nomogram

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## Introduction

Placenta is the biggest endocrine organ in human body responsible for the intrauterine development of fetus. In the last two decades, findings proving the significance of placental weight are published increasingly. Placental weight is affected by many factors such as maternal age, weight, weeks of gestation, geographical region, ethnic origin, maternal conditions (smoking, pregestational systemic diseases, preeclampsia, gestational diabetes, endocrinologic pathologies etc.).[1-6]

Conditions affecting placenta also affect fetus indirectly. Factors affecting both birth weight and placental weight are similar. Determining birth weight percentiles of societies according to weeks of gestation helps clinicians of those societies to diagnose and determine therapy process for fetal growth anomalies and other intrauterine pathologies.

In our study, we aimed to analyze distribution, according to weeks of gestation, of placental and newborn weights between 37 and 42 weeks of gestations.

## Methods

Our study included pregnants between 37 and 42 weeks of gestation who carried out spontaneous vaginal delivery at Zeynep Kamil Maternity & Child Training and Research Hospital between 01/12/2012 and 31/04/2013.

Detailed histories of pregnants were obtained, their heights and weights were measured, and their body mass indexes (BMI) were calculated. Birth weights and placental weights of newborns as well as their birth weeks were measured and recorded. Fetal chromosomal and structural anomalies, pregnancies with fetal deaths, preterm and post-term pregnancies, multiple pregnancies and pregnancies with maternal diseases were excluded from the study.

Patient data were analyzed by SPSS 11.5 package program (SPSS Inc., Chicago, IL, USA). Descriptive statistical analyses and regression analyses were carried out. One-way ANOVA and Post Hoc-test (Tukey HSD method) were performed. Normal distribution consistencies of variables were evaluated by Kolmogorov-Smirnov test, and independent samples T test was used. Results were analyzed at 95% confidence interval with $p<0.05$ significance level.

## Results

Our study included 317 pregnancies who were complying with our study criteria. The age range of the cases was 18-41, mean age was 26.3±5, mean parity was 1.7±1.2, and mean BMI was found 28.7±3.9. The range of weeks of gestation was 37-42 in the study, and mean weeks of gestation was 39.4±1.4, mean newborn weight was 3325.4±413 g, and mean placental weight was 626±122 g.

While 174 of the newborns were female, 146 of them were male. There was no significant difference among male and female newborns in terms of birth week and placental weight; however, it was found that birth weights were higher in male babies ($p=0.004$) (**Table 1**).

Significance of all models for the correlations between parameters was analyzed. It was found that the correlation between placental weight (PW) and maternal weight (MW) was linear ($PW = MW\times1.4+522.2$; $p=0.037$; $r2=0.014$) (**Fig. 1**), but it was not consistent with a significant cubic model ($p=0.1$). No significant correlation was found between PW and maternal BMI ($p>0.05$). In the comparison of other parameters, it was found that cubic regression model was more consistent and significant. The correlation between PW and weeks of gestation (WoG) was weak; the equation of cubic regression analysis was $PW= ((WoG\times505.3)-(WoG2\times6.3)-9508.8)$ ($r2=0.032$; $p=0.008$) (**Fig. 2**).

The equation of cubic regression analysis for the correlation between PW and newborn birth weight (BW) was $PW= ((BW\times0.9)+(1.1E-005\times BW2) + 202.6)$ ($r2=0.31$; $p<0.001$) (**Fig. 3**). The equation for the correlation between newborn BW and WoG was $BW= ((WoG\times1423.5)-(16.7\times WoG2)-26783)$ ($r2=0.16$; $p<0.001$) (**Fig. 4**). Also, the correlation between BW and maternal BMI was weak but significant, and the equation was $BW= ((BMI\times30.4)-(0.006\times BMI3)+2600)$ ($r2=0.02$; $p=0.45$) (**Fig. 5**).

The distributions of percentiles of placental weight and newborn birth weight according to weeks of gestation are given in **Tables 2** and **3**. Placental weight/newborn weight was 0.19±0.03, and it was found that there was no significant difference between 37 and 42 weeks of gestation.

## Discussion

Placental weight and newborn birth weight are affected by many maternal, fetal and environmental factors.

**Table 1.** Weeks of gestation, placental weight and birth weight of newborns according to their genders.

| | Gender | N | Mean | Standard deviation | P |
|---|---|---|---|---|---|
| Weeks of gestation | Female | 174 | 39.4 | 1.5 | 0.933 |
| | Male | 146 | 39.4 | 1.4 | |
| Placental weight | Female | 174 | 624.9 | 117.9 | 0.925 |
| | Male | 146 | 626.2 | 127.3 | |
| Birth weight | Female | 174 | 3264.3 | 407.8 | 0.004 |
| | Male | 146 | 3396.7 | 408.8 | |

**Table 2.** Percentile of placental weight according to weeks of gestation.

| Weeks of gestation | Percentiles | | | | | | |
|---|---|---|---|---|---|---|---|
| | 5 | 10 | 25 | 50 | 75 | 90 | 95 |
| 37 | 392.50 | 430.00 | 503.00 | 560.00 | 670.00 | 745.00 | 785.00 |
| 38 | 375.90 | 432.00 | 520.00 | 620.00 | 672.00 | 789.00 | 847.90 |
| 39 | 471.85 | 503.00 | 560.00 | 649.00 | 720.00 | 829.00 | 892.70 |
| 40 | 442.40 | 484.70 | 544.50 | 631.00 | 700.00 | 770.00 | 853.00 |
| 41 | 445.00 | 470.00 | 560.00 | 620.00 | 700.00 | 780.00 | 820.00 |
| 42 | 470.00 | 500.00 | 575.50 | 610.00 | 705.00 | 800.00 | |

Also, race and genetic structures are shown as the reason for this difference. It is also known that placental and newborn weights are affected by gestational complications (preeclampsia, intrauterine growth retardation, gestational diabetes). The percentiles of placental weight and newborn birth weight according to weeks of gestation enable clinicians to compare newborn with the data of population.[1-6]

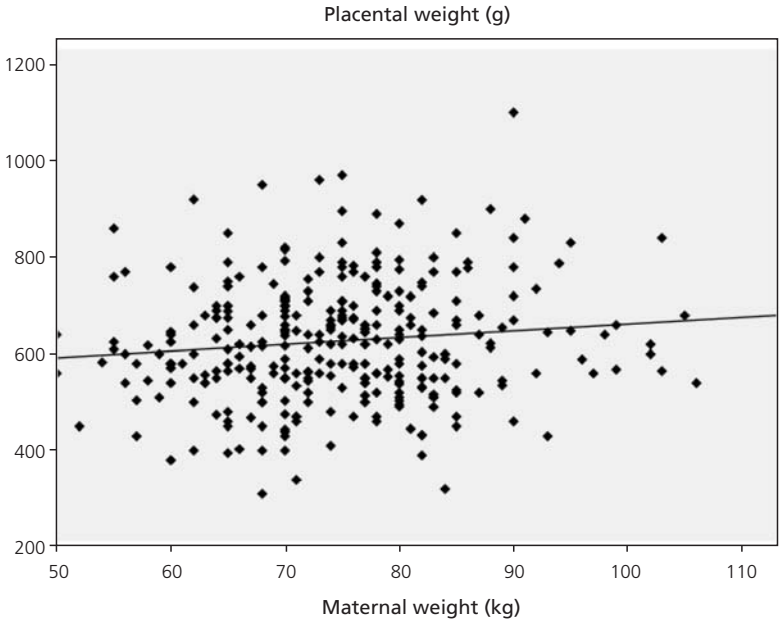


**Fig. 1.** The correlation between maternal weight and placental weight.

**Table 3.** Percentile of newborn birth weight according to weeks of gestation.

| Weeks of gestation | Percentiles | | | | | | |
|---|---|---|---|---|---|---|---|
| | 5 | 10 | 25 | 50 | 75 | 90 | 95 |
| 37 | 2300.00 | 2440.00 | 2720.00 | 2970.00 | 3120.00 | 3430.00 | 3835.00 |
| 38 | 2449.00 | 2732.00 | 2950.00 | 3220.00 | 3500.00 | 3696.00 | 4087.00 |
| 39 | 2651.00 | 2753.00 | 3040.00 | 3380.00 | 3630.00 | 3859.00 | 3956.00 |
| 40 | 2815.50 | 2950.00 | 3090.00 | 3385.00 | 3700.00 | 3933.00 | 4034.50 |
| 41 | 2950.00 | 3070.00 | 3160.00 | 3400.00 | 3700.00 | 3950.00 | 4125.00 |
| 42 | 3100.00 | 3380.00 | 3435.00 | 3540.00 | 3750.00 | 3990.00 | |

In this study, placental weight was compared with weeks of gestation, maternal age, newborn birth weight, maternal body mass index variables. The correlation between placental weight and weeks of gestation was found to be weak (r2=0.032; p=0.008). In our study, 50th percentile values of placental weights between 37 and 42 weeks of gestation were 560-620-649-631-620, and 610, respectively; and it was seen that there was an increase until 39 weeks of gestation, but then it decreased. Although it is considered that placental weight may display a societal difference, there is no literature presenting current placental weight percentiles in our country. Almog et al. conducted a study on 20.635 singleton and 527 twin pregnancies between 24 and 44 weeks of gestation, and analyzed placental weights of female babies, male babies and twin pregnancies, and the ratio of placental weight to newborn birth weight. They found a significant correlation between placental weights and weeks of gestation in all groups evaluated separately (p<0.0001) (r2>99%).[1] Placental weight percentiles of this study were compared to data of our study and it is seen that the placental weights in our study is lower than those in the study of Almog et al. during the same weeks of gestation. Almog et al. found that the ratio of placental weights to newborn birth weights is highly correlated with weeks of gestation (r=0.35; p<0.001). In the study of Haavaldsen et al. performed on 536.954 singleton pregnancies, it was observed that mean placental weight under age 20 was 647.1 g while it was 691.3 g

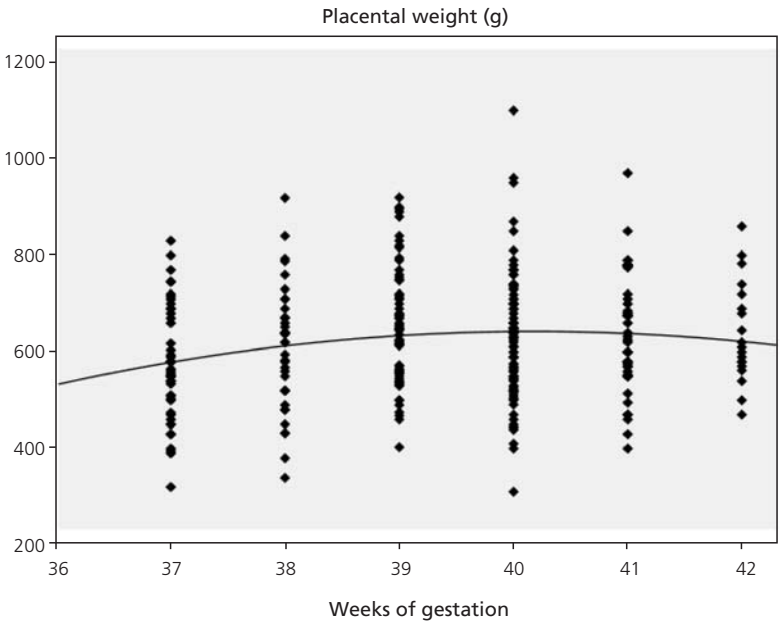


**Fig. 2.** The correlation between weeks of gestation and placental weight.

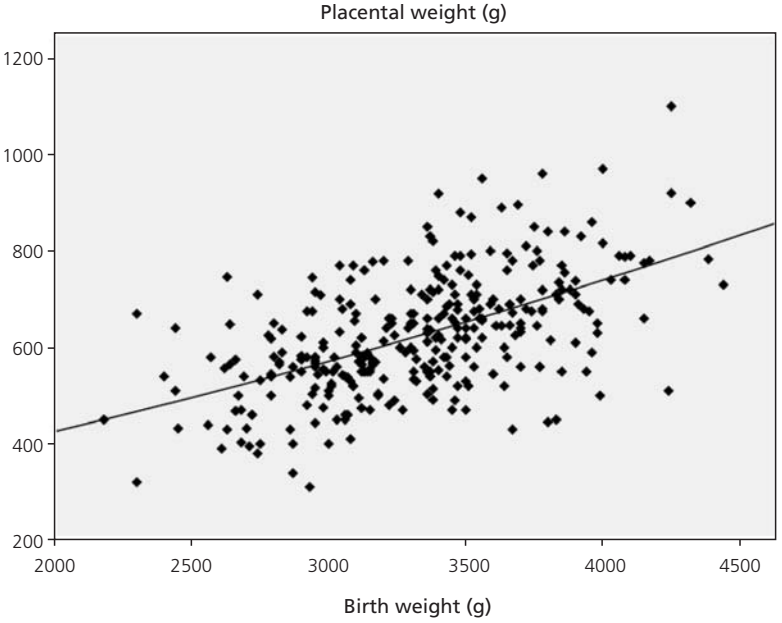


**Fig. 3.** The correlation between newborn weight and placental weight.

over age 45.[2] Authors, calculating mean placental weight as 673.1 g, reported that placental weight Z scores of 12.4% of 40-44-year-old women were in the highest decimal, while 9.6% of them were in the lowest decimal. Placental weight Z score of pregnants at or above age 45 was 15.8% as being the highest decimal, the lowest decimal was found to be 10.4%, which means that Haavaldsen et al. found an increasing

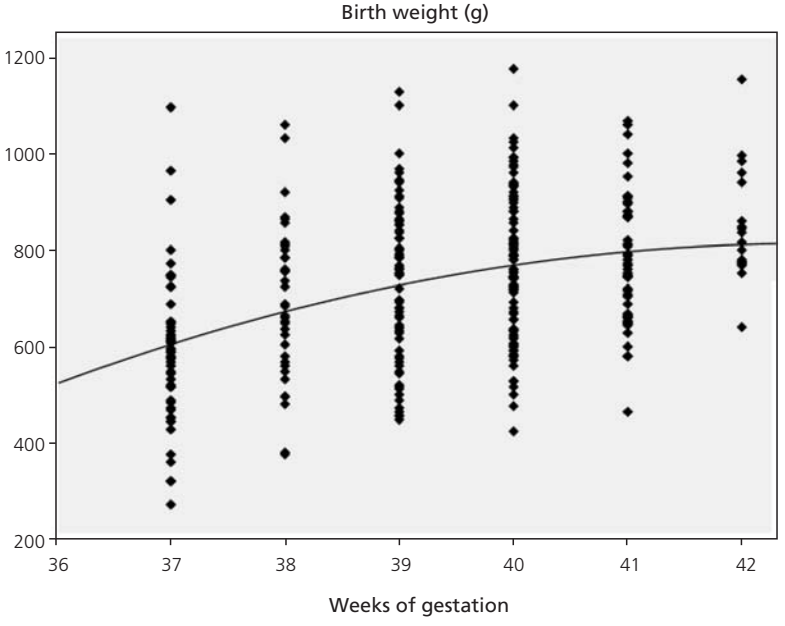


**Fig. 4.** The correlation between weeks of gestation and birth weight.

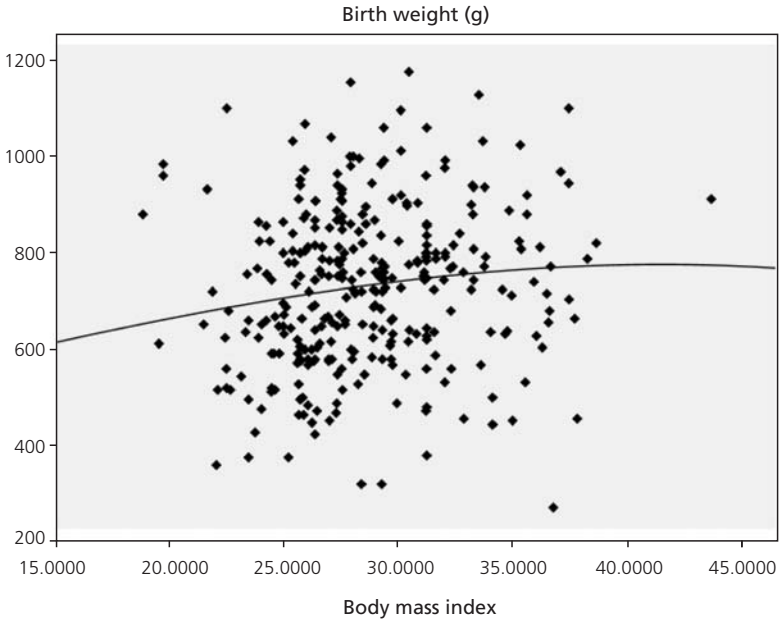


**Fig. 5.** The correlation between body mass index and birth weight.

prevalence between placental weight and maternal age increase with placental weight Z score in the highest decimal (Wald test p<0.001).[2] However, comparing placentas of patients together in this study who deliver by cesarean and vaginally may pose a problem. All patients in our study delivered vaginally, and no correlation was detected between placental weight and maternal age (p=0.397). Also, a similar comparison could be not performed since there was limited number pregnancies below age 20 and above age 40 in our study.

Soliman et al. performed a study on 100 non-preeclamptic pregnants to research placental factors affecting perinatal and postnatal development, and they compared placental weight, maternal weight, newborn birth weight, height, head circumference, and childhood measurements. They found a significant correlation between placental weight and maternal weight (r=0.21; p=0.031), and between placental weight and newborn birth weight (r=0.71; p<0.001). This case supports the idea that mothers with more weight have bigger placentas, and therefore they have bigger babies. Also, it was observed in this study that placental weights were correlating with early childhood body mass index. In our study, a weak linear correlation was found between placental weight and maternal weight (p=0.037; r2=0.014); however, there was no correlation between placental weight and maternal BMI (p>0.05). According to Almog et al., this

**Table 4.** Comparison of placental weights (gram) at 50th percentile.

| Weeks of gestation | Current study | Almong et al.[1] | | Thompson et al.[7] | |
|---|---|---|---|---|---|
| | | Male | Female | Male | Female |
| **37** | 560 | 627 | 622 | 620 | 610 |
| **38** | 620 | 648 | 640 | 650 | 640 |
| **39** | 649 | 664 | 654 | 670 | 660 |
| **40** | 631 | 679 | 668 | 690 | 670 |
| **41** | 620 | 695 | 680 | 700 | 680 |
| **42** | 610 | 707 | 688 | 700 | 690 |

**Table 5.** Comparison of newborn birth weights (gram) at 50th percentile.

| Weeks of gestation | Current study | Thompson et al.[7] | |
|---|---|---|---|
| | | Male | Female |
| 37 | 2970 | 3245 | 3188 |
| 38 | 3220 | 3467 | 3369 |
| 39 | 3380 | 3639 | 3538 |
| 40 | 3385 | 3802 | 3683 |
| 41 | 3400 | 3943 | 3807 |
| 42 | 3540 | 4031 | 3883 |

rate was found to be correlated with diseases such coronary artery disease, diabetes, stroke and hypertension which may develop during adulthood.[1] Salafia et al. used the increase in the ratio of placental weight/birth weight as an indicator of an insufficient placenta for normal fetal growth.[8] They reported that placental weight increased compared to fetal weight relatively due to insufficient placental nutrition, and therefore placental weight/birth weight ratio increased. These patients are under risk during adulthood in terms of coronary artery disease, diabetes, hypertension, and respiratory diseases.[3-6]

In our case, there is a significant correlation between birth weight and weeks of gestation (r2=0.16; p<0.001); and 50th percentile birth weight of pregnancies between 37 and 42 weeks of gestation are 2970, 3220, 3380, 3385, 3400, and 3540 g, respectively. On the other hand, there was a weak but significant correlation between birth weight and maternal BMI (r2=0.02; p=0.45). Thompson et al. carried out a study for placental weight percentiles on 198.971 pregnants of whom 85.7% were Norwegian and were between 24 and 44 weeks of gestation, and they excluded patients who had clinical problems regarding to placenta (placenta praevia, abruptio placentae, incomplete placenta, manual extraction, placental curettage etc.) since they were considered as the factors that might affect placental weight. The authors reported the percentiles of placental weight and of newborn birth weight as gender-specific in their studies. It was found that the placental weights in both male and female babies were higher than the placental weights found in our study (**Table 4**). Another disadvantage of the study of Thompson et al. is the method used for measuring placental weight. The authors also reported similarly that placental weight increased until 39 weeks of gestation, and tended to remain stable after that week. It was found that birth weights according to weeks of gestation of female and male newborns in their study were higher than the newborn weights in our study (**Table 5**). Also, Thompson et al. pointed out that placental weight percentiles and newborn birth weights may vary according to weeks of gestation; however, the ratio of placental weight/newborn birth weight will not indicate a significant difference.[5] In our study, we found placental weight/newborn weight as 0.19±0.03; however, this rate did not demonstrate any significant change between 37 and 42 weeks of gestation.

## Conclusion

It is considered that the current nomograms used and percentile distributions of our own population are higher than it is supposed to be, and it is determined that it may lead to make mistakes in analyzing cases. Placenta and newborn nomograms obtained in our study between 37 and 42 weeks of gestation may be more suitable to use in evaluating pregnancies in our country.

**Conflicts of Interest:** No conflicts declared.

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