Evaluation Of Antenatal Factors Affecting Placental Weight In Term Pregnancies

Term Gebelerde Plasenta Ağırlığını Etkileyen Antenatal Faktörlerin Değerlendirilmesi

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Geliş Tarihi / Received : 12.05.2023 Kabul Tarihi / Accepted: 24.07.2023

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Hippocrates Medical Journal / Hippocrates Med J 2023, 3(2):62-67 DOI: 10.58961/hmj.1295505

Abstract

Aims The aim of this study was to evaluate whether various antenatal factors affect placental weight in term pregnant women who gave birth vaginally.

Materials and Methods This observational study was conducted between January and August 2022 in Karaman Training and Research Hospital. Six hundred and thirty parturients after thirty-seventh gestational week with vaginal delivery were enrolled to this study. The maternal age, parity, body mass index, chronic diseases, and placental weight, weight, length and gender of he newborns were documented. Primary outcome of this study was to evaluate the factors such as age, body mass index, parity, anemia and chronic disease of mothers and weight of the newborns. Secondary outcomes were predicting the effect of gender and tobacco use during pregnancy. Linear regression analyses with Enter methos was applied while evaluating the factors affecting placental weight.

Results As we evaluated the findings of the study, we found that birth weight and parity had a statistically significant influence on placental weight.(p>0,001 and p=0,024 ,respectively) In primipara pregnant , the average weight was 580 grams, whereas it was 600 grams in multiparas.(p=0,008) Only gestational diabetes was shown to have a significant effect on placental weight when 13 disease categories were investigated.(p=0,024)Body mass index of mothers , maternal anemia with hemoglobin level ≤11 gr/dL and smoking habits had no effect on placental weight.

Conclusion The results of this study support, parity, birthweight of the newborn and gestational diabetes mellitus are critical factors affecting placental weight.

Keywords Birth weight, chronic disease, gender, placenta, pregnant

Özet

Amaçlar Bu çalışmanın amacı, vajinal doğum yapmış miadında gebelerde çeşitli antenatal faktörlerin plasenta ağırlığını etkileyip etkilemediğini değerlendirmektir.

Gereç ve Yöntemler Bu gözlemsel çalışma Ocak-Ağustos 2022 tarihleri arasında Karaman Eğitim ve Araştırma Hastanesi'nde yapılmıştır. Otuz yedinci gebelik haftasını tamamlayarak vajinal doğum yapan 630 gebe bu çalışmaya alındı. Anne yaşı, paritesi, vücut kitle indeksi, kronik hastalıkları, plasenta ağırlığı, yenidoğanların da doğum ağırlığı, boyu ve cinsiyeti kaydedildi. Bu çalışmanın birincil sonucu, plasenta kitlesini etkileyebilecek anne yaşı, vücut kitle indeksi, parite, anemi ve kronik hastalık ve yenidoğan ağırlığı gibi faktörleri değerlendirmektir. Gebelik sırasında tütün kullanımının yanı sıra cinsiyetin etkisinin değerlendirilmesi bu çalışmanın ikincil bir sonucuydu. Plasenta ağırlığını etkileyen faktörler değerlendirilirken Enter yöntemi ile lineer regresyon analizleri uygulandı.

Bulgular Çalışmanın bulgularını değerlendirdiğimizde, doğum ağırlığının ve paritenin plasenta ağırlığı üzerinde istatistiksel olarak anlamlı bir etkiye sahip olduğunu gözlemledik (sırasıyla, p>0,001 ve p=0,024). Primipar gebelerde ortalama plasenta ağırlığı 580 gram iken, multiparlarda 600 gram (p=0,008). 13 hastalık kategorisi incelendiğinde sadece gestasyonel diyabetin plasenta ağırlığı üzerine anlamlı etkisi olduğu gösterildi (p=0,024). Annelerin vücut kitle indeksi, hemoglobin düzeyi ≤11 gr/dL olan annedeki anemi ve sigara alışkanlığının plasenta ağırlığı üzerinde etkisi bulunmamıştır.

Sonuç Bu çalışmanın sonuçları, parite, yenidoğanın doğum ağırlığı ve annede gestasyonel diyabet varlığının plasenta ağırlığını etkileyen kritik faktörler olduğunu desteklemektedir.

Anahtar Kelimeler Doğum ağırlığı, kronik hastalık, cinsiyet, plasenta, gebe

INTRODUCTION

Placenta is an organ with many functions during pregnancy such as providing the transfer of nutrients, oxygen and other substances between mother and fetus, protecting the fetus from external environment and synthesis of some pregnancy specific hormones. A well-functioning placenta is essential for fetal health.[1-3] The placenta's weight and its functions can indicate the well-being of the fetus. [1-3] A low placental weight indicates inadequate placentation, whereas a large placental weight may be the result of maternal diabetes or excess weight gain during pregnancy. Both have been recognized as risk factors for adverse maternal, fetal, neonatal, and child outcomes.[4,5] In addition, changes in the placenta and vascular structure due to smoking and maternal chronic diseases may cause placental insufficiency and intrauterine growth retardation in the fetus.[6] Parity, gender, weight and height of the newborn may also affect placental weight. A healthy placenta is required for the birth of a healthy infant.

In this study, we aimed to evaluate the effect of various antenatal factors on placental weight in term pregnancies.

MATERIAL and METHODS

This observational study was conducted at the Karaman Training and Research Hospital between January and August 2022 after approval was obtained from the Karamanoglu Mehmetbey University Ethics Committee (01-2023/13).

Term pregnant women who gave birth vaginally were included in the study. Written informed consent was obtained from all study participants.

The study included all the pregnant women over the age of 18 who have given vaginal birth between 37-42 weeks of gestation. Multiple pregnancies, stillbirth, congenital abnormalities, and retained placentas that had to be extracted manually were excluded from the study.

Demographic data of mothers were recorded. Routine complete blood count results were also recorded when term pregnant women were admitted to the delivery room. We diagnosed pregnant women with anemia according to WHO criteria when hemoglobin level was less than 11 g/dL)[7] The infant and placenta were weighed routinely following delivery. The placentas were immediately placed in a bowl and weighed with the membranes and umbilical cord still attached. The bowl's mass was deducted from the total weight. After initial care and examination of babies, their weight, height and gender were noted. Week of birth was also documented.

Statistical analyzes were evaluated using the IBM Statistical Package for Social Sciences 22.0 (SPSS, Chicago, IL) program. Correlation heatmap plots were created using the Python 3.7.9 (Delaware, USA) software program. Normal distribution was evaluated with the Shapiro Wilk test. Linear regression analysis and Enter method were applied for the combined effects of independent variables on placental weight, and correlation analysis was applied for their dual effects. Normally distributed data in a continuous structure are presented as mean ± standard deviation, and non-normally distributed data are presented as median (Q1-Q3). Statistical significance level was taken as $p<0.05$. The correlation heatmap plot was used to show the correlation between the variables.

RESULTS

Six-hundred-and-thirty women were enrolled to this study 35,2 %(n=222) of them were nulliparous and 64,8%(n=408) were multiparous. Diabetes was reported in 28 women, of whom 3,8 % (n=24) had gestational diabetes, 0,63%(n=4) had pregestational diabetes. 47,3% (n=298) of infants were female, whereas 52,7% (n=332) were male. The average weight and height of female infants were 3197,73 ±390 g and 49,95 ±1,55 cm, respectively. Male newborns have an average weight of 3261,90±379,45 g and a height of 50,32±1,47 cm. Mean maternal age, BMI, birth weight and length of the newborns, placental weight and gestational age at birth are listed in **Table 1.** 22,6 % (n=139) of pregnant women were anemic. 58 pregnant smokers (9,2%) were identified, with an average daily consumption of 7,88 cigarettes.

Table 1: Demographic characteristics of participants

Parameters	**Mean ±SD (n=630)**
Age (years)	28,00 ±5,33
Birthweight of the newborn(g)	3232,15 ± 380,33
Length of the newborn (cm)	50,15±1,51
Placental weight (g)	602,73±116,16
Maternal weight (kg)	74,73±5,43
Maternal length (cm)	161,22 ±5,43
Body mass index (BMI)	28,74 ±4,20
Gestational age	275,58 ±7,5

The variables are presented as mean ± standard deviation(range)

A statistically significant relationship was also found between neonatal weight and placental weight (p=<0,001). The placental weight was also unaffected by the infant gender and week of birth. Also, BMI and maternal anemia were not found to have significant relationship with placental weight (p=0,861, p=0,807 respectively) **(Table 2).** We observed that parity had a statistically significant impact on placental weight when we analyzed the variables affecting placental weight (p=0,024) **(Table 2).**

Table 2: Parameters Affecting Placental Weight

"Parameters	**R**	**R Square**	**Adj. R Square**	**Durbin-Watson**	**B**	**Standard Error**	**CI (95%)**	**p Value**	**Affect Percentage**
Constant					198,25	159,76	-115,47 to 511,96	0,268	-
Age(years)					-0,45	0,89	-2,2 to 1,29	0,626	0,07
Parity					-6,47	4,54	-15,39 to 2,45	0,112	0,97
Abortus					2,88	6,65	-10,18 to 15,95	0,721	0,43
Gender of the newborn					-6,80	7,74	-21,99 to 8,39	0,435	1,02
Length of the newborn (cm)					2,67	2,95	-3,13 to 8,46	0,668	0,40
Maternal hemoglobin(g/dl)					-1,39	13,33	-27,58 to 24,79	0,807	0,21
Maternal hematocrit (%)	0,61	0,372	0,345	1,212	0,28	1,42	-2,51 to 3,07	0,715	0,04
Maternal thrombocyte					0,00	0,00	0,00 to 0,00	0,307	0,00
Maternal leukocyte					1,27	0,98	-0,65 to 3,19	0,083	0,19
Primiparity					24,91	10,7	3,90 to 45,92	0,024	3,75
BMI					-0,49	0,90	-2,26 to 1,29	0,861	0,07
Weight of the newborn (gr)*					0,18	0,01	0,15 to 0,20	>0,001	0,03
Gestational age					-1,1	0,47	-2,01 to 0,18	0,060	0,17
Smoking count/day					-0,37	1,34	-3,00 to 2,26	0,831	0,06

Linear Regression Analysis with Enter Method was applied.
**gr:gram*

We also analyzed the impact of gravidity on placental mass and discovered a significant correlation (p=0,008) **(Table 3).** Only GDM had statistically significant effect in placental weight when the medical diseases of the women were evaluated (p=0,024). However, pregestational diabetes was not found to effect placental weight **(Table 4).**

Table 3: Effect of gravidity on placental weight

	G=1	**G≥2**	**p value**
Placental weight(g)	580,0 (510,0-650,0)	600,0 (528,0-689,5)	**0,008**

Data are presented as median (Q1-Q3) (range)

Table 4: Chronic disesase that effect plasental weight

Parameters	R	R Square	Adj R Square	Durbin-Watson	B	Standard Error	Condidence Interval (95%)	P value	Affect Percentage
Hypothyroidism	0,61	0,372	0,345	1,212	-9,68	11,32	-31,91 to 12,56	0,435	1,46
Hypertension					53,31	32,58	-10,67 to 117,28	0,126	8,03
Arrhythmia					18,15	68,29	-115,95 to 152,25	0,756	2,73
Asthma					-32,68	37,86	-107,03 to 41,66	0,326	4,92
Diabetes					-19,13	56,02	-129,14 to 90,88	0,771	2,88
Familial Mediterranean Fever					19,75	68,30	-114,38 to 153,88	0,759	2,97
Gestational diabetes mellitus					-39,24	19,67	-77,86 to 0,62	**0,024**	5,91
Anemia					-66,73	68,15	-200,55 to 67,09	0,309	10,05
Hydronephrosis					98,48	96,93	-91,86 to 288,81	0,329	14,83
COPD*					-28,64	68,65	-163,44 to 106,17	0,674	4,31
Thalassemia minor					46,28	68,31	-87,86 to 180,41	0,505	6,97
Tachycardia					117,00	68,65	-17,81 to 251,81	0,082	17,62
Gestational hypertension					-65,80	57,62	-178,96 to 47,36	0,216	9,91

Linear Regression Analysis with Enter Method was applied.

**Chronic obstructive pulmonary disease*

DISCUSSION

The weight of the placenta is influenced by a number of biological and environmental parameters. Fetal sex and maternal parity are the most persistent factors that cause variation in healthy placentas, with parity having a greater effect than fetal sex.[5] It has long been recognized that fetal sex influences placenta weight, due to sex-specific placental gene expression, biomarker variations, and gene-environment interactions.[8] Recently there has been a rising interest in the relationship between parity and placentation. Several biological investigations have demonstrated that mothers maintain the remodeling of maternal spiral arteries and retain a biological memory that aids placentation in subsequent pregnancies.[9-11] However, in our study we did not find statistically significant effect of fetal sex and maternal parity on placental weight.

In many scientific studies, the effect of parity on placental weight has been ignored and focused more on placental weight and feto-placental ratio. Recently, Wallace et al. and Ogawa et al. established reference centiles adjusted for gestational age, parity and fetal sex that demonstrated nulliparity had a bigger effect on placenta weight than the effect of fetal sex.[5,11] While other reference curves for placental weight have been developed, only these two studies have classified the curves according to both of these factors.[5,12] In our study, rather than parity, we found that whether the pregnancy is the first pregnancy of the mother or not , affect the placental weight (p=0,024). Multigravid women have more placental weight compared to primigravid women.

The health and well-being of women is negatively impacted by maternal anemia, which also raises the risk of adverse consequences for the mother and the newborn. Iron deficiency anemia is the biggest nutritional issue worldwide, especially for pregnant women. Maternal anemia might be expected to cause fetal hypoxemia and stimulate placental growth. However, although it is common in pregnancy, anemia is not found to be related with placental weight in various studies.[13,14] Similarly, in our study we did not find correlation between fetal anemia and placental weight.

A high maternal body mass index has also been correlated to a big placenta.[15] High BMI increases gestational diabetes risk. There is evidence that increased placental weight is related to every type of diabetes.[16] Similarly, in our study we found that gestational diabetes significantly increases placental weight. However, we did not find the same effect with pregestational diabetes probably due to low number of patients with pregestational diabetes.

Tobacco use during pregnancy may cause a lot of complications such as low birth weight, short newborn height, shorter pregnancy duration, increased rate of spontaneous abortion, higher rate of intrauterine growth retardation and perinatal mortality. Studies have shown that the fetal /placental weight ratio decreases due to smoking effect on fetal growth.[1] In a lot of studies conducted, restricted number of criteria impacting placental weight were considered. However, in our study we did not find significant effect of smoking on placental weight. The discrepancies between the study findings can be due to the variations on the objective declaration of the number of cigarettes smoked, which should be further evaluated much more in detail like using some blood markers that may demonstrate the intensity and frequency of smoking.

Study limitations

The major limitation of our study is the low number of patients to evaluate the effect of certain medical conditions, like pregestational diabetes, on placental weight. A further limitation of the study is that we did not include cesarean deliveries in the research.

CONCLUSİON

In terms of antenatal factors, placental weight is found to be affected only by gestational diabetes and the number of gravidity. In order to evaluate the effect of certain medical conditions on placental weight, further studies with more patients are still needed.

ACKNOWLEDGEMENTS

Ethıcal Declerations

The Karamanoğlu Mehmetbey University Ethics Committee granted ethical approval (Date: 19/01/2023; Number:01-2023-13). It complied with the Helsinki Declaration's ethical criteria for human testing (2013).

Conflict of Interest Statement:

No conflict of interest was declared by the authors.

Financial Disclosure:

The authors declared that this study received no financial support.

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