Original Article

Could fetal gender affect maternal serum placental alkaline phosphatase levels in healthy pregnant women?

Fetal cinsiyet sağlıklı gebelerde serum plasental alkalen fosfataz seviyelerini etkileyebilir mi?

Hacer Uyanikoglu[1], Sibel Sak[1], Adnan Incebiyik[1].

1 Harran University Medical Faculty, Department of Obstetrics and Gynecology, Sanliurfa, Turkey

Corresponding author:

Hacer Uyanikoglu

Department of Obstetrics and Gynecology, Faculty of Medicine, Harran University, Sanliurfa, Turkey.

E-mail: huoglu@hotmail.com Tel: +90535 5740425 Fax: +90 414 318 3192

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Abstract

Aim: We aimed to research whether fetal gender affects maternal placental alkaline phosphatase (ALP) levels in uncomplicated pregnancies with late term.

Materials and Methods: The serum placental ALP measurement was carried out in 88 healthy pregnant women at 38 - 39 weeks of gestation. Infant sex was determined at the delivery for all women included in this study. Placental ALP levels were compared between pregnant women bearing female and male fetuses.

Results: Although placental ALP levels were slightly higher in pregnant women carrying female fetuses than in male bearing pregnant women, this difference was not statistically significant ($p > 0.05$).

Conclusions: Fetal gender was seen not to affect maternal serum placental ALP levels in healthy pregnant women at 38 - 39 weeks of gestation.

Keywords: Fetal, gender; placental alkaline phosphatase

Öz

Amaç: Normal term gebeliklerde fetal cinsiyetin maternal plasental alkalen fosfataz (ALP) seviyesine etkisinin araştırılması amaçlandı.

Yöntem ve Gereçler: Termde olan 88 sağlıklı gebede serum plasental ALP ölçümü yapıldı. Bebeklerin cinsiyeti çalışmaya alınan tüm kadınların doğumları sırasında belirlendi. Plasental ALP seviyeleri kız ve erkek doğuran gebe kadınlar arasında karşılaştırıldı.

Bulgular: Kız fetüse sahip gebelerde plasental ALP düzeyleri daha yüksek olmakla birlikte bu farklılık istatistiksel olarak anlamlı değildi ($p > 0.05$).

Sonuç: 38 - 39'uncu gebelik haftalarında fetal cinsiyetin maternal serum plasental ALP seviyelerini sağlıklı gebe kadınlarda etkilemediği görüldü.

Anahtar Kelimeler: Fetal, cinsiyet, plasental alkalen fosfataz,

Introduction

Alkaline phosphatase (ALP) is an ubiquitous enzyme involved in transport of phosphate across cell membranes. Serum ALP levels increase significantly during pregnancy due to the increased secretion from placenta. It's levels can reach three to four times the normal range. Many studies have shown that placental ALP isoenzyme activity contribute to the increased serum total ALP in pregnant women (1, 2). Placental isoenzyme has been found to be maximally increased at 38 weeks of gestation (3). Some hormones and peptides that secreted by the syncytiotrophoblasts in related fetal gender differences have been studied (4). It has been shown that pregnant women with female fetuses have higher maternal serum hCG levels compared to male bearing pregnant women (5). Although elevated activity of serum ALP levels have been reported in complicated pregnancy such as gestational diabetes, intrauterin growth restriction, preterm delivery and preeclampsia, and a genetic abnormality has been suspected in one case, the mechanism of serum placental ALP increasing is not well understood (6-10). Relationship between fetal gender and placental ALP level has not been studied previously, so this study is the first in literature.

We aimed to investigate if fetal gender may affect placental ALP levels and thereby causes different serum levels of placental ALP between female and male bearing healthy pregnant women.

Materials and Methods

A total of 88 healthy singleton pregnant women admitted to our out-patient Obstetric Department of Harran University, Medical Faculty, in June and Aug 2015. This study conformed with the principles of the 2008 Declaration of Helsinki and was approved by the local ethics committee of Harran University, Medical Faculty, Turkey. Detailed information was given to all pregnant women enrolled in the study, and all the participants signed consent forms.

Maternal age, gravidity, parity, and gestational age were documented for all pregnant women. All women were at term gestation in ultrasonograpic examination (Voluson 730 Expert scanner, GE Medical systems). Since chronic diseases, multiple pregnancies and smoking can affect serum levels of ALP in pregnant women, these patients were excluded from the study (11).

Maternal venous blood samples were collected in a plain bottle. The blood analyses were performed within 2 h of blood sampling using a hematology analyzer (GEN-S; Beckman-Coulter Inc., Brea, CA) in the biochemistry laboratory of our hospital. Placental ALP levels were measured using specific immunoassays. **Placental ALP** (Cat No: E-EL-H1555, Elabscience, China) measurements were in picograms per milliliter (pg/mL).

Table 1. Comparison of demographic and clinical characteristics

	Pregnancies (F) (n = 47)	Pregnancies (M) (n = 41)	p
Maternal age (year)	31.3 ± 5.2	31.6 ± 4.9	NS
Gravida (n)	5.3 ± 2.2	5.7 ± 2.3	NS
Parity (n)	3.7 ± 1.8	3.9 ± 1.8	NS
Abortus (n)	0.6 ± 0.7	0.7 ± 1.1	NS
Gestational age (week)	39.1 ± 0.6	38.1 ± 1.8	NS
Fetal weight (g)	3440 ± 692	3360 ± 796	NS

Data are presented as mean ± SD; NS: not significant (p > 0.05); F: female; M: male

All analyses were performed using Statistical Packages for Social Sciences (SPSS) for Windows, Version 20.0 (SPSS, Chicago, IL). All data were expressed as means and standard deviations. Comparisons of values between the groups with normally distributed variables were performed using a dependent samples t test. The between- groups differences without normal distribution were checked with Mann-Whitney U test, while groups with categorical variables were compared with Pearson chi-square test. Differences in the groups' biochemical parameters were analyzed using independent samples t test. A value of $p < 0.05$ was considered statistically significant.

Results

Comparison of clinical characteristics in both groups are shown in Table 1.

There were no significant differences in maternal age, gestational age, gravidity, parity, abortion history and fetal birth weight between the groups. There were 47 female and 41 male fetuses. The fetuses were at term gestation and they had no anomaly. All pregnancies were uncomplicated.

Table 2. Serum placental ALP levels in both groups

	Pregnancies (F) (mean ± SD) (n = 47)	Pregnancies (M) (mean ± SD) (n = 41)	p
Placental ALP (pg/mL)	52.0 ± 8.1	51.3 ± 4.9	> 0.05

SD: standart deviation; ALP: alkaline phosphatase; F: female; M: male

Table 2 lists the variations observed in the placental ALP levels according to fetal sex. Although the placental ALP values were slightly

higher in pregnant women bearing female fetuses than in male bearing pregnant women, this difference was not significant statistically (Figure 1).

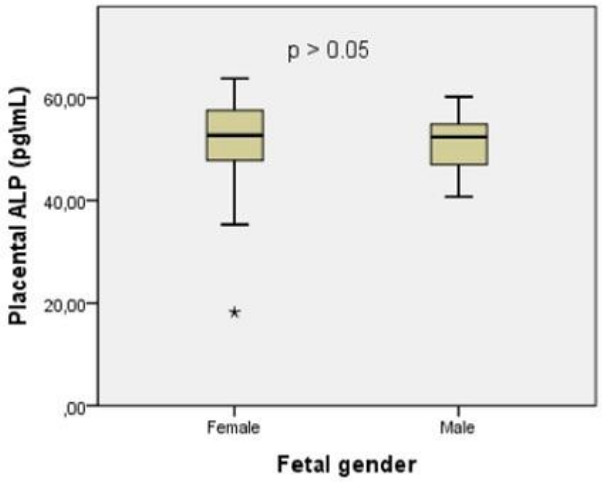

Figure 1: The placental ALP levels according to fetal gender

Discussion

In this study, we firstly showed that fetal gender factor can not affect maternal serum placental ALP levels at the late term gestation in healthy pregnant women.

The primary source of human placental ALP is syncytiotrophoblasts, which mainly synthesizes this enzyme during the second and third trimester. By term, placental ALP becomes a major ALP at circulation in pregnant women (8). In previous studies, it has been reported that serum total ALP levels increase in pregnant women progressively from 31 weeks to term, whereas no significant alteration was shown below 16 weeks of gestation (3, 12). So we designed this study at 38 - 39 weeks of gestation, which placental ALP reaches peak levels.

Previous studies have shown that total, placental, and neutrophil ALP (NALP) levels may be important markers in the prediction of adverse events during pregnancy. NALP is an indicator of placental function in early miscarriages and as a marker for prenatal diagnosis of Down's syndrome, and the usefulness of total ALP measurement have shown as a predictor of preterm birth (13, 14). Furthermore, in literature isolated elevation of placental ALP was seen in an uncomplicated pregnancy (7). There are little studies that comparing the fetal gender and the maternal serum hCG, NALP, and some other peptides, secreted by the syncytiotrophoblasts, in pregnant women (4, 5, 15, 16). But, there is no study investigating only the relation of serum placental ALP levels with fetal gender factor. In this study, we aimed to find out whether only fetal gender has an effect on serum placental ALP levels in uncomplicated late term pregnancies because of the placental ALP levels have thought to be related with many complications seen during pregnancy (6, 9, 13, 14).

Placental factors or overexpression of X chromosome by the placenta have been suggested as the cause of different maternal hCG levels (5, 15). Steier et al. demonstrated that gender factor may affect on the synthesis or metabolism of maternal hCG levels throughout the second and

third trimester (17). We thought the serum placental ALP levels may be affected from gender factor in third trimester pregnancies such as maternal hCG levels.

Although a similar examination with our study by Mol et al. reported the effect of fetal female gender on maternal total and placental ALP levels between 32 and 36 weeks of gestation (12), we showed the placental ALP levels were slightly higher in pregnant women carrying female fetuses than in male bearing pregnant women, but this difference was not statistically significant. Conversely, our study was conducted between 38 - 39 weeks of gestation and we studied with more patient numbers than Mol et al. (88 vs. 30, respectively). This issue should be supported with further studies.

Conclusion

Our study is the first in literature. We found that fetal gender seems can not affect maternal serum placental ALP levels in healthy pregnant women with late term. More comprehensive studies, including more patients, are needed to verify the relation of this issue.

***Ethics Committee Approval**: Ethics committee approval was received for this study from the ethics committee of Harran University.*

***Informed Consent:** Written informed consent was obtained from patients who participated in this study.*

Author Contributions: Concept, Design and Writing –U.H.; Supervision - H.NG.

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Conflict of interest

The authors declare that they have no conflict of interest.

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