

# The Determination of Fetal Gender with Gestational Sac Volume Maternal Age and Body Mass Index

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**OBJECTIVE:** In this study, we aimed to examine the effects of fetal gender on Gestational Sac Volume (GSV), maternal age and Body Mass Index (BMI) between 10 and 12 gestational weeks in order to detect the fetal gender in diseases being transferred genetically with x by using non-invasive methods.

**STUDY DESIGN:** 37 pregnant women who came for routine antenatal controls between 10 and 12 gestational weeks were incorporated in study. The GSV was measured via transabdominal ultrasonography on those pregnant women, maternal ages were determined and BMI was calculated. Then, between 20 and 22 gestational weeks, pregnant women were taken in sonographic evaluation for sex determination.

**RESULTS:** The average age of pregnant women was 32 (min.20 - max.41). 28 of them (76%) were pregnant in 10 weeks, 5 of them (14%) were pregnant in 11 weeks, and 4 of them (10%) were pregnant in 12 weeks. The GSV, maternal age and BMI values of all of the pregnant women were compared. No significant relationship was found between male and female fetuses in terms of GSV, maternal age and BMI values ( $p>0.05$ ).

**CONCLUSION:** We found that GSV, maternal age and BMI have no effect for determination of fetal gender which is very important for hereditary diseases in early pregnancy.

**Keywords:** Fetal gender, Ultrasonography, First trimester

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## Introduction

Fetal gender determination is performed through the first trimester after 12 gestational weeks or through transabdominal or transvaginal evaluation in early the second trimester gestational weeks. The fetal gender determination has clinical importance for hereditary diseases (hemophilia, Duchenne muscular dystrophy, G6PDH enzyme deficiency and etc.) which are transferred through X chromosome.<sup>1,2,3</sup> If the fetal gender can be determined via sonography before 12 gestational weeks, no invasive methods such as CVS, which may cause fetal loss in pregnant women with hereditary disease history in their families, won't be applied.

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Fetal external genital organs are similar in both of genders till 6 week, no distinction can be made. In that week, there is a pair of genital fold in genital region. In male fetus; penis and penile urethra arise from medial fold, and scrotum arises from lateral fold. For female fetus; labium minus develops from medial fold, and labium majus develops from lateral fold. Then, especially after 8 gestational weeks, external genital organs differ.<sup>4,5,6</sup>

Because of improvements on resolutions of ultrasonography devices and 3D imaging opportunities, fetal gender determination can be performed earlier, between 12 and 13 gestational weeks. Before 14 week and when fetus is in sagittal position in image, fetal gender determination is performed by focusing on angle between lumbosacral line and genital tubercle. If the angle between genital tubercle and lumbosacral line of fetus is higher than 30°, the fetus is determined as male; if that angle is lower than 30° or parallel with horizontal lumbosacral line, the fetus is determined as female. The fetal genders are then verified by following CVS or the second trimester sonographic evaluation.<sup>1,2,3,4</sup>

In this study; gender determination was performed by comparing sonographic findings with various criteria before 12 gestational week of pregnant women.

## Material and Method

37 pregnant with no systematic diseases (hypertension, anemia, diabetes, autoimmune diseases and etc.) from pregnant women who came to our hospital between March 2012 and December 2012 for routine control of their pregnancies between 10 and 12 gestational weeks were incorporated in study. The gestational sac volume (GSV) of pregnant women was measured by trans-abdominal ultrasonography. Besides that, maternal age was determined and body mass index (BMI) was calculated. Then in 20-22 gestational weeks, those pregnant were examined for gender determination through transabdominal ultrasonography again. For GSV, measurements were performed in 3 transabdominal plans (antero-posterior, longitudinal, transverse), and GSV was calculated automatically. GSV and fetal gender were measured and determined through same ultrasonography device (General Electric Logic P 5 2009 Korea) with 5.5 MHz convex probe. The pregnant women incorporated in our study were informed, and conformity approval was taken from local ethic commission. Maternal age, gestational week, fetal gender, GSV and maternal BMI measurements were evaluated statistically via "student t test".

## Results

37 pregnant women were examined in our study. The average age of pregnant women was 32 (min.20 - max.41). 28 of them (76%) were pregnant for 10 weeks, 5 of them (14%) were pregnant for 11 weeks, and 4 of them (10%) were pregnant for 12 weeks. The GSV, maternal age and BMI values of all of the pregnant women were compared (Table 1).

No significant relationship was found between male and female fetuses in terms of GSV, maternal age and BMI values ( $p>0.05$ ). In order to ensure more specific and homogenous

dispersion of found values, GSV, maternal age and BMI values of pregnant women at 10 gestational week with most frequent samples, were compared with fetal gender (Table 2).

It was found that GSV, maternal age and BMI values did not change with fetal gender in this group, and that there was no significant relationship ( $p>0.05$ ). As seen in both of two tables, no significant relationship was found between fetal gender and GSV, maternal age and BMI ( $p>0.05$ ).

## Discussion

Fetal gender determination is generally performed through sonographic examination at 12 and 14 gestational weeks. Again with CVS in same weeks or with genital examination of babies after birth, the fetal gender is verified.<sup>1,2,3</sup>

Whitlow et al. determined the fetal gender with 85% accuracy in 12 gestational weeks and 77% accuracy in 14 gestational weeks through transabdominal ultrasonography. They verified the fetal genders of babies by genital examination after birth.<sup>1</sup> Efrat et al. reported the fetal gender with 70.3% accuracy in 11 gestational weeks, with 98.7% accuracy in 12 gestational weeks and 100% accuracy in 13 gestational weeks through transabdominal sonographic evaluation. Researchers verified the fetal gender via CVS.<sup>2</sup> In their another study, Efrat et al. reported the fetal gender with 85% accuracy in 12 weeks-12 weeks and 3 days old fetuses, with 96% accuracy in 12 weeks and 4 days - 12 weeks and 6 days old fetuses, with 97% accuracy in 13 weeks - 13 weeks and 6 days old fetuses. They verified the genders of fetuses by examination of babies after birth.<sup>3</sup> By evaluating babies at 11 and 14 weeks, Behrendt et al. stated that maternal BMI increases affect the imaging at fetal gender determination in first trimester negatively.<sup>7</sup> Hsiao et al. reported the fetal gender with 71,9% accuracy in 11 weeks, with 92% accuracy in 12 weeks and with 98,3% accuracy in 13 weeks.<sup>8</sup> Chelli et al. reported fetal gen-

Table 1: Changes on GSV, maternal age and BMI of all of fetuses

10-12 weeks Fetal Gender	Female	Male	p
n	20	17	
GSV (ml)	51.44±22.37	47.04±18.67	0.67
Age	32.83±6.1	31.22±2.9	0.90
BMI (kg/m <sup>2</sup> )	25.62±5.61	24.61±5.37	0.45

Table 2: Changes on GSV, maternal age and BMI values of 10 week - old fetuses

10 week Fetal Gender	Female	Male	p
n	15	13	
GSV (ml)	44±15.0	46±19.8	0.95
Age	33.22±4.9	31.28±3.1	0.83
BMI (kg/m <sup>2</sup> )	26.7±3.8	24.1±5.7	0.26

der with 85,7% accuracy in 11-14 weeks through transabdominal sonographic evaluation.<sup>9</sup>

In this study, we evaluated the usability of non-invasive methods in the first trimester with GSV, maternal age and BMI for fetal gender determination without using invasive methods for pregnant women in early pregnancy periods such as 10 and 12 gestational weeks.

In our study, fetal GSV measurement and maternal BMI calculation were performed through transabdominal ultrasonography at between 10 and 12 gestational weeks. By performing fetal gender determination and verification at same cases in second trimester and we confirmed fetal gender after birth; a relationship was searched between pre-found GSV, maternal age and BMI. In literature, we did not find any non-invasive study which is examining fetal gender differentiation between 10 and 12 gestational weeks with GSV and extra-fetal structure criteria (maternal age, BMI and etc.), just like our study.

## Conclusion

Based on parameters which can be measured in routine antenatal controls of pregnant women in first trimester, the relationship between fetal gender, GSV, maternal age and BMI was examined. The study was conducted based on predictions that other 3 parameters would differ according to fetal gender, and that fetal gender could be determined between 10 and 12 gestational weeks. But no significant relationship was found between fetal gender and other 3 parameters. It is thought that it might be caused from evaluation of low number of pregnant women and fetus groups. We believe that our study which was started as pre-study may light this subject.

## Fetal Cinsiyetle Gestasyonel Kese Hacmi

### Maternal Yaş ve Vücut Kitle İndeksi Değişimi

**AMAÇ:** Bu çalışmada x'e bağlı kalıtsal geçiş gösteren hastalıklarda fetal cinsiyeti noninvazif bir yöntemle belirleyebilmek için, 10 - 12 haftalar arasında fetal cinsiyetin Gestasyonel Kese Hacmi (GSV), maternal yaş ve vücut kitle indeksi (BMI) üzerine etkisini incelemeyi amaçladık.

**GEREÇ VE YÖNTEM:** Rutin antenatal kontrollere gelen 10-12 haftalar arasındaki 37 gebe çalışmaya dahil edildi. Bu gebelerde GSV, transabdominal ultrasonografi ile ölçüldü, maternal yaş belirlendi ve BMI hesaplandı. Gebeler daha sonra 20-22.

haftalarında cinsiyet tayini için sonografik incelemeye alındı.

**BULGULAR:** Gebelerin yaş ortalaması 32 (min.20-max. 41)' dir. Bunların 16'sı (%76) 10 haftalık, 3'ü (%14) 11 haftalık ve 2'si de (%10) 12 haftalıktır. Bütün gebelerin GSV, maternal yaş ve BMI değerleri karşılaştırıldı. Kız ve erkek fetüslerin GSV, maternal yaş ve BMI değerleri arasında anlamlı bir ilişki bulunmadı ( $p>0,05$ ).

**SONUÇ:** Gebeliğin erken döneminde kalıtsal hastalıklar için önemli bir konu olan fetal cinsiyetin belirlenmesinde GSV, maternal yaş ve BMI 'nin etkisinin olmadığı sonucuna varıldı.

**Anahtar Kelimeler:** Fetal cinsiyet, Ultrasonografi, Birinci trimester

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