

A Comparison of Echocardiographic and Troponin I (cTnI) Values in Nulliparous and Multiparous Women

Hiç Doğum Yapmamış ve Çok Doğum Yapmış Kadınların Ekokardiyografik ve Troponin I (cTnI) Değerlerinin Karşılaştırılması

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ABSTRACT

Objective: In this study, the structure and function of the heart were analyzed by echocardiography in sagittal, transverse and coronal planes in women attending the cardiology outpatient clinic of Healthy Science University Van Training and Research Hospital in 2021. The study aimed to compare cTnI levels and echocardiographic measurements between nulliparous and multiparous women.

Materials and Methods: The study was conducted in 80 women between the ages of 25-35, 40 of whom had nulliparous, and 40 of whom had multiparous (at least three births). Participants' age, educational level, and residence location were also obtained. Two-dimensional (2D) and M-mode imaging echocardiography was performed with a Philips Hd11xe echocardiography device and a 2.0 MHz transducer. Troponin I (cTnI) levels of cardiac troponins were analyzed in blood plasma. The statistical significance level was taken as 0.05 and SPSS (ver:25) package program was used for calculations. Since the independent variable had two categories, "Independent sample t-test" was used.

Results: According to the findings, a statistically significant difference was found between nulliparous and multiparous women in terms of education level, residence location and age. Left ventricular end-diastolic diameter, left ventricular end-systolic diameter, left atrial size, right ventricular size, aortic root width, ejection fraction, mitral lateral E'/A', mitral septal E'/A' and tricuspid lateral E'/A' were statistically significant between the two groups.

Conclusion: The negative impact of increased birth rate on heart function was found to be statistically significant. Therefore, more comprehensive studies examining the effects of increasing birth numbers on the cardiac system are needed and such studies can make significant contributions to literature.

Keywords: *Anatomy, birth number, echocardiography, heart, troponin I*

ÖZET

Giriş: Bu çalışmada, 2021 yılında Sağlık Bilimleri Üniversitesi Van Eğitim Araştırma Hastanesi kardiyoloji polikliniğine başvuran kadınlarda ekokardiyografi cihazı ile sagittal, transvers ve koronal düzlemlerde kalbin yapı ve fonksiyon analizi yapıldı. Araştırmada, hiç doğum yapmamış kadınlar ile çok doğum yapmış kadınların cTnI ve Ekokardiyografi cihazı ölçüm sonuçlarının karşılaştırmalı değerlendirilmesi amaçlandı.

Materyal ve Metot: Çalışma 25-35 yaş aralığında, 40'ı hiç doğum yapmamış, 40'ı ise çok sayıda doğum yapmış (en az üç doğum) 80 kadında yapıldı. Katılımcıların yaşları, eğitim durumları ve ikamet ettikleri yer bilgileri de alındı. Philips Hd11xe ekokardiyografi cihazı ve 2,0 MHz transduser kullanılarak iki boyutlu (2D) ve M-mode görüntülemeyi içeren ekokardiyografik inceleme yapıldı. Kardiyak troponinlerden Troponin I (cTnI)'nın kan plazmasındaki seviyelerine bakıldı. İstatistiksel anlamlılık düzeyi 0.05 olarak alındı ve hesaplamalar için SPSS (ver:25) paket programı kullanıldı. Bağımsız değişkenin iki kategorisi olduğu için "Bağımsız örneklem t-testi" kullanılmıştır.

Bulgular: Elde edilen bulgulara göre, çok sayıda doğum yapmış kadınlar ile hiç doğum yapmamış kadınlar arasında eğitim-yaşadıkları yer-yaş karşılaştırmasında istatistiksel olarak anlamlı farklılık elde edildi. İki grup arasında ki sol ventrikül diastol sonu çapı, sol ventrikül sistol sonu çapı, sol atriyum boyutu, sağ ventrikül boyutu, aort kök genişliği, ejeksiyon fraksiyonu, mitral lateral E'/A', mitral septal E'/A' ve triküspit lateral E'/A' ölçüm değerleri istatistiksel olarak anlamlı bulundu.

Sonuç: Artan doğum sayısının kalp fonksiyonları üzerine olumsuz etkisi istatistiksel önemde tespit edildi. Bu nedenle, artan doğum sayısının kardiyak sistem üzerindeki etkilerini inceleyen daha kapsamlı çalışmalara ihtiyaç duyulmakta ve bu tür araştırmalar literatüre önemli katkılar sağlayabilir.

Anahtar kelimeler: *Anatomi, doğum sayısı, ekokardiyografi, kalp, troponin I*

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INTRODUCTION

The heart is the central organ of the cardiovascular system (Guyton and Hall, 2001). Echocardiography, the most widely used noninvasive cardiac imaging technique, assesses cardiac chamber dimensions and function (Lang et al., 2015). Accurate detection methods should be used for the diagnosis and prognosis of individuals with cardiovascular complaints. Cardiac troponin is a key diagnostic biomarker in individuals with cardiovascular complaints (Chapman et al., 2017). When a person has a heart attack or suffers heart muscle damage, the heart muscle protein troponin enters the bloodstream (Katrukha and Katrukha, 2021; Kociol et al., 2015).

In studies conducted to date, pregnancy, childbirth and postpartum processes are the most important physiological changes that negatively affect women's quality of life and health (Aksu and Çatalgöl, 2017). Pregnancy is a dynamic process associated with significant physiologic changes in the cardiovascular system (Yılmaz et al., 2017). These changes include the increased metabolic needs of mother and fetus and the mechanisms by which the maternal body adapts for fetal growth (Tan and Tan, 2013; Ayçiçek et al., 2018). From an anatomical and physiological point of view, it is almost impossible for a woman who have been pregnant or given birth rarely retain the same anatomical structure as nulliparous women. (Akyüz and Bayındır, 2013). Pregnancy and peripartum, the prenatal period, are important processes in terms of cardiac and circulatory changes. The incidence of heart disease in pregnant women is between 0.5% and 1%. Therefore, this rate is a remarkable cause of mortality for mother and fetus (Sanghavi and Rutherford, 2014; Webster, 2014).

The aim of this study was to compare the echocardiography device measurements and Troponin I (cTnI) values of women between the ages of 25-35 years who had nulliparous and women who had multiparous and to determine whether there was a difference between the groups.

MATERIALS and METHODS

Study Population

A total of 80 voluntary female participants between the ages of 25-35 years, who had nulliparous and had multiparous (at least three births), who came to the cardiology outpatient clinic of Healthy Science University Van Training and Research Hospital, between 16 June 2021 and 16 September 2021, were included in the study and two groups were formed with the following characteristics.

The groups included women who did not have any structural heart disease, diabetes, hypertension, chronic obstructive pulmonary disease (COPD) and obesity during routine examinations, treatment and check-up procedures. The number of births in women included in the study was based on the number of

births; any abortion cases were not taken into account. Additionally, BMI was not taken into account in comparison between groups.

Nulliparous (Group 1-n:40): Women who had nulliparous who came to the Cardiology outpatient clinic of Healthy Science University Van Training and Research Hospital.

Multiparous (Group 2-n:40): Women who had multiparous (at least three births) attending the Cardiology outpatient clinic of Healthy Science University Van Training and Research Hospital.

Echocardiographic Evaluations and Blood Test Assessment

The data required for the study were collected by echocardiography device measurements and troponin I (cTnI) results. Echocardiography was used to analyze the structure and function of the heart in sagittal, transverse and coronal planes. Two-dimensional (2D) and M-mode echocardiography were performed using a Philips Hd11xe echocardiograph and a 2.0 MHz transducer. Measurements of the anatomical chambers of the heart and Doppler measurements were obtained from the parasternal long axis and apical four-chamber windows. Measurements were taken with the women in the left lateral decubitus position. The parasternal long axis image was obtained by placing the transducer in the 3-4th intercostal space on the left edge of the sternum. The apical four-space image was obtained by placing the transducer on the left nipple at the point of maximum pulse.

Statistical Analysis

The measurements of 80 women were analyzed using the SPSS-25 package program. For this purpose, frequency and percentage distributions were reported for discrete variables, mean and standard deviation for continuous variables, and median and quartile deviation for ordinal variables. Furthermore, this demographic information was compared according to the women's parity status. Chi-square analysis was used in comparisons made according to variables of education level and place of residence of nulliparous and multiparous women. However, in some cases, because the number of cells with an expected value less than 5 in the crosstabs exceeded 20% of the total number of cells, the Fisher-Freeman-Halton Exact test was used as an alternative method. Age and all other measurements related to the participating women were treated as continuous scores. Therefore, the distributions of these variables were first examined. To determine the normality of the distributions, skewness and kurtosis were examined. In this study, the values generally ranged between -2 and +2. A change in these values within the ± 2 range is generally interpreted as an indication that the distribution does not deviate significantly from normality. The Levene test was used to determine the homogeneity of the distributions. Based on the results obtained, the use of

parametric tests in the study was deemed appropriate. In this context, because the independent variable was dichotomous, the "Independent Samples t-test" was used. When performing the t-test, the coefficients and p values obtained for cases where the distributions were not homogeneous and where there was no equal variance were reported. A significance level of 0.05 was taken into account in the interpretation of the results obtained from the statistical tests performed in the study. No artificial intelligence (AI)-assisted technologies (Big Language Models [LLMs], chatbots or image generators) were used in the production of this article.

RESULTS

The results, as shown in figure 1, indicate that in the mean values of left ventricular end-diastolic diameter, left ventricular end systolic diameter, left atrium, right ventricle, aortic root width measurements of the two study groups; it was found that the mean value of Multiparous was higher than the mean value of Nulliparous. The mean values obtained showed that there was a significant difference between the groups (**p<0.001).

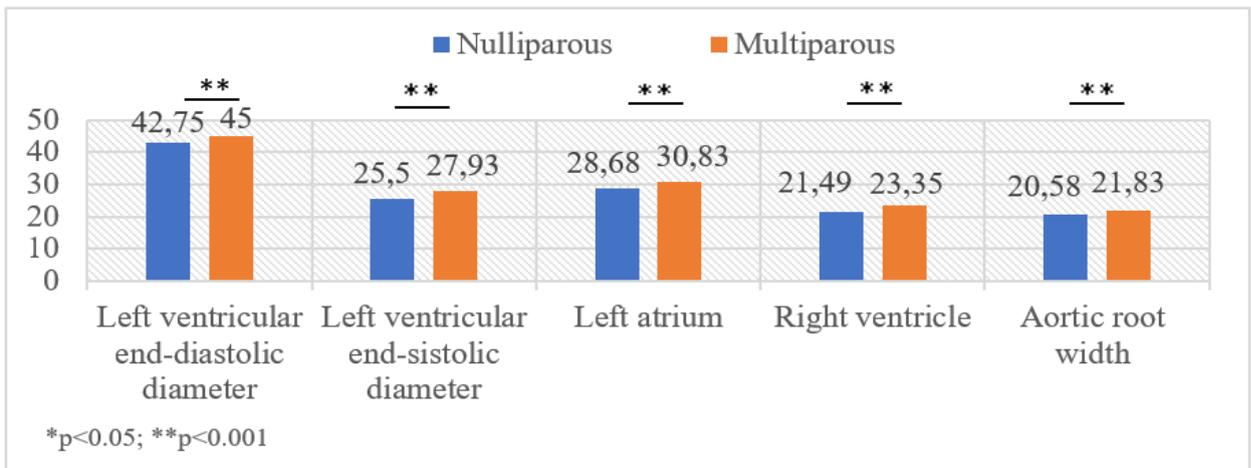


Figure 1. A comparison of the measurements of the left ventricular end-diastolic and end-systolic diameters, the left atrium, the right ventricle and the aortic root width between nulliparous and multiparous women

Data from figure 2 presents, the mean values of ejection fraction, mitral lateral E', mitral lateral A', mitral septal E', mitral septal A', tricuspid lateral E', tricuspid lateral A' measurements of the two study

groups; it was found that the mean value of Nulliparous was higher than the mean value of Multiparous. The mean values obtained showed that there was a significant difference between the groups (**p<0.001).

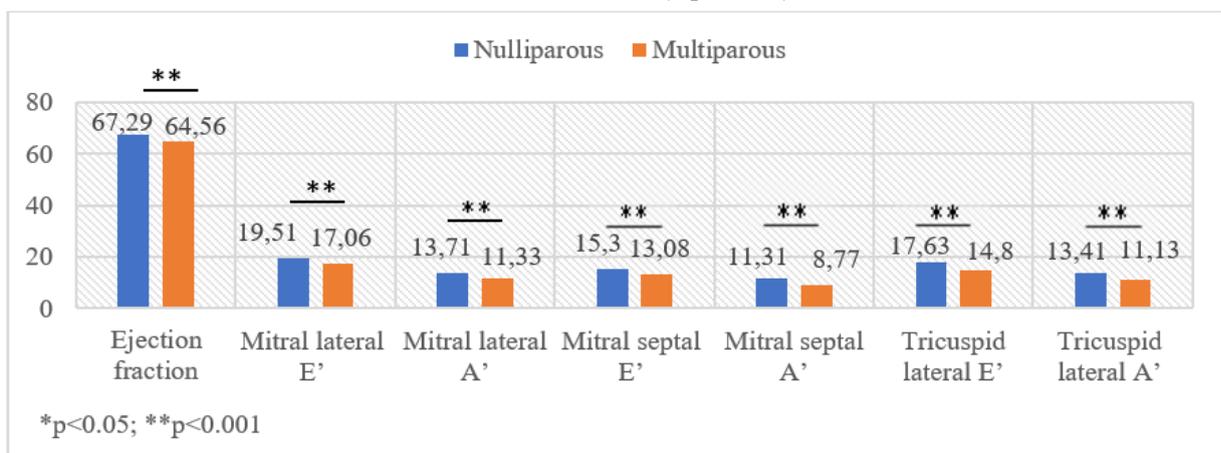


Figure 2. A comparison was made of the ejection fraction and tissue Doppler parameters, including mitral lateral E', mitral lateral A', mitral septal E', mitral septal A', tricuspid lateral E' and tricuspid lateral A', between nulliparous and multiparous women.

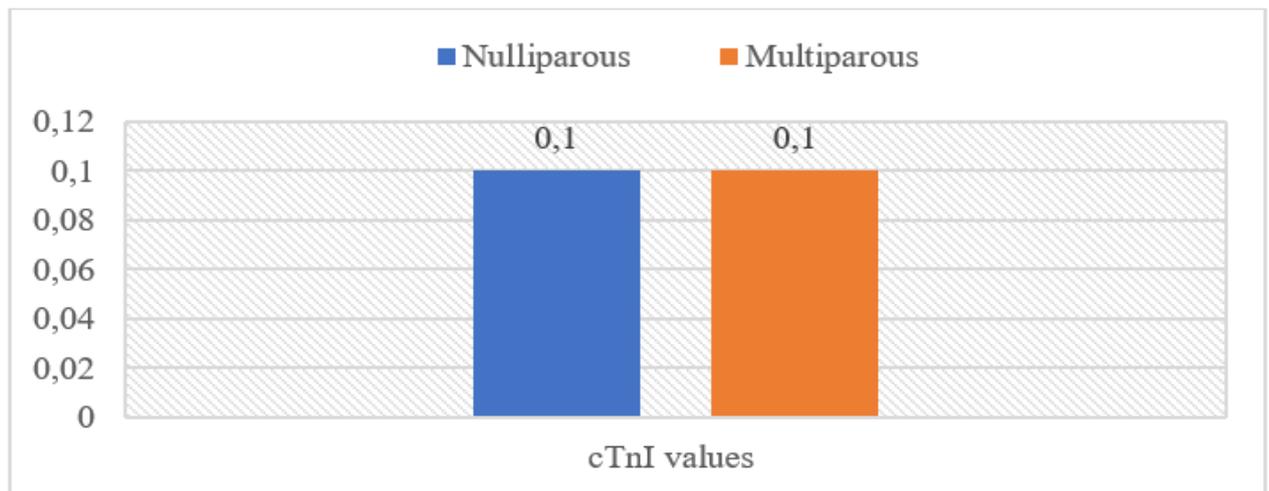


Figure 3. A comparative analysis of cardiac troponin I (cTnI) concentrations in nulliparous and multiparous women.

As figure 3 shows, the cTnI values of the two study groups did not differ statistically significantly ($p > 0.05$). As shown in table 1, indicate that in the comparison of the educational level of the groups in our study with the number of births, it was observed that the number of births decreased as the academic level increased ($X^2=95.48$; $p < 0.001$). In the comparison

of the number of births with the residence location of the groups; the number of births increased more in rural areas ($X^2=29.07$; $p < 0.001$). In the comparison of age and number of births of the groups; increased number of births was observed more in older ages ($t_{78}=-4.44$; $p < 0.001$). No comparison was made between the groups with respect to age and BMI.

Table 1: Demographic evaluation of the participants

	Nulliparous		Multiparous			
Education Level						
	N	%	N	%	$X^2(sd=4)^1$	P
Primary school	0	0.0	31	77.5	95.48	0.000**
Secondary school	0	0.0	9	22.5		
High school	19	47.5	0	0.0		
Associate degree	7	17.5	0	0.0		
License	14	35.0	0	0.0		
Total	40	100.0	40	100.0		
Residence Location						
	N	%	N	%	$X^2(sd=2)^1$	p
City	40	100.0	20	50.0	29.07	0.000**
District	0	0.0	14	35.0		
Village	0	0.0	6	15.0		
Total	40	100.0	40	100.0		
Age						
	N	$\bar{X} \pm SS$	N	$\bar{X} \pm SS$	$t (sd=78)^2$	p
	40	28.70 \pm 2.08	40	31.28 \pm 3.02	-4.44	0.000**
Number of births						
	N	M (Q ₁ -Q ₃)	N	M (Q ₁ -Q ₃)		
	40	---	40	4 (3-5)		

* $p < 0.05$; ** $p < 0.001$; ¹Fisher-Freeman-Halton Exact Test; ²Independent Sample T-Test; M: Median

DISCUSSION

This study was aimed to determine the effect of number of births on cardiac echocardiographic and Troponin I (cTnI) values of women with multiparous (at least three births) and nulliparous

women, using echocardiography device and Troponin I (cTnI) results.

Savu et al. (2012) reported that left ventricular performance was evaluated throughout pregnancy in their study. In a series echocardiographic study of 51 healthy pregnant women without

complications, conducted in each trimester and 3 to 6 months after delivery, evaluated the performance of the left ventricle, taking into account the actual load and shape of the left ventriculus. They found that there was an increase in cardiovascular output during pregnancy, and a decrease in overall vascular resistance due to higher pulse volume and increased heart rate. They said these values have returned to their initial values after birth and multiple births could lead to pathological growth in the heart cavities. Comparing the left ventricular diastolic end diameter (Nulliparous: \bar{X} =42.75, Multiparous: \bar{X} =45.00) and left-ventricle systolic end diameter (Nulliparous: \bar{X} = 25.50, Multiparous: \bar{X} = 27.93) in the two groups that formed this study, the left ventricular systolic and diastolic values significantly increased in the Multiparous compared to Nulliparous ($p<0.001$). This comparison shows that the heart cavities have begun to expand due to systolic and diastolic dysfunction. The results of Savu et al. (2012) support the findings.

A study by Lechmanová et al. (2002) compared the electrical parameters of the heart area with pre- and post-partum hemodynamic parameters for healthy non-obese pregnant women and healthy obese non-gravid women. They reported that increased left ventricular pump function accompanied by increased heart rate and decreased peripheral resistance in the pregnant women group and that there was an increase in heart rate and left ventricular pump function. Comparison of the left ventricular diastolic end diameter (Nulliparous: \bar{X} =42.75, Multiparous: \bar{X} =45.00) and left ventricular systolic end diameter (Nulliparous: \bar{X} =25.50, Multiparous: \bar{X} =27.93) in the two groups that formed this study; the value of left ventricular systolic and diastolic values was significantly higher in the Multiparous than in the Nulliparous ($p<0.001$). In parallel with the findings of Lechmanová et al. (2002), this study suggests that there may be a correlation between birth rate and heart dysfunction in women, and that dysfunctions can lead to enlargement in the heart cavities due to systolic and diastolic dysfunction.

Conclusion

The increase in birth rates appears to have potential effects that may lead to impairments in cardiac function. These effects manifest particularly as enlargement of cardiac chambers (left ventricular end-diastolic diameter, left ventricular end-systolic diameter, left atrium, right ventricle, aortic root width measurements) due to systolic and diastolic dysfunction. Additionally, a significant decrease in tissue doppler measurements (ejection fraction, mitral lateral E', mitral lateral A', mitral septal E', mitral septal A', tricuspid lateral E', tricuspid lateral A'), an objective indicator of systolic and diastolic dysfunction, was observed in multiparous women. The results obtained at the end of the study suggest that there is no relationship between birth rates and the Troponin I. This information is the first to be obtained as a result of this research.

The findings are the first comparable results of a comparative study of the heart function of nulliparous and multiparous women. In this respect in this current study, believe that measuring and evaluating the cardiac functions between the groups with echocardiography device and comparing them with Troponin I results will constitute a reference and contribute to the literature.

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Conflict of Interest: No conflicts of interest, financial or otherwise, are declared by the authors.

Ethics Committee Approval: This study was designed and conducted in accordance with the ethical guidelines set forth in the Declaration of Helsinki and this study was approved by Van Yuzuncu Yil University Noninterventional Clinical Research Ethical Committee (Decision no:2021/05-21, Date: 16.04.2021) to conduct a study on patients admitted to the cardiology outpatient clinic.

'A Comparison of Echocardiographic and Troponin I (cTnI) Values in Nulliparous and Multiparous Women' the study titled was obtained from the doctoral thesis of Van Yüzüncü Yil University Health Sciences Institute, Department of Veterinary Anatomy on 27/12/2022.

Authorship Contributions: BYC and KH conceived, designed research, analyzed data, prepared figures and performed experiments.

REFERENCES

- Aksu S, Çatalgöl Ş. (2017). Kadınların doğum sonrası uzun dönem fiziksel sağlık problemleri ve algıladıkları sağlık düzeyi ile ilişkisi. *Kadın Sağlığı Hemşireliği Dergisi*, 3(2), 22.
- Akyüz G, Bayındır Ö. (2013). Gebelik ile ilişkili osteoporoz. *Türkiye Fiziksel Tıp ve Rehabilitasyon Dergisi*, 53,145.
- Ayçiçek S, Akkaya S, Ede H, Polat C, Gül T. (2018). Kalp hastalıkları olan gebelerin değerlendirilmesi: bir üniversite hastanesinin üç yıllık deneyimi. *Journal of Ankara University Faculty of Medicine*, 71(3),194.
- Chapman AR, Lee KK, McAllister DA Cullen L, Greenslade JH, Parsonage W, et al. (2017). Association of highsensitivity cardiac troponin I concentration with cardiac outcomes in patients with suspected acute coronary syndrome. *The Journal of the American Medical Association*, 318,1913.
- Guyton AC, Hall JE. (2001). *Medical Physiology*. 10th edition. Ankara: Nobel Medical Bookstores, 38,101.
- Katrukha IA, Katrukha AG. (2021). Myocardial injury and the release of troponins I and T in the blood of patients. *Clinical Chemistry*, 67(1),124.

- Kociol RD, Pang PS, Gheorghide M, Fonarow GC, O'Connor CM, Felker GM. (2010). Troponin elevation in heart failure prevalence. *Journals of the American College of Cardiology*, 56 (14),1071.
- Lang RM, Badano LP, Mor-Avi V, Afilalo J, Armstrong A, Ernande L, et al. (2015). Recommendations for cardiac chamber quantification by echocardiography in adults: an update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. *European Heart Journal-Cardiovascular Imaging*, 16,233.
- Lechmanová M, Parížek A, Halaška M, Slavíček J, Kittnar O. (2002). Changes of the electrical heart field and hemodynamic parameters in the 34th to 40th weeks of pregnancy and after delivery. *Archives of Gynecology and Obstetrics*, 266,145.
- Sanghavi M, Rutherford JD. (2014). Cardiovascular physiology of pregnancy. *Circulation*, 130,1003.
- Savu O, Jurcut R, Giusca S, Mieghem TV, Gussi I, Popescu BA et al. (2012). Morphological and functional adaptation of the maternal heart during pregnancy. *Circulation Cardiovascular Imaging*, 5, 289.
- Tan K, Tan L. Alterations in physiology and anatomy during pregnancy.(2013). *Best Practice and Research Clinical Obstetrics and Gynaecology*, 27(6),791.
- Webster J. (2014). Haemodynamic changes in pregnancy. *Journal of Hypertension*, 32,742.
- Yılmaz Ö, Altındağ T, Ülkümen BA, Pala HG. (2017). Gebelik ve perikardiyal hastalıklar. *Kafkas Journal of Medical Sciences*, 7(3),262.