

# Analysis of Laboratory and Obstetric Outcomes in Preeclampsia: A Comparative Study of Bolu and Şanlıurfa

## Preeklampside Laboratuvar ve Obstetrik Sonuçların Analizi: Bolu ve Şanlıurfa'nın Karşılaştırmalı Bir Çalışması

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### ABSTRACT

**Aim:** The aim of this study is to compare the obstetric outcomes of preeclamptic pregnant women in two different centers.

**Material and Method:** In this retrospective study, biochemical, blood count, and obstetric data of pregnant women who presented to obstetrics clinics due to preeclampsia in Şanlıurfa (n=363) and Bolu (n=72) were analyzed.

**Results:** A total of 435 pregnant women diagnosed with preeclampsia were included in the study. No significant differences were observed between Şanlıurfa and Bolu in terms of age, hemoglobin levels, and mode of delivery. However, systolic (SBP) and diastolic (DBP) blood pressures, AST, ALT, gravidity, and parity were significantly higher in Şanlıurfa compared to Bolu. Although proteinuria was more frequently observed in Bolu, it was more severe in Şanlıurfa. Additionally, Rh antigen positivity was found to be more common in preeclamptic pregnancies.

**Conclusion:** Our study demonstrated that preeclamptic pregnant women in Şanlıurfa exhibited more severe laboratory findings and a higher rate of preeclampsia-related complications compared to those in Bolu.

**Keywords:** Preeclampsia; pregnancy; obstetric outcome

### ÖZ

**Amaç:** Çalışmanın amacı iki farklı merkezde preeklampşik gebelerin obstetrik sonuçlarının karşılaştırılmasıdır.

**Gereç ve Yöntem:** Çalışmada Urfa (n=363) ve Bolu (n=72) ilinden preeklampsi nedeniyle kadın doğum kliniklerine başvuran gebelerin biyokimya, kan sayımı ve obstetrik verileri retrospektif olarak incelendi.

**Bulgular:** Çalışmaya 435 preeklampsi tanımlı gebe dahil edildi. Şanlıurfa ve Bolu illeri arasında yaş, hemoglobin ve doğum şekli açısından farklılık gözlenmedi. Sistolik (SKB) ve diastolik (DKB) kan basınçları, AST, ALT, gravite ve parite Şanlıurfa'da Bolu iline göre anlamlı yüksek tespit edildi. Proteinüri Bolu'da daha sık görülmekle birlikte, Şanlıurfa ilindeki proteinüri daha şiddetliydi. Preeklampşik gebelerde Rh antijeni pozitifliğinin daha fazla olduğu görüldü.

**Sonuç:** Çalışmamızda Şanlıurfa ilindeki preeklampşik gebelerde laboratuvar bulgularının daha şiddetli seyrettiği ve preeklampsiye bağlı komplikasyon oranının daha fazla olduğu tespit edilmiştir.

**Anahtar Kelimeler:** Preeklampsi; gebelik; obstetrik sonuçlar

### INTRODUCTION

Preeclampsia is a multisystem disorder that emerges after the 20th week of pregnancy and can persist for up to four weeks postpartum. Its main clinical findings include elevated blood pressure, edema, and proteinuria. When preeclampsia is accompanied by loss of consciousness and tonic-clonic seizures resembling epileptic convulsions, it is referred to as "eclampsia." The two main concerns regarding preeclampsia are its nature as a multisystem disease and its potential to lead to eclamptic crises if left untreated (1).

Classified as one of the hypertensive disorders of pregnancy, preeclampsia is a pregnancy-related complication observed in 5–10% of all pregnancies and ranks among the top three causes of maternal mortality worldwide (2). In Turkey, preeclampsia is the second leading cause of maternal death (3). Globally, approximately 500,000 perinatal deaths occur annually due to preeclampsia (4). Hemorrhage and embolism are among the leading causes of preeclampsia-related mortality (5). Another severe complication of preeclampsia that threatens both maternal and fetal life is placental abruption.

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Proper management of preeclampsia can prevent maternal morbidity and mortality (6). Recognizing preeclampsia, understanding its clinical and etiological factors, and assessing whether regional factors influence the course of preeclampsia in pregnant women in Turkey could enhance treatment strategies and improve maternal health outcomes. Therefore, this study retrospectively evaluates the data of preeclamptic pregnancies from two different provinces in Turkey.

## MATERIAL AND METHODS

Ethical approval for the study was obtained from the Bolu Abant İzzet Baysal University Clinical Research Ethics Committee (decision number: 62/2023).

In this study, demographic and clinical data were retrospectively obtained from the database of the Department of Obstetrics and Gynecology at Şanlıurfa Training and Research Hospital. Pregnant women diagnosed with preeclampsia who presented to the Emergency Department of Obstetrics and Gynecology at Şanlıurfa Training and Research Hospital (n=363) and the Department of Obstetrics and Gynecology at Bolu Abant İzzet Baysal University Training and Research Hospital (n=72) between January 1, 2022, and February 1, 2023 were included in the study. Pregnant women diagnosed with preeclampsia or chronic hypertension were excluded from the study.

The following variables were retrospectively analyzed: number of patients, age, systolic blood pressure (SBP), diastolic blood pressure (DBP), urinary protein levels, gravidity, parity, hemoglobin levels, mode of delivery, birth weight, presence of multiple pregnancy, aspartate aminotransferase (AST), alanine aminotransferase (ALT), and blood type.

### Statistical Analysis

The data in this study were summarized using frequency, percentage, mean, median, and standard deviation, as appropriate. The normality of the distribution of quantitative variables was assessed using visual methods such as histograms, as well as the Kolmogorov-Smirnov and Shapiro-Wilk tests. Categorical variables were compared using Pearson's chi-square test and Fisher's exact test. For comparisons between two independent groups of quantitative variables, the Mann-Whitney U test was applied. A p-value < 0.05 was considered statistically significant. Effect size was calculated with Cramer's V for chi-square values and Eta Squared tests for Mann-Whitney U. All statistical analyses were performed using IBM SPSS Statistics 21.0 for Windows (New York, USA).

## RESULTS

A total of 363 preeclamptic pregnant women from Şanlıurfa and 72 from Bolu were included in the study. No significant difference was observed between the two provinces regarding the rates of cesarean section (C/S) and normal vaginal delivery (NVD) (p=0.717). Hemoglobin levels were similar between Şanlıurfa and Bolu. Since there were no pregnant women with low platelet counts in Bolu, a comparison between the two provinces could not be made; all pregnant women in Bolu had normal platelet levels.

Systolic blood pressure (SBP) (p<0.001) and diastolic blood pressure (DBP) (p=0.026) were significantly higher in pregnant women from Şanlıurfa compared to those from Bolu. The mean SBP and DBP values in Şanlıurfa were 160.80±23.96 mmHg and 96.87±16.91 mmHg, respectively, whereas in Bolu, the mean SBP was 146±13.81 mmHg and the mean DBP was 90.15±12.15 mmHg.

Among liver function tests, both AST (p<0.001) and ALT (p=0.008) levels were significantly higher in preeclamptic pregnant women from Şanlıurfa compared to those from Bolu. Although proteinuria was more frequently observed in Bolu (p<0.001), higher grades of proteinuria (3+, 4+) were more common in Şanlıurfa.

Regarding birth weights, low birth weight (2289.34±985.32 g) was more prevalent among preeclamptic pregnancies in Şanlıurfa, whereas in Bolu, normal birth weight (2781.23±640.18 g) was more frequently observed. The mean maternal age of preeclamptic pregnant women was similar between the two provinces (p=0.285). However, gravidity (p<0.001) and parity (p<0.001) were significantly higher in Şanlıurfa than in Bolu (Table 1).

Among the pregnant women included in the study, no cases with AB- blood type were identified in either province. The most common blood type among preeclamptic women in Şanlıurfa was O+, whereas in Bolu, A+ blood type was more prevalent (Table 2).

## DISCUSSION

In this study, we aimed to compare the laboratory and obstetric outcomes of preeclamptic pregnant women in Şanlıurfa and Bolu. We found that SBP and DBP were significantly higher in Şanlıurfa, while proteinuria was more frequently observed in Bolu but was more severe in Şanlıurfa. Among liver function tests, AST and ALT levels were higher in Şanlıurfa. Additionally, preeclamptic mothers in Şanlıurfa had higher parity and gravidity, and infants born to these mothers were more prone to low birth weight (LBW). Regardless of grouping, Rh positivity was more common in preeclampsia.

**Table 1.** Demographic characteristics of preeclamptic pregnant women in Şanlıurfa and Bolu

Groups	Variables						p	effect size
	Birth Type							
	C/S			NVD				
	n	%		n	%			
Şanlıurfa	323	89,0		40	11,0		0,717*	0,017#
Bolu	63	87,5		9	12,5			
	Systolic blood pressure (mmHg)						<0,001**^	0,253#
	Normal			High				
	n	%		n	%			
Şanlıurfa	136	42,4		185	57,6			
Bolu	54	75,0		18	25,0			
	Diastolic blood pressure (mmHg)						0,026**^	0,112#
	Normal			High				
	n	%		n	%			
Şanlıurfa	259	80,7		62	19,3			
Bolu	66	91,7		6	8,3			
	Platelet Count						-	
	Normal			Low				
	n	%		n	%			
Şanlıurfa	353	97,2		10	2,8			
Bolu	72	100,0		0	0,0			
	AST						<0,001**^	0,214#
	Normal			High				
	n	%		n	%			
Şanlıurfa	243	66,9		120	33,1			
Bolu	67	93,1		5	6,9			
	ALT						<0,008**^	0,128#
	Normal			High				
	n	%		n	%			
Şanlıurfa	312	86,0		51	14,0			
Bolu	70	97,2		2	2,8			
	Proteinuria						<0,001**^	0,260#
	Yok		+1,+2		+3,+4			
	n	%	n	%	n	%		
Şanlıurfa	37	12,1	159	51,8	111	36,2		
Bolu	0	0,0	60	83,3	12	16,7		
	Birth Weight (gr)						-	
	LBW		Normal		Macrosomic			
	n	%	n	%	n	%		
Şanlıurfa	194	54,6	152	42,8	9	2,5		
Bolu	22	31,4	46	65,7	2	2,9		
	Heamoglobin						0,471*	0,026#
	<12			12 and above				
	n	%		n	%			
Şanlıurfa	149	40,9		215	59,1			
Bolu	8	50,0		8	50,0			
	Age						0,285**^	0,0004 <sup>λ</sup>
	Mean	Median		SD				
Şanlıurfa	30,8	32,0		7,3				
Bolu	31,4	29,0		5,6				
	Parity						<0,001**^	0,075 <sup>λ</sup>
	Mean	Median		SD				
Şanlıurfa	4,6	4,0		3,3				
Bolu	2,2	1,0		1,3				
	Gravity						<0,001**^	0,079 <sup>λ</sup>
	Mean	Median		SD				
Şanlıurfa	3,8	3,0		3,0				
Bolu	2,6	1,0		0,8				

LBW: Low birth weight. \*:Pearson Chisquare, \*\*:Fisher's Exact Test, +:Mann-Whitney U test, ^: p<0.05, #: Cramer's V, λ:Eta squared

**Table 2.** Distribution of blood types among preeclamptic pregnant women in Şanlıurfa and Bolu

Blood Group	Urfa	Bolu	%
O+	118	25	32,9
O-	11	4	3,4
A+	112	27	32
A-	9	1	2,3
B+	83	8	20,9
B-	6	0	1,4
AB+	24	7	7,1
AB-	0	0	0

Preeclampsia is defined as hypertension occurring after the 20th week of pregnancy, accompanied by either proteinuria or end-organ dysfunction in the absence of proteinuria (7). Diagnostic criteria include systolic blood pressure  $\geq 140$  mmHg and/or diastolic blood pressure  $\geq 90$  mmHg on at least two occasions four hours apart, or a single reading of SBP  $\geq 160$  mmHg or DBP  $\geq 110$  mmHg. According to our results, SBP and DBP were significantly higher in preeclamptic pregnant women in Şanlıurfa compared to Bolu. A study analyzing the hypertensive patient profile in Şanlıurfa found that average blood pressure levels in Şanlıurfa were higher than in other provinces of Turkey (8). The high prevalence of hypertension in Şanlıurfa may contribute to higher blood pressure levels in preeclamptic pregnancies. The reason for the more severe course of preeclampsia in Şanlıurfa may be the fact that patients consulted health services less frequently during pregnancy, the frequency of follow-up was less, and preeclampsia prophylaxis was started late.

According to the 2020 ACOG criteria, proteinuria is one of the diagnostic criteria for preeclampsia (9). While the degree of proteinuria varies between cases (10), it is not considered a predictor of prognosis (9,11). In our study, proteinuria was more common in Bolu (1+,2+), whereas severe proteinuria (3+,4+) was more frequently observed in Şanlıurfa. The lack of complete urine proteinuria records in 56 out of 364 cases in Şanlıurfa may have contributed to this difference. Furthermore, while 24-hour urine collection is the gold standard for measuring urinary protein excretion, preeclampsia diagnosis is typically based on the spot urine protein-to-creatinine ratio. Isolated proteinuria in pregnancy can reach up to 8% (12).

Preeclampsia can occur in all women of reproductive age. While advanced maternal age (>35 years) is associated with more complicated perinatal outcomes (13), the average maternal age for preeclampsia is 32 years (14). In our study, maternal age was similar in both Bolu and Şanlıurfa (Şanlıurfa: 30.8 years, Bolu: 31.4 years), which aligns with previous studies on preeclamptic pregnancies (15,16).

Parity is defined as the number of deliveries of fetuses  $\geq 24$  weeks of gestation, regardless of whether they were live or stillborn. Studies have shown that increased parity is associated with a higher risk of preeclampsia complications(17). In our study, parity and gravidity were significantly higher in Şanlıurfa than in Bolu. This finding correlates with data from the Turkish Statistical Institute (TÜİK), which reports that Şanlıurfa has the highest birth rate in Turkey (18). Additionally, our results indicating higher rates of LBW in Şanlıurfa support the hypothesis that increased parity is linked to more severe preeclampsia complications.

Low birth weight is defined as a birth weight <2500 g, regardless of gestational age (19). LBW is a well-known complication of preeclampsia (20). Our findings revealed that LBW was more common in Şanlıurfa. According to the 2018 Turkey Demographic and Health Survey (TDHS) conducted by Hacettepe University, LBW is more prevalent in the eastern regions of Turkey (21).

Liver dysfunction occurs in approximately 3% of all pregnancies (22). AST and ALT enzymes are used to assess liver injury in clinical practice (23). In severe preeclampsia, AST and ALT elevations are considered diagnostic criteria (24). In our study, AST and ALT levels were significantly higher in Şanlıurfa compared to Bolu. While it is evaluated the differences of SBP, DBP, proteinuria and liver enzymes between Bolu and Şanlıurfa, it should be considered Bolu and Şanlıurfa is divergent from each other in terms of socioeconomically (access to health services) and culturally (eating habits).

Recent studies suggest that A and B blood group antigens may play a role in the pathophysiology of preeclampsia(25). Although the mechanism remains unclear for blood group O, conflicting results have been reported, with some studies indicating an increased risk in AB (26), A (27), B (28), and O (29) blood groups, while others found no significant association (30). If a consistent relationship is established, ABO blood grouping could become part of routine clinical practice for primary pregnancy care, allowing for better risk stratification (31). In our study, no AB- blood type was detected in either province. In Şanlıurfa, the most common blood type among preeclamptic women was O+, while in Bolu, it was A+. The high prevalence of O Rh(+) blood type in Şanlıurfa aligns with general population data from the region.

Study limitations include the limited sample size and incomplete hospital records, which restricted access to additional laboratory and obstetric data. Since our study included comparisons with data containing only two hospital in Bolu and Şanlıurfa, the generalizability of the results from different geographic regions was limited.

## CONCLUSION

Our study revealed that laboratory findings were more severe and preeclampsia-related complications were more frequent in Şanlıurfa. Preeclampsia significantly impacts maternal and child health, and our findings suggest that regional sociocultural, economic, and demographic differences affect health outcomes. Based on our results, improving hospital record systems could contribute to better maternal and child health outcomes and enhance prenatal care. More comprehensive preventive strategies and management protocols for preeclampsia can be developed with future studies.

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