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Asymmetric Dimethyl Arginine and Oxidant/Antioxidant Level in Preeclamptic Mothers and Their Babies

Preeklamptik Anne ve Bebeklerinde Asimetrik Dimetil Arjinin ve Oksidan/Antioksidan Düzeyi

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ABSTRACT

Aim: It is thought that asymmetric dimethyl arginine(ADMA) level is significantly higher in pregnant women with preeclampsia compared to healthy pregnant women, ADMA elevation develops before the clinical signs of preeclampsia, and ADMA plays a role in the pathogenesis of preeclampsia. In this study, it was aimed to investigate whether serum ADMA, total nitrite and nitrate (NOx), arginine and total antioxidant capacity (TAC) and levels in placenta samples taken from healthy and preeclamptic pregnant women and their babies are associated with preeclampsia, whether preeclampsia can be detected beforehand with these markers, and whether possible problems that may develop in the mother and baby can be prevented as a result.

Material and Methods: 62 pregnant women and their babies who were followed up in Zonguldak Bülent Ecevit University obstetrics service are divided two groups; 31 preeclamptic pregnant and babies (Group I), formed Patient group; 31 pregnant and babies without preeclampsia (Group II), formed Control Group. Blood samples were obtained from mothers before birth, from the cord during birth, from babies in first 24 hours after birth and placenta samples were obtained from each pregnant to evaluate in the study. Age, weight, initial pregnancy state, pregnancy period, systolic and diastolic blood pressure levels of mothers with and without pre-eclampsia diagnosis, while birth weights, genders, problems and complications during treatment process, clinic and laboratory properties, prognosis, ADMA, arginine, NOx and TAC levels of babies were examined in this study.

Results: There was no significant difference between two groups about antenatal factors that effect on prognosis. In the comparison of blood values, ADMA level of preeclamptic group was significantly higher ($p<0.001$) while arginine value was significantly lower ($p=0.001$) than control group, there was no significant difference in NOx level and TAC between two groups. In the evaluation of cord ADMA level of preeclamptic group was significantly higher ($p=0.001$) while nitric oxide value was significantly lower ($p=0.017$) than control group and there was no significant difference in arginine and TAC. Values which are studied in placenta samples showed that ADMA and arginine values were significantly high ($p<0.001$) total antioxidant capacity level was low ($p=0.004$) in placenta of preeclamptic group. There was no difference in NOx value of two groups. In the consideration of data of babies, mean pregnancy weeks and genders were similar. Against the values of samples from mother, cord and placenta, when baby blood was compared, ADMA value of control group was significantly high ($p=0.009$) while arginine value of preeclamptic group was significantly high ($p=0.041$) and there was no difference between two groups about their NOx and TAC.

Conclusion: In this study, it is determined that serum ADMA level of preeclamptic mother group increases in accordance with literature values. This study does not support the decrease of nitric oxide synthesis thesis in preeclamptic patients as mentioned in literature. To determine the women with the high risk in the early period, the asymmetric dimethyl arginine may be used as the new risk decisive.

Keywords: Preeclampsia, asymmetric dimethyl arginine, total nitrite and nitrate (NOx), arginine, total antioxidant system

ÖZ

Amaç: Preeklampsili gebelerde asimetrik dimetilarjinin (ADMA) düzeyinin sağlıklı gebelere göre anlamlı oranda yüksek olduğu, ADMA yüksekliğinin preeklampsinin klinik işaretlerinden daha önce geliştiği ve ADMA'nın preeklampsinin patogenezinde rol oynadığı düşünülmektedir. Bu çalışmada, sağlıklı ve preeklamptik gebeler ve bebeklerinden alınan serum ADMA, nitrik oksit metaboliti total nitrit ve nitrat (NOx), arjinin ve total antioksidan kapasite (TAK) ve plasenta örneklerindeki düzeylerinin preeklampsi ile ilişkili olup olmadığı, bu belirteçlerle preklampsinin önceden tespit edilip edilemeyeceği ve bunun sonucunda anne ve bebekte gelişebilecek olası sorunların önlenip önlenemeyeceğinin araştırılması amaçlanmıştır.

Gereç ve Yöntemler: Zonguldak Bülent Ecevit Üniversitesi Kadın Doğum Servisinde takip edilen 62 gebe ve bebeği çalışmaya alınarak preeklampsisi olan 31 gebe ve bebeği Grup I, hasta grubunu; preeklamptik olmayan 31 gebe ve bebeği ise Grup II, kontrol grubunu oluşturdu. Çalışmada değerlendirilmek üzere annelerden doğumdan önce, korddan doğum sırasında, bebeklerden doğumdan sonraki ilk 24 saat içinde kan örnekleri ve her gebeden plasenta örneği alındı. Preeklampsi tanısı olan ve olmayan annelerin yaşı, kilosu, ilk gebelik durumu, gebelik süreleri, sistolik ve diastolik kan basıncı değerleri, bebeklerin ise doğum ağırlıkları, cinsiyetleri, tedavisi süresince gelişen problem ve komplikasyonları, klinik ve laboratuar özellikleri, prognozları, ADMA, arjinin, NOx ve TAK düzeyleri incelendi.

Bulgular: İki grup karşılaştırıldığında prognozu etkileyebilecek antenatal faktörler açısından anlamlı fark yoktu. Preeklamptik anne grubunda ADMA düzeyinin anlamlı olarak yüksek ($p<0.001$), arjinin değerinin anlamlı olarak düşük olduğu ($p=0.001$), NOx düzeyi ve TAK arasında ise fark olmadığı saptandı. Kord kanı değerlendirildiğinde preeklamptik grupta ADMA düzeyinin anlamlı olarak yüksek ($p=0.001$), NOx değerinin anlamlı olarak düşük olduğu ($p=0.017$), arjinin düzeyleri ve total antioksidan kapasite arasında fark olmadığı saptandı. Preeklamptik grup plasentasında ADMA ve arjinin değerlerinin anlamlı olarak yüksek olduğu ($p<0.001$), total antioksidan kapasite düzeyinin düşük olduğu görüldü ($p=0.004$). NOx değerinin iki grup arasında farklı olmadığı saptandı. Bebek kanları karşılaştırıldığında anne, kord kanı ve plasenta örneklerinin aksine kontrol grubunda ADMA değerinin anlamlı yüksek olduğu ($p=0.009$), preeklamptik grupta arjininin anlamlı olarak yüksek olduğu ($p=0.041$), iki grup arasında NOx ve TAK açısından fark olmadığı saptandı.

Sonuç: Bu çalışmada preeklamptik anne grubunda serum ADMA düzeyinin literatür ile uyumlu olarak arttığı saptandı. Çalışma literatürdeki preeklamptik hastalarda nitrik oksit sentezinin azaldığı tezini desteklememektedir. Yüksek risk altındaki kadınların erken dönemde belirlenmesinde ADMA yeni bir risk belirleyicisi olarak kullanılabilir.

Anahtar Sözcükler: Preeklampsi, asimetrik dimetilarjinin, total nitrit ve nitrat (NOx), arjinin, total antioksidan kapasite

INTRODUCTION

Preeclampsia is a multisystemic disease of pregnancy that presents with hypertension and proteinuria after the twentieth week of gestation. It is among the important causes of maternal and perinatal morbidity and mortality (1,2). Although the etiology of preeclampsia is still unknown, studies have suggested that conditions such as increased pressor responses, prostaglandins, nitric oxide, endothelins, genetic predisposition, immunologic factors, inflammatory factors and endothelial cell activation may play a role.

Nitric oxide (NO) is one of the most important vasoactive mediators released from the endothelium, which has a role in maintaining vascular tone and structure. NO is important in the regulation of fetoplacental circulation as a potent vasodilator in pregnancy, as well as in the inhibition of platelet activation and limitation of leukocyte adhesion to the endothelium. Studies have demonstrated the presence of nitric oxide synthase (NOS) in placental villi. Placental NOS is of the endothelial type and syncytiotrophoblasts are the main source of placental endothelial NOS (eNOS). It is known that both NO production and response to NO is increased in normal pregnancy (3). This increase is thought to play a role in many physiologic mechanisms that maintain pregnancy (4). Therefore, it has been thought that a dysfunction in the NO system may be involved in the pathogenesis of preeclampsia and many studies with conflicting results have been conducted on this subject (5). These observations suggest that the status of NO biosynthesis in women during normal pregnancy and pre-eclampsia is not yet clearly defined.

ADMA is a methylated arginine derivative formed by the post-synthesis addition of methyl groups to arginine residues in nucleoproteins by the protein arginine methyl transferase (PRMT) enzyme and the degradation of these proteins. The main determinant of ADMA level is the enzyme dimethyl arginine dimethyl aminohydrolase (DDAH). DDAH is a cytosolic enzyme. Overproduction of DDAH has been shown to increase nitric oxide synthase (NOS) activity and NO production. Studies show that the increase in ADMA is important in the regulation of signal transduction of the NO system. ADMA is a marker for endothelial dysfunction in renal diseases, cardiovascular system, hypertension and ischemic stroke and inhibits the endogenous NO enzyme. Studies have shown that ADMA levels increase before the findings of preeclampsia. Endothelial dysfunction is associ-

ated with elevated ADMA levels in early pregnancy (6). Lipid peroxidation increases and antioxidant activities decrease in women with preeclampsia or those who were hypertensive before pregnancy. As a result, oxidative stress negatively affects the fetus in the intrauterine environment (7,8).

Identifying the pregnant women at risk before detecting the clinical signs of preeclampsia is very important in the improvement of treatment to reduce the morbidity and mortality of mother and infant. Currently, there is no gold standard test or method for early diagnosis. In this study, we aimed to determine whether the levels of ADMA, NOx, arginine and total antioxidant capacity in blood and placenta samples obtained from healthy and preeclamptic pregnant women and their infants are associated with preeclampsia. In addition, it was also aimed to investigate whether preeclampsia could be detected in advance with these markers and whether possible problems that may develop in the mother and baby could be prevented as a result.

MATERIAL and METHODS

Our study was conducted prospectively by determining 31 pregnant women with preeclampsia and their infants as Group I (patient group) and 31 non-preeclamptic pregnant women and their infants as Group II (control group). Approval for our study was obtained from Bülent Ecevit University Ethics Committee.

The data related to the age, weight, first pregnancy status, gestational duration, systolic and diastolic blood pressure values of mothers, and birth weight, gender, complications during treatment, clinical and laboratory characteristics, and prognosis of infants were analyzed. After the twentieth week of pregnancy, patients with a blood pressure of 140-159/90-109 mmHg at least twice at four-hour intervals or >160/110 mmHg a few minutes apart, spot urine ≥+1 or proteinuria >300 mg in 24 hours were considered to be pre-eclamptic. Information about the pregnancy was obtained from the hospital records and detailed information was obtained from the mothers. Infants with major congenital anomalies and pathology requiring surgery were excluded from the study. ADMA, NO, arginine and total antioxidant capacity were determined from maternal blood, cord blood, 2 milliliters (ml) of blood obtained from the infant and placenta samples from 2 groups.

Blood samples and tissues were stored in a deep freezer (-80°C) until analysis. Nitric oxide metabolite total nitrite and nitrate (NOx) levels in serum and tissue were measured by Griess reaction. In this reaction, sulfanilamide solution was added and after waiting, N-1-naphthylethylenediamine dihydrochloride solution was added and then its absorbance was measured with a microsensor at a wavelength of 540 nm (9). Nitrite concentrations of the samples were determined by comparison with the nitrite standard reference curve. Total antioxidant capacity (TAC) levels were determined using a Shimadzu UV 1601 spectrophotometer (Shimadzu Corporation Kyoto, Japan) using a commercial kit (Immundiagnostik, Bensheim, Germany) based on the colorimetric method; serum and tissue ADMA concentrations were measured using a commercial enzyme-linked immunosorbent assay (ELISA) kit (Immundiagnostik, Bensheim, Germany) in combination with immunoquantification, and serum and tissue arginine levels were measured using ELISA kits (Cusabio Wuhan, China).

Statistical Analysis

Statistical analysis of the study was performed in SPSS 19.0 package program. Descriptive statistics of categorical variables were given as frequency and percentage and descriptive statistics of continuous variables were given as mean, standard deviation, median, minimum and maximum values. The compatibility of continuous variables with normal distribution was analyzed by Shapiro-Wilk test. Independent sample t test was used for 2 group comparisons of normally distributed variables and Mann Whitney U test was used for 2 group comparisons of variables that did not show normal distribution. The relationships between continuous variables were analyzed by Spearman correlation analysis. Yates chi-square and Fisher exact chi-square tests were used for group comparisons of categorical variables. In all statistical analyses in the study, comparisons with p values below 0.05 were considered statistically significant.

Since there was no prediction about the parameters to be used in calculating sample sizes or a reference study in the literature that could be used to obtain these parameters, the effect size defined by Cohen* was used. The minimum sample size required for the study is 60 for the independent sample t-test, with an effect size = 0.70, which will provide 75% test power at 95% confidence level. This sample size also includes the sample sizes required for other analysis methods to be used in the study. The relevant calculation was made in the G-Power 3.1.9.2 package program.

RESULTS

There was no difference between the groups in terms of maternal age, nulliparity and mean gestational week. The difference between mean systolic and diastolic blood pressure in the preeclamptic group was statistically significant ($p<0.001$). Birth weight was lower in the preeclamptic mother group ($p = 0.001$). There was no significant difference between other demographic and laboratory parameters of mothers and infants (Table 1,2).

Hospitalizations due to respiratory distress were significantly higher in preeclamptic infants ($p=0.008$). The rate of antibiotic initiation after hospitalization was also higher in the preeclamptic group ($p=0.026$).

ADMA levels in maternal blood, cord blood and placenta were found to be significantly higher in the preeclamptic group, whereas in infant blood, these levels were found to be higher in healthy infants. The values of ADMA, arginine, NOx and TAC in the maternal blood, cord blood, infant blood and placenta in the preeclamptic and non-preeclamptic groups are shown in Table 3. In addition, no correlation was found between maternal blood pressure and maternal level of ADMA, arginine, NOx and TAC. In the preeclamptic group, ADMA value of the infant increased as the systolic blood pressure value has increased and there was a weak correlation between these values (p=0.048, r=0.359). No correlation was found between blood pressure and ADMA level of the infant in the control group. In the preeclamptic group, infant NOx level was increased with increasing infant weight and a moderate correlation was found (p=0.002, r =0.543). No correlation was found in other parameters. In the control group, there was no correlation between infant weight and the parameters in infant serum. In the preeclamptic group, infant NOx levels increased with increasing gestational week and there was a weak correlation (p=0.023, r=0.407). No correlation was found between gestational week and ADMA, arginine, and TAC level of the infant. No correlation was found between gestational week and ADMA, arginine, NOx, and TAC level in the control group. There was no correlation between gestational week and maternal level of ADMA, arginine, NOx, TAC in both groups.

DISCUSSION

Fickling et al. demonstrated the relationship between preeclampsia and ADMA for the first time and found that the level of ADMA was significantly higher in pregnant women with preeclampsia compared to healthy pregnant women (10). In a normal pregnancy, the level of ADMA generally decreases compared to the non-pregnant group and increases with gestational age in the second and third trimesters. The decrease in ADMA and the concomitant increase in NO in early pregnancy are thought to be related to hemodynamic adaptation, high organ perfusion requirement and uterine relaxation. The increase in ADMA with advancing pregnancy helps to prepare uterine muscle fibers for higher contractile activity. In preeclamptic pregnant women, the level of ADMA is significantly higher than both normotensive pregnant women and non-pregnant controls. Higher level of ADMA even in early-onset preeclamptic patients

Table 1-2: Demographic and laboratory characteristics of mothers and infants.

	Group I (n=31)	Group II (n=31)	p
Age of Mother	28.9 ± 5.9 (18-42)	28.8 ± 4.9 (21-37)	0.945[a]
Mother Weight	85.7 ± 19.2 (54-130)	74.5 ± 10.7 (50-93)	0.007[a]
Gestation Period (week)	36.4 ± 2.9 (30-40)	36.8 ± 2.9 (33-38)	0.980[b]
Systolic Blood Pressure (mmHg)	153.4 ± 14.6 (140-190)	111.1 ± 8.8 (90-126)	<0.001[b]
Diastolic Blood Pressure (mmHg)	91.7 ± 11.0 (60-110)	68.5 ± 6.2 (55-82)	<0.001[b]
Heart Peak Beat (/min)	84.61 ± 8.76 (72-102)	81.45 ± 13.53 (66-136)	0.039[b]
Maternal White Sphere Count (/mm)^3	12780.64 ± 3223.6 (5400-17400)	11887.09 ± 2975.2 (5700-20300)	0.261[a]
Maternal Haemoglobin (g/dl)	11.05 ± 1.37 (8.8-13.7)	10.72 ± 1.21 (8.1-13.4)	0.313[a]
Maternal Platelet Count (/mm)^3	201677.4 ± 65587.8 (90000-355000)	203064.5±58525.17 (111000-384000)	0.933[b]
Birth Weight (gram)	2493.87 ± 972.24 (850-3900)	3262.90 ± 629.83 (1910-4050)	0.001[a]
Kord Ph	7.31 ± 0.05 (7.15-7.41)	7.31 ± 0.37 (7.26-7.39)	0.865[b]
1st min. APGAR	8.03 ± 1.07 (5-9)	8.22 ± 1.23 (4-9)	0.244[b]
5th min. APGAR	9.32 ± 0.70 (8-10)	9.45 ± 0.88 (7-10)	0.226[b]
Number of Infant White Spheres (/mm)^3	10229.03 ± 4071.13 (5100-25900)	10806.45 ± 1972.29 (7800-15100)	0.197[b]
Infant Haemoglobin (g/dl)	15.2 ± 1.04 (12.7-18.1)	14.72 ± 1.31 (12-17.1)	0.108[b]
Infant Platelet Count (/mm)^3	285387 ± 111939.2 (170000-659000)	273700.0 ± 77608.72 (115000-461000)	0.724[b]

[a] Independent Sample t test, [b] Mann Whitney U test

	Group I (n=31) n (%)	Group II (n=31) n (%)	p
Nulliparity (%)	14 (45.1)	9 (29.0)	0.293[a]
Baby Gender (Male)	14 (45.2)	17 (54.8)	0.611[a]
Low Birth Weight	18 (58.1)	4 (12.9)	0.001[b]

[a] Yates Chi-square Test, [b] Fisher Chi-square test

Table 3: ADMA, NO, Arginine, TAC Levels*.

	Parameters*	Group I (n=31)	Group II (n=31)	p
Mother Blood	ADMA (umol/L)	0.92 ± 0.288 (0.46-1.8) 0.84	0.652 ± 0.146 (0.22-1.02) 0.65	**<0.001****
	NOx (umol/L)	26.74 ± 12.82 (8.1-60.9) 24.1	25.80 ± 13.03 (7.5-58.4) 22.9	0.735
	ARGININE (umol/L)	35.17 ± 17.50 (22.8-89.9) 30.2	41.27 ± 15.67 (20.9-103.2) 37.5	**0.001****
	TAK (umolTroloxEquivalent/L)	289.43 ± 72.44 (132.8-408.2) 285.1	291.82 ± 70.00 (181.4-435.8) 264.1	0.972
Cord Blood	ADMA (umol/L)	0.887 ± 0.05 (0.74-1.02) 0.89	0.589 ± 0.17 (0.27-0.97) 0.55	**0.001****
	NOx (umol/L)	14.92 ± 8.64 (8.9-49.2) 12	20.077±14.11 (9.3-57.6) 13.5	**0.017****
	ARGININE (umol/L)	40.16 ± 21.52 (21.5-107.5) 32.7	40.57 ± 25.70 (9.8-133.9) 31.7	0.693
	TAK (umolTroloxEquivalent/L)	284.24 ± 49.67 (191.3-412.3) 282.3	289.96 ± 54.28 (173.7-381.7) 302.9	0.349
Baby Blood	ADMA (umol/L)	0.723 ± 0.48 (0.61-0.85) 0.73	0.759 ± 0.48 (0.65-0.84) 0.77	**0.009****
	NOx (umol/L)	25.90 ± 12.83 (6.6-52.7) 24.9	27.49 ± 8.78 (7.6-41.6) 29.4	0.571
	ARGININE (umol/L)	45.11 ± 13.83 (22.9-86.5) 40.8	38.45 ± 9.93 (26.1-70.8) 36.2	**0.041****
	TAK (umolTroloxEquivalent/L)	297.17 ± 83.34 (105.3-413.1) 306.2	326.67 ± 71.52 (178.2-445.5) 332.1	0.140
Plasenta	ADMA (umol/g prot)	0.466 ± 0.36 (0.4-0.63) 0.47	0.433 ± 0.014 (0.39-0.45) 0.43	**<0.001****
	NOx (umol/g prot)	6.40 ± 4.11 (2-19.2) 5	4.20 ± 1.50 (0.7-6.6) 4.5	0.065
	ARGININE (umol/g prot)	29.31 ± 18.89 (12.1-72.8) 20.7	15.60 ± 6.26 (7.6-43.6) 14.4	**<0.001****
	TAK (umolTroloxEquivalent/mg protein)	0.35 ± 0.15 (0.17-375.8) 0.31	0.50 ± 0.21 (0.18-0.98) 0.47	**0.004****

*Parameters are shown with minimum-maximum and median values. **Mann-Whitney U test

may suggest a relationship between disease severity and timing of clinical manifestations of preeclampsia. Savvidou et al. found that the level of ADMA is elevated with abnormal uterine artery Doppler waves before the development of clinical signs of preeclampsia (11). Speer et al. found that in preeclampsia, the level of ADMA begins to elevate in the mid-gestation period and remains elevated until delivery (12). Kim YJ et al. found that the level of L-Arginine was

significantly lower in preeclamptic pregnancies compared to normal pregnancies, but no significant difference was found in ADMA levels (13).

In our study, the level of ADMA measured in serum, infant cord blood and placenta samples of preeclamptic mothers were found to be significantly higher than the control group. These results support the thought that ADMA is effective in the pathogenesis of preeclampsia.

Tsukahara et al. found that the level of ADMA in cord blood of newborns was twice as high as in healthy children and adults, regardless of delivery method and preeclampsia (14). In our study, contrary to our expectations, serum level of ADMA was found to be higher in control group compared to preeclamptic infants during the postnatal period. There are limited number of pediatric studies conducted to demonstrate normal level of ADMA. Because of the small number of studies and lack of clear data, it was thought that more comprehensive studies should be performed in terms of ADMA elevation in control group infants.

It has been shown that plasma amino acid turnover is increased during the acute inflammatory response. This turnover may be explained by the inflammatory and hypermetabolic state induced by endogenous mediators (15). As a result of increased body protein breakdown, endogenous amino acids pass into the plasma, the level of L-Arginine increases by being reduced from protein by proteolysis and by external food and drugs, while on the other hand, it may decrease as a result of the breakdown of L-Arginine by many metabolic pathways in which L-Arginine participates; therefore, it may cause unstable changes in plasma levels (16,17). Noris et al. found lower levels of L-Arginine in umbilical cord blood and villous tissues of pregnant women with preeclampsia (18). In our study, there was no difference in cord blood levels of arginine, whereas infant and placental levels were significantly increased in the preeclamptic group. Similar to the study by Kim YJ et al., the level of arginine was found to be significantly lower in the preeclamptic mother group compared to the control group. Increased level of ADMA in preeclamptic pregnant women may explain the low level of arginine since it is provided by arginine methylation and proteolysis. Theoretically, arginine could replace ADMA and restore NOS activity. Arginine can be used in treatment to eliminate the effects of increased ADMA or to reduce the level of ADMA (19). Arginine supplementation may improve endothelial dysfunction by preventing NOS inhibition by ADMA.

Studies have shown that endothelial nitric oxide plays an important role in maintaining vascular tone. It has been claimed that decreased nitric oxide synthesis increases vascular resistance in preeclamptic patients. However, there are different opinions for NO production in preeclamptic patients. Although high concentrations of ADMA were found in the serum of preeclamptic mothers in our study, no difference was found between the two groups in terms of NO, similar to the study by Davidge et al (20). In addition to studies with different opinions, our study does not support the hypothesis that nitric oxide synthesis is suppressed in the pathogenesis of preeclampsia. Nitric oxide is a variable molecule and is synthesized in many tissues and cells. Therefore, plasma nitric oxide level alone may not indicate endothelium-derived nitric oxide. The reason for the absence of a difference between the two groups in maternal serum is that nitric oxide release is also affected by the presence of systemic diseases, nutrition, environmental factors, age, immunohistochemical method used and the location of the placenta sampling. However, a significant decrease was found in NOx levels in cord blood obtained from the preeclamptic group ($p=0.017$). In the placenta and infant blood studies, no significant difference was found in accordance with the maternal results ($p=0.065$, $p=0.57$). More detailed and large-scale studies should be performed to reveal the role of nitric oxide in the pathophysiology of preeclampsia and endothelial dysfunction.

Akyol et al. found that the level of ADMA and malondialdehyde (MDA) and the activity of antioxidant enzymes increased in the cord blood of patients with preeclampsia (21). Budak et al. found no statistical difference between normal and preeclamptic groups in terms of total antioxidant capacity (22). In the literature, there are contrary studies showing that total antioxidant capacity was increased (23) and decreased (24). Increased oxidative stress and inadequate antioxidant defense in pregnant women due to preeclampsia and placental dysfunction have been shown to affect both pregnant women and infants prenatally (25-27). In our study, there was no difference in total antioxidant capacity levels between two groups. It has been suggested that antioxidant systems are activated to eliminate endothelial cell damage due to increased free radicals in preeclamptic pregnant women. The low total antioxidant capacity in the placenta affected by preeclampsia due to utilization supported this thesis. Since the total antioxidant capacity found to be normal in both groups in maternal and infant blood reflects the whole body system, it can be said that antioxidant substances from other parts of the body cause this result. In the preeclamptic group, no significant correlation was found between maternal systolic and diastolic blood pressure values, maternal and infant serum ADMA, NOx, arginine and TAC values and the risk of SGA and respiratory distress in the infant. Although this result showed that elevated ADMA was associated with preeclampsia, ADMA was not associated with perinatal complications of preeclampsia such as SGA and respiratory distress.

In conclusion, it is extremely important to understand the pathogenesis of diseases and develop treatment protocols, and to identify risk factors in healthy people before diseases occur. ADMA, which is a frequently investigated molecule due to its inhibitory effect on NO, was found to be high in preeclamptic mothers in our study. It was concluded that ADMA can be used as a risk predictor in the early detection of preeclamptic mothers.

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Author Contributions

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Conflicts of Interest

There is no conflict of interest.

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Ethical Approval

The study was conducted with the permission of the Clinical Research Ethics Committee of Zonguldak Bülent Ecevit University (Date: 22.01.2013, No: 2013/2)

Review Process

Extremely peer-reviewed and accepted.

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