



ORIGINAL ARTICLE

Mean Platelet Volume and Ischemia Modified Albumin Levels in Cord Blood of Infants of Diabetic Mothers



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Key Words

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Background: Gestational diabetes mellitus (GDM) is a risk for the health of both the pregnant women and her infant. Its unfavorable effects start *in utero* and continue after birth. It is known that GDM increases oxidative stress and decreases antioxidant enzyme activities. In this study we aimed to investigate cord blood mean platelet volume (MPV) and ischemia-modified albumin (IMA) levels of infants of diabetic mothers (IDM).

Methods: Twenty-nine pregnant women with GDM between 37 and 41 gestational weeks who gave birth by spontaneous vaginal delivery were enrolled as study participants together with 20 healthy pregnant women as a control group. Weight, length, and head circumference of babies were measured by the same standard tape immediately after birth. Five milliliters of umbilical venous blood were obtained to study MPV and IMA levels.

Results: There was statistically significant difference in levels of MPV ($p = 0.037$) and IMA ($p < 0.001$) between groups. They increased in IDM compared with their healthy peers.

Conclusion: Evaluation of MPV and IMA together is useful for representing the potential oxidative stress of IDM.

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1. Introduction

Prevalence of gestational diabetes mellitus (GDM) is increasing worldwide and it is reported to range from 1% to 14% in the literature.¹ Race, increasing age, and obesity are the risk factors. Early diagnosis and adequate treatment is important for prevention of complications. While pre-eclampsia, polyhydramnios, fetal macrosomia, and operative delivery are complications that are seen in GDM pregnant women, hypoglycemia, hypocalcemia, hyperbilirubinemia, and polycythemia are some of the complications seen in the infants of diabetic mothers (IDM). Besides an increment in perinatal mortality, the risk of developing type II diabetes mellitus in the following 10 years increases by 20–30%. Obesity and impaired glucose tolerance ratios increase in the childhood period of IDM.²

Literature about the oxidative stress increasing effect of GDM and decreased antioxidant enzyme capacity in those pregnant women is limited.³ Ischemia modified albumin (IMA) is a biomarker for acute ischemia that is approved by the US Food and Drug Administration. When exposed to ischemic conditions, the N-terminus of albumin is damaged, which makes it unable to bind metals and capable of being measured by an albumin cobalt-binding test. Because its levels in the blood increase within minutes of the onset of ischemia and return to normal within 6–12 hours, IMA has been implicated in the detection of acute ischemia prior to necrosis.^{4–6} Pregnancy generates a stressful condition in the woman that is related to increased oxidative stress.⁷ Gugliucci et al demonstrated a marked difference of IMA levels between pregnant and nonpregnant women. IMA levels also increase in normal vaginal delivery.^{8–10} There is insufficient literature investigating the correlation between GDM and IMA levels. Ma et al found that high levels of IMA and blood glucose levels in GDM pregnant women significantly decreased to normal levels after 6 weeks of regular treatment.¹¹

The mean platelet volume (MPV) is a useful marker to determine platelet morphology. A normal range of cord blood MPV levels in healthy newborns has been defined.¹² Kipper et al¹² also revealed the alterations in thrombocyte and IMA level in mature and premature infants. Diabetes also changes thrombocyte function and morphology. Increased MPV is a direct sign of thrombocyte synthesis and activation. MPV increases as a result of thrombocyte synthesis. Sak et al showed a clear increase in the MPV of GDM pregnant women compared with the control group.¹³

To our knowledge, this is the first study to investigate the cord blood IMA and MPV levels in the same group of diabetic patients. In our study, our aim is to investigate these parameters as a sign of oxidative stress in the IDM.

2. Materials and methods

We performed a case–control study from June 2012 to July 2013 at the Departments of Obstetrics and Gynecology and Pediatrics at Çanakkale Onsekiz Mart University Faculty of Medicine. The approval of the ethics committee of our university was obtained. Every patient included in the study signed an informed consent form before participating in the study. We enrolled 29 GDM pregnant women between 37 and 41 gestational weeks who gave birth by spontaneous

vaginal delivery together with 20 healthy pregnant women as a control group. Pregnant women who did not want to enroll in the study, gave birth by cesarean delivery, those who had multiple pregnancies, those with chronic diseases and fetal anomalies, those using chronic medications, and those who smoked were excluded from the study.

Postpartum 1st minute and 5th minute APGAR scores were recorded. Babies were weighed without clothes immediately after birth. The length of the baby and head circumference were measured using the same standard tape. Five milliliters of umbilical venous blood were obtained just after delivery into dry tubes with separating gel. Blood was centrifuged at 800g at 4°C for 15 minutes and the separated serum was immediately analyzed or frozen at –80°C until use. Spectrophotometric measurements were made in a Beckman DU 640 spectrophotometer (Beckman Coulter Inc, Fullerton, CA, USA). IMA was measured by the decrease in cobalt 2+ binding as previously described.⁴ We introduced minor modifications in the method to adapt it to a 96-well plate reader. Briefly, we added 100 µL of patient serum to 25 µL of a solution of 1 g/L cobalt chloride and a blank for each serum was prepared similarly; +25 µL of a 9.0 g/L solution of NaCl. After agitation and 10 minutes' incubation at 25°C, dithiothreitol (25 µL of a 1.5 g/L solution) was then added. After mixing and 2 minutes' incubation, the absorbance of assay mixtures was read at 470 nm, zeroing with the individual blank. IMA values are expressed in absorbance units (AU). Platelet count and MPV determinations were performed based on the Coulter Counter model LH (Coulter Electronics, Hialeah, FL, USA). Data were recorded using the SPSS 15.0 statistical software package (SPSS Inc., Chicago, IL, USA). Descriptive data are shown as mean ± standard deviation. Mann–Whitney *U* test was applied for comparisons. A *p* value < 0.05 was considered significant.

3. Results

Table 1 shows the cord blood levels of IMA and MPV in the IDM and control groups. The serum IMA levels were significantly higher in the IDM group compared with the control group (*p* < 0.001; Figure 1). The mean IMA value was 912.20 ± 92.41 AU in IDM group and 715.60 ± 150.35 AU in the control group. There was also a statistically significant difference between groups in MPV values. The serum MPV was significantly higher in the IDM group (*p* = 0.037; Figure 2). In the IDM group, the mean serum MPV was 8.11 ± 0.95 fL and in control group it was 7.55 ± 0.72 fL.

Table 1 Cord blood mean platelet volume (MPV) and ischemia modified albumin (IMA) levels of participants.

	GDM pregnant women	Healthy controls	<i>p</i>
MPV, fL	8.11 ± 0.95	7.55 ± 0.72	0.037
Mean ± SD			
IMA, absorbance unit	912.20 ± 92.41	715.60 ± 150.35	<0.001
Mean ± SD			

Data are presented as the mean ± standard deviation. GDM = gestational diabetes mellitus.

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