

# Comparison of the Neonatal Outcome in Mothers with Gestational Diabetes (GD) in Two Periods

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## ABSTRACT

*Gestational diabetes is one of the most common metabolic complications during pregnancy. Pregnant diabetic mothers, if not well regulated, are more often subject to a number of acute conditions and complications during pregnancy and childbirth. Hypoglycemia, hypocalcemia, hypertrophy, lower Apgar are often seen in children. In this case control study we compared mothers with GD and their infants to mothers without GD and their children both in 2015 and 2018 in order to determine whether there are any differences among them, and to compare the perinatal outcome of their infants. Examinees were born in 2015 and 2018 (262) at KBC Osijek. The control group (262) included first neonates born after the examinees in 2015 and 2018. The results are shown in tables, with absolute and relative frequencies, and the significance of differences in the chi-square test with confidence interval at 95 %, with statistical significance accepted at  $p < 0.05$  level. Different acute conditions and other chronic illnesses are more common in mothers with GD. They have more complications during labor. Their infants are more often diagnosed with hypertrophy, hypoglycemia, and hypocalcemia. They also require more oxygen treatment, longer hospitalization and birth by C-section. In 2018, the number of hypoglycemic and hypocalcemic infants was twice lower, and their hospitalization much shorter. Better care for mothers during pregnancy and their glycemic control have led to significantly less complications in their infants and better perinatal outcome of such infants.*

**Key words:** diabetes, perinatal outcome, pregnancy

## Introduction

Gestational diabetes (GD) is diagnosed according to WHO guidelines to the following criteria: fasting plasma glucose 5.1–6.9 mmol / l; glucose after 1 hour in plasma > 10.0 mmol / l or glucose after 2 hours in plasma 8.5–11.0 mmol / l, after administration of 75 grams of glucose orally. Adverse perinatal outcome associated with GD leads to fetal hypertrophy, a more frequent delivery by caesarean section, which results in more frequent birth injuries. The prevalence of GD is 4.67%<sup>1</sup>. In a population with a high prevalence of type 2 diabetes, there is an increased risk of developing GD. The most important factors associated with the development of GD are: obesity, maternal age, and overweight during pregnancy<sup>1</sup>. This is due to a possible disorder of carbohydrate metabolism that develops with age. About 6.8% of mothers who had GD were over 40 years of age<sup>2</sup>. Further risks of developing GD are: a

large number of births, GD and poor perinatal outcome in past pregnancy, the presence of diabetes mellitus in the family, low growth, polycystic ovary syndrome, preeclampsia, and multiple pregnancy<sup>1</sup>. GD has been associated with an increased risk of infection in both mother and child<sup>3</sup>. Mothers have reduced urinary antibacterial activity, a defect in polymorphonuclear leukocyte function, and less cellular immunity due to hyperglycemia. The adhesive capacity of the bladder epithelium is increased. The possibility of preeclampsia is increased as a result of GD<sup>4</sup>. Diffuse vasospasm leads to ischemia which damages many organs, especially the brain, kidneys and liver. Preeclampsia is classified according to pressure values and proteinuria<sup>5</sup>. About 10–20% of pregnant women with diabetes experience preeclampsia<sup>6</sup>. About 10% of pregnant women with GD have polyhydramnios as a complication<sup>7</sup>.

In diabetic pregnant women, polyhydramnios is more common, either due to decreased fetal ingestion or to increased osmolality of fetal water due to high glucose values in fetal water. Women with GD often have associated and chronic diseases. The most common are thyroid diseases (15–30%). In diabetic pregnant women, the number of terminations of pregnancy by caesarean section is increased. This is due to the significantly higher incidence of complications (fetal macrosomia, preeclampsia, anomalous position of the child during the labor)<sup>6</sup>. For pregnant women weighing 4000 g or more, elective caesarean section is recommended<sup>1</sup>. Women with hypertension as a chronic disease often experience exacerbation due to GD<sup>7</sup>. According to some studies, 13.5% of pregnant women with GD have a cesarean delivery<sup>8</sup>. Poorly controlled GD results in placental changes (fibrin deposits in syncytiotrophoblast, cytotrophoblast hyperplasia) are found. Placental abruption is an emergency that is life-threatening to the mother and the fetus. Risk factors include abruption in a previous pregnancy, polyhydramnios and multiple pregnancies, maternal old age, preeclampsia and thrombophilia<sup>1</sup>. Newborns of mothers with poorly controlled GD may be hypertrophic due to hyperinsulinism<sup>10</sup>. The size of the brain is not enlarged and the head is disproportionately smaller than the body<sup>11</sup>. Hypertrophic newborns are at increased risk of preterm birth, shoulder distortion and hypoglycemia<sup>12</sup>. According to research, 27.9% of infants of diabetic mothers have a birth weight above the 90<sup>th</sup> centile for gestational age<sup>8</sup>. Maternal diabetes is often the cause of preterm birth – up to 15.2%<sup>13</sup>.

A study conducted among pregnant women with GD and those with type 2 diabetes mellitus showed a lower Apgar score in the 1st and 5th minutes of their infants<sup>12</sup>. Their newborns have an increased risk of pathological jaundice (16.27% risk)<sup>1</sup>, they more often develop respiratory distress syndrome, hypoglycemia and are hospitalized longer<sup>14</sup>. They are more often in need of oxygenation or invasive mechanical ventilation. The incidence of respiratory complications among them is 34% higher than in other infants<sup>15</sup>. Elevated CRP levels have been found in children of mothers with GD<sup>16</sup>. There is a positive correlation between CRP concentration and insulin resistance. The incidence of urogenital and respiratory infections in diabetic pregnant women is increased<sup>6</sup> as well as the incidence of sepsis among their infants which is 0.59%<sup>1</sup>. Some of the complications of perinatal asphyxia are related to the placenta, such as premature discharge of the placenta, placenta previa, or umbilical cord disorders – prolapsed umbilical cord<sup>10</sup>. Studies performed on hypertrophic infants with an umbilical cord pH less than 7 have found that hypertrophic infants of mothers with diabetes have a higher incidence of asphyxia than infants of mothers without diabetes<sup>17</sup>. Most of them have transient asymptomatic hypoglycemia 1 to 4 hours postnatally, and then glucose levels return to normal spontaneously. Symptoms of prolonged hypoglycemia include sweating, tachycardia and shivering, attacks of cyanosis, apnea and convulsions. All signs are nonspecific as they may also occur in various other conditions (hypocalcemia, sepsis, or in children who have suffered asphyxia)<sup>18</sup>.

If the mother was well controlled during pregnancy, hypoglycemia in the newborn would be much less pronounced<sup>19</sup>. The incidence of hypoglycemia among children whose mothers have diabetes ranges from 2.1% to 4.6%<sup>8</sup>. Shoulder distortion is a rare but serious birth trauma. Difficulties during the labor in giving birth first to the shoulder after the head can lead to long-term injuries such as nerve injury and skeletal fracture<sup>20</sup>. Maternal trauma may also be intracranial hemorrhage and central and peripheral nervous system injuries, skull and skeletal injuries. The incidence of heart disease in newborns of diabetic mothers is 6–15%<sup>21</sup>. Congenital heart problems in a child of a mother who has diabetes are caused by exposure to teratogenic effects at very early stages of cardiac development. According to research, the most common heart diseases in neonates of mothers with GD are PDA, open foramen ovale, atrial septal defect, and hypertrophic cardiomyopathy. Hypertrophic cardiomyopathy is a transient condition, with withdrawal of symptoms occurring between 2 and 4 weeks of the child's life while septal hypertrophy recedes within 2 to 12 months<sup>11</sup>. Newborns of mothers with GD may also suffer from hypocalcemia (asphyxia, RDS). Symptoms of hypocalcemia itself include irritability, sweating and tachypnea. According to studies of infants of mothers with poorly controlled diabetes, they are at increased risk of developing hypocalcemia<sup>22</sup>. The incidence of hypocalcemia according to some authors is 1.8% in neonates of diabetic mothers<sup>13</sup>.

### Aims

We tried to investigate the incidence of newborns whose mothers had GD in 2 time periods, in 2015 and 2018. The goal is to point out the incidence of acute, chronic and reproductive diseases in pregnancy as well as complications in childbirth of such mothers in two one year periods (with the distance of 3 years) and to compare them. Early neonatal outcome based on length of hospitalization, need for oxygen therapy and mechanical ventilation in 2015 or 2018, as well as differences in the clinical picture of the newborn are described. Epidemiological and other characteristics of newborns of the observed groups are compared: the order of pregnancies and births, mode of birth, birth weight, gestation of the child, vitality at birth, and possible comorbidity of the child in 2015 and 2018.

### Subjects and Methods

The study covered two year period and was conducted at the University Hospital Osijek. It was a case control study. Subjects were newborns of mothers who had GD in 2015 and 2018. For each infant, the control group was the first infant born after him whose mother did not have GD. The data on the mothers' diseases were collected (acute – which included preeclampsia, polyhydramnion, infections, thrombocytopenia and the like; chronic – hypertension, pulmonary disease, heart disease, hypo or hyperthyroidism). Reproductive conditions were reported – miscarriages, in vitro fertilization, sterility and the like. The method of delivery was marked as vaginal or caesarean section;

elective or urgent. Complications in childbirth included those with umbilical cord (dropped umbilical cord, umbilical cord wrapped, etc.), placenta (abruption of placenta, placental bandage, placenta accreta, etc.), premature rupture of membranes and complications with the position of the newborn. Infant data included: Apgar score in the 1st and 5th minutes, gestational age, birth weight, C – reactive protein, existence of hypoglycemia and hypocalcemia, length of hospitalization, and need for oxygenation or mechanical ventilation as well as existence of congenital heart diseases. The results are presented in absolute and relative frequencies, tables, and the significance of differences among independent samples is shown by chi-square test with 95% confidence interval,  $p < 0.05$ . In the smaller sample, the chi quadrant was tested with Yates correction. Data were analyzed by statistical procedures for testing differences and correlations using the statistical Excel program.

## Results

### *Characteristics of mothers and neonates in two observed periods*

Table 1 shows slightly more mothers over 40 years in the group with GD than in controls. Much older mothers were seen in 2018. Infants of mothers with GD were more frequently born by caesarean section (both planned and urgent) than infants whose mothers did not have GD; in 2018, almost 30% fewer infants (from mothers with GD) were born by elective caesarean section, while the percentage of those born by emergency caesarean section was almost the same in 2015 and 2018. In the control group, the percentage of newborns born by elective and emergency caesarean section was significantly reduced in 2018. There were 14% more vaginal deliveries in 2018 compared to 2015, while in 2015 there were 10% more deliveries by emergency caesarean section than in 2018. We can see that there is a significant difference in the

**TABLE 1**  
CHARACTERISTICS OF NEWBORNS

Characteristics	Value	Mothers in pregnancy									
		With GD				p	Without GD				p
		2015		2018			2015		2018		
N	%	N	%	N	%	N	%				
Gender	Male	78	57.4	70	55.6	0.77	76	55.9	62	49.2	0.28
	Female	58	42.6	56	44.4		60	44.1	64	50.8	
Way of delivery	1	72	52.9	76	60.3	0.34	90	66.2	101	80.2	0.04
	2	28	20.6	18	14.3		17	12.5	10	7.9	
	3	36	26.5	32	25.4		29	21.3	15	11.9	
Apgar score	<7	13	9.6	13	10.3	0.84	6	4.4	4	3.2	0.60
	7=>	123	90.4	113	89.7		130	95.6	122	96.8	
Birth weight	Eutrophic	91	66.9	75	59.5	0.42	99	72.8	98	77.8	0.55
	Hipotrophyc	24	17.6	25	19.8		24	17.6	20	15.9	
	Hipertrophyc	21	15.4	26	20.6		13	9.6	8	6.3	
The age of the mother	<20	2	1.5	1	0.8	0.54	4	2.9	6	4.8	0.51
	20-40	121	89.0	108	85.7		126	92.6	117	92.9	
	>40	13	9.6	17	13.5		6	4.4	3	2.4	
Gestation alter	<37	17	12.5	23	18.3	0.20	9	6.6	13	10.3	0.28
	37=>	119	87.5	103	81.7		127	93.4	113	89.7	
C- reactive protein	<=5	112	82.4	109	86.5	0.36	117	86.0	97	77.0	0.06
	> 5	24	17.6	17	13.5		19	14.0	29	23.0	
Total		136		126			136		126		

Way of delivery: 1- vaginally. 2-caesarian section. 3- urgent caesarian section

vitality of infants from mothers with GD and those without the same. Comparing 2015 and 2018, vitality of neonates was the same (those with AS less than 7). Vitality of newborns of diabetic mothers was much lower than of those born of mothers without GD. Infants of mothers with GD are significantly more likely to be hypertrophic, but if we compare their birth weight in 2015 and 2018, we will notice that there is almost no significant difference in the proportion of hypertrophic infants. In the control group, we see that the proportion of hypertrophic newborns in 2018 is about 30% lower. Among the infants whose mothers had GD, there were statistically significantly more preterm infants than among those in the control group. If we compare infants whose mothers had GD in the 2 observed years, more premature infants were in 2018 (but the same was observed among the infants in the control group). C reactive protein greater than 5 mg / l was found more frequently in 2018 in infants of mothers without GD, while in children whose mothers had GD it was at almost the same frequency in 2015 and 2018. There was no difference in the incidence of elevated CRP in children whose mothers had and did not have GD.

#### *Illnesses of mothers and complications during delivery*

In Table 2 we see that mothers who did not have GD were more often without any pregnancy problem in both periods. Those who had GD more frequently in 2015 were without other pregnancy problems ( $p=0.02$ ). More mothers with GD had acute illnesses during pregnancy ( $p=0.001$ ) in 2018 than in 2015. In both years, chronic diseases in pregnancy were more common among mothers with GD, but if we compare two years the percentage of mothers with chronic diseases were equal. There was no significant statistical difference in complications in childbirth in the study group between 2 years. Wrong child position was

more common in newborns of mothers with GD. There were more mothers with wrong baby position and umbilical cord problems in 2015 than in 2018.

#### *Illnesses of newborns, hypoglycemia, hypocalcemia, duration of hospitalization, and the need for oxygenation*

Table 3 shows that in the control group, there were more children with heart defects ( $p = 0.02$ ) in 2018 than in 2015, and the percentage of such newborns was equal in both periods in those of mothers with GD. Meconium amniotic fluid was 7% more frequent in newborns of control group in 2015 than in 2018 ( $p=0.04$ ). Percentage of newborns with meconial amniotic fluid was equal in both periods for those of mothers with GD. Table 3 shows that hypoglycemia and hypocalcemia were significantly more frequent in children of mothers with GD. In 2015, there were almost twice as many hypoglycemic children compared to 2018 ( $p < 0.05$ ) in the study group. In 2015, there were also more children who had hypocalcemia ( $p < 0.05$ ). In the control group there is no statistical significance in the above two parameters between the 2 observed annual periods. Newborns whose mothers had GD were more likely hospitalized longer than those of mothers without GD. Table 3 shows that in 2018, children of mothers with GD were twice as often hospitalized for only a short time (up to 3 days after spontaneous birth) compared to 2015 ( $p=0.002$ ). A significantly shorter hospitalization after spontaneous birth in 2018 was also observed among the control infant group than in 2015 ( $p < 0.001$ ). The proportion of infants with hospitalization longer than 3 days was higher in newborns of mothers with GD in 2015 than in 2018. ( $p=0.03$ ). Newborns from control group were hospitalized much shorter after the spontaneous delivery in the second year, 2018 ( $p=0, 05$ ). In the control group, children were more frequently hospitalized up to 6 days after caesarean section in 2015

**TABLE 2**  
MOTHERS MORBIDITY AND COMPLICATIONS IN LABOR

		Mothers in pregnancy									
		With GD				p	Without GD				p
		2015		2018			2015		2018		
N	%	N	%	N	%	N	%	N	%		
Mothers' illnesses*	0	61	44.9	39	31.0	0.02	78	57.4	70	55.6	0.77
	1	40	29.4	62	49.2	0.001	26	19.1	33	26.2	0.17
	2	26	19.1	25	19.8	0.88	17	12.5	15	11.9	0.88
	3	34	25.0	23	18.3	0.19	27	19.9	16	12.7	0.12
Complications in labor**	0	63	46.3	62	49.2	0.64	69	50.7	63	50.0	0.91
	1	37	27.2	27	21.4	0.28	39	28.7	35	27.8	0.87
	2	5	3.7	9	7.1	0.21	5	3.7	10	7.9	0.14
	3	26	19.1	24	19.0	0.99	27	19.9	27	21.4	0.75
	4	13	9.6	5	4.0	0.07	11	8.1	5	4.0	0.16
Total		136		126			136		126		

\*0 – without illness. 1 – acute. 2 – chronic. 3 – reproductive

\*\*0 – without complications. 1 – with umbilical cord 2 – with placenta 3 – premature rupture of membranes. 4 – wrong position of the newborn

**TABLE 3**  
OXYGENATION, DURATION OF HOSPITALIZATION, HYPOGLYCAEMIA AND HYPOCALCEMIA

		Mothers in pregnancy					
		With GD			Controls(without GD)		
		N (%)	N (%)	p	N (%)	N (%)	p
		2015	2018	p	2015	2018	p
Duration of hospitalisation	Caesarian section. hospitalization up to 6 days	35 (25.7)	33 (26.2)	0.93	37 (27.2)	18 (14.3)	0.01
	Caesarian section. hospitalization more than 6 days	29 (21.3)	17 (13.5)	0.1	9 (6.6)	7 (5.6)	0.72
	Vaginal delivery. hospitalization up to 3 days	37 (27.2)	57 (45.2)	<0.01	38 (27.9)	67 (53.2)	<0.01
	Vaginal delivery. hospitalization more than 3 days	35 (25.7)	19 (15.1)	0.03	52 (38.2)	34 (27)	0.05
Mechanical ventilation	Yes	5 (3.7)	7 (5.6)	0.19	3 (2.2)	6 (4.8)	0.26
	No	131 (96.3)	119 (94.4)		133 (97.8)	120 (95.2)	
Oxygenation	Yes	41 (30.1)	29 (23.0)	0.47	24 (17.6)	16 (12.7)	0.27
	Ne	95 (69.9)	97 (77.0)		112 (82.4.2)	110 (87.3)	
Hypoglycemia	Da	13 (9.6)	7 (5.6)	<0.01	3 (2.2)	2 (1.6)	0.71
	No	123 (83.8)	119 (98.5)		133 (97.8)	124 (98.4)	
Hypocalcemia	Yes	9 (6.6)	4 (3.2)	<0.01	3 (3.2)	1 (0.8)	0.35
	No	127 (93.4)	122 (96.8)		133 (96.8)	125 (99.2)	
Newborn illnesses	Congenital harth diseases	7 (5.1)	8 (6.3)	0.68	1 (0.7)	7 (5.6)	0.02
	Others	129 (94.9)	118 (93.7)		135 (99.3)	119 (94.4)	
	Total	136	126	262	136	126	262

versus 2018 ( $p=0.01$ ). Oxygenation was significantly more frequent in the infants of mothers who had GD, but there was no statistically significant difference in oxygenation and mechanical ventilation among neonates in the study groups in two one-year periods. Oxygen therapy was more frequently performed in 2015 both in the subjects and in the control group. Mechanical ventilation was more frequently performed in the study group in 2018 (the same was among the infant control group).

## Discussion

### *Characteristics of mothers with GD*

In 2015, 2165 children were born, of whom 6.3% were newborns of mothers who had GD. In 2018, there were 1954 births and 6.4% were born to mothers who had GD. This is approximately the same incidence when compared to the literature stating that the incidence of births from diabetic mothers is 4.67%<sup>1</sup>. We saw a decline in the number of newborns over the years. This could also be connected with the large expatriation of fertile, young families. The percentage of older mothers is increasing in 2018, but the difference is not significant (in 2015 the percentage was 9.6% and 13.5% in 2018). According to the literature, 6.8% of mothers over 40 receive GD 2. Mothers with GD are probably more hesitant to decide on pregnancy than those who do not have the disease, and it is likely that a higher percentage of older mothers in 2018 is also conditioned by the higher incidence of GD in old age. Among the control group, the proportion of older mothers declined in 2018.

### *Characteristics of newborns*

Elective and emergency caesarean section is more often performed in pregnant women with GD due to complications<sup>1</sup>. In the literature, we find that 13.5% of diabetic pregnant women end up giving birth by caesarean section<sup>6</sup>. This is in line with the results obtained, where in 2015, 20.6% of pregnant women had caesarian section, and in 2018, 14.3%. The proportion of pregnant women who delivered by caesarean section decreased in 2018, most notably the proportion of those who delivered by emergency caesarean section, and this indicates a more careful monitoring of pregnant women with GD. In 2018, there were slightly more vaginal births. This can be explained by better control of gestational diabetes itself and less pronounced fetal complications such as fetal hypertrophy which is an important cause of caesarean section. There is a significant difference in the way of birth in the control groups; in 2018, vaginal births were more frequent, while in 2015 urgent and even elective caesarean sections were more frequent; today, better care is provided for all groups of pregnant women. Apgar scores less than 7 in neonates of mothers with GD were three times more frequent in both periods than in the control group. In the study groups, there was no difference in the birth rate of less vital infants in the two observed periods, whereas in the control groups, better perinatal care led to a decrease in the number of less vital infants. GD is a risk factor for a lower Apgar score<sup>12</sup>. Maternal diabetes has been shown to lead to newborn hypertrophy<sup>14</sup>. In the study groups in both periods there were more hypertrophic newborns than in controls, the proportion of them even increased in 2018. Diabetic mothers, according to the litera-

ture, have hypertrophic newborns in 27.9% of cases<sup>8</sup>; we got an approximately similar percentage in 2018 (20.6%). The cause is probably good glycemic control in mothers in 2015 and 2018. Mothers with GD were twice as likely to have premature infants as mothers without GD. This is in line with the literature because GD is a risk factor for preterm delivery in 15.2% of cases; 12.5% were born prematurely in 2015 and 18.3% in 2018, which is roughly similar to the percentage reported in the literature<sup>13</sup>. GD is a potential risk for elevated levels of CRP because assisted births that may increase CRP levels are more likely to be performed in such pregnant women<sup>16</sup>. In the study groups, CRP was more frequently elevated in 2015 (17.6%) and decreased in 2018 (13.5%), which probably means that at-risk pregnancies are monitored more closely, reducing the frequency of possible complications. In the control groups, the percentage of infants with elevated CRP values is increasing (2015 – 14%, 2018 – 23%).

#### *Mother illnesses and complications in delivery*

Pregnant women who did not have GD were significantly more likely to have no illnesses during pregnancy in both 2015 and 2018. Acute diseases such as infections and various conditions such as preeclampsia and polydramnion were significantly more common in pregnant women with GD. In 2015 the percentage of such women was 29.4% and in 2018 – 49.2%. GD carries the risk of developing these acute conditions<sup>4</sup>. According to research, preeclampsia is experienced by 10–20% of diabetic pregnant women<sup>6</sup>. When compared 2015 and 2018, pregnant women without GD in 2018 were significantly more likely to have various acute illnesses. This may be due to better recording or more aggressive approach to labor. Chronic diseases (such as hypothyroidism) were 30% more common in pregnant women with GD than in the control group. The proportion of those with chronic illnesses did not change over the observed 2 years. Reproductive diseases (such as miscarriage) were more common in pregnant women with GD in both years than in those without. The share of reproductive diseases in pregnant women with GD decreased in 2018 compared to 2015. Complications in childbirth such as those with umbilical cord, placenta, or premature rupture of membranes were slightly more common in neonates of mothers with GD than in those without, but the difference is not significant. Wrong position of the newborn of mothers with GD was twice as common in 2015 than in 2018. Literature data confirm that GD is a risk factor for this<sup>6</sup>.

#### *Illnesses of newborns, hypoglycemia, hypocalcemia, duration of hospitalization, and the need for oxygenation*

There is a significant difference in the incidence of heart defects, which were significantly more common in infants whose mothers had GD. In pregnant women with GD, the risk of various heart defects is 6–15%<sup>21</sup>. In this study, the incidence of heart defects among them was 5.1% in 2015 and 6.3% in 2018. Hypoglycemia was statistically significantly more common in infants whose mothers had GD. They had hypoglycemia four times more

likely due to maternal insulin<sup>19</sup>. In 2015, 9.6% of newborns of mothers with GD had hypoglycemia, and in 2018, 5.6% which is slightly higher than the literature results – 2.1 to 4.6%<sup>8</sup>. Hypoglycemia is a common complication in newborns whose mothers have diabetes, making it clear that care for these mothers was better in 2018. In both years, hypocalcemia was 3 times more frequent in children of mothers with GD than in those without it. And according to the literature, hypocalcemia is more common in newborns of mothers with GD<sup>22</sup>. Approximately 1.8% of children of mothers with GD have hypocalcemia. Its frequency in 2015 was 6.6% and in 2018 it was 3.2%, which is slightly above the literature data<sup>13</sup>. There were half the number of hypocalcemic infants in 2018, which indicates better care for pregnant women with GD. Newborns of the study group in 2015 had 15% more hospitalizations longer than 6 days after caesarean section compared to controls, while the non-diabetic group had 13% more hospitalizations longer than 3 days after spontaneous delivery. This can be explained by the fact that newborns of mothers with GD are more often affected by caesarean section and more often have complications. In 2018, the surveyed infants had 12% more frequent hospitalization up to 6 days after caesarean section, and longer than 6 days. This is a result of a more frequent caesarean section in children of mothers with GD<sup>1</sup>. A comparison of the total for both years shows that infants of mothers with diabetes were more frequently hospitalized more than 6 days after caesarean section and those whose mothers did not have GD were more frequently hospitalized up to 3 days after spontaneous delivery.

When comparing the years 2015 and 2018 in the groups of the examinees, it is evident that in 2018 children were hospitalized shorter after the caesarean section and after the spontaneous delivery. In 2015, 1/4 newborns stayed in the hospital for up to 3 days (and in 2018, nearly 1/2). After a caesarean section, in 2015 25.7% of newborns and in 2018 only 13.5% stayed more than 6 days at the hospital. This is due to lower number of complications in newborns and their better care in 2018, which means that they had a faster discharge from the hospital. In the control group, children were more likely to be hospitalized up to 6 days after caesarean section in 2015, and children in 2018 were twice as likely to be hospitalized up to 3 days after spontaneous delivery. This fact is also connected with better quality care for infants and the possibility of their early discharge from the hospital. Oxygen therapy was significantly more frequently performed in infants whose mothers had GD than in infants whose mothers did not. According to the literature, 34% of infants of mothers with GD have respiratory complications and require some form of ventilation, while in this study, respiratory complications and oxygenation requirements were performed in 30.1% in 2015 and in 2018 in 23%<sup>15</sup>. Mechanical ventilation was also more frequently performed in infants of mothers with GD in pregnancy; more frequently in 2018 (5.6%) than in 2015 (3.7%).

## Conclusions

In 2015 6.3% of infants had a mother with GD, and in 2018 6.4%. Among mothers with GD, there is a higher proportion of those over 40 years of age. Cesarean section births are more common in this group also. The Apgar score was more often lower in infants whose mothers had GD. Children of mothers with GD are more often hypertrophic. There were more preterm births in the infant groups of mothers with GD in 2015 and 2018 compared to the control groups, and in 2018, 30% more than in 2015. This indicates that GD was a risk factor for the birth of preterm infants. CRP levels of more than 5 were more often in the study group of 2015. This could mean that 2018 births were less traumatic for newborns. Acute diseases such as infections, preeclampsia and polyhydramnion were more common in pregnant women with GD than in those without it. These conditions were more common

in 2018, but the same was in the control group, which could mean that acute infections have generally become more common. Hypoglycemia was more common in children of mothers with GD, but in 2018 the proportion of such newborns was lower. Similar was the case with hypocalcemia, which was three times more common in infants of mothers with GD. There were twice less hypocalcemic newborns in 2018 than in 2015. The need for oxygenation was higher in newborns of mothers with GD than in those without such mothers, but it was reduced in 2018. The need for mechanical ventilation was greater in 2018. However, if we add the number of such infants to the number who needed oxygenation, we will see that the need for oxygenation was significantly reduced in 2018. It may be concluded that better care for mothers with GD and their glycemic control have led to significantly less complications and better perinatal outcome of their infants.

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## USPOREDBA NEONATALNOG ISHODA U MAJKI S GESTACIJSKIM DIJABETESOM TIJEKOM DVA RAZDOBLJA

### SAŽETAK

Gestacijski dijabetes je jedna od najčešćih metaboličkih komplikacija u trudnoći. Majke su češće podložne raznim akutnim stanjima i kroničnim bolestima i jako je važno da budu pomno praćene i liječene. Kod njihove djece se češće javljaju hipoglikemija, hipokalcemija, hipertrofija, kao niži Apgar score. Istraživanje je studija parova. Uspoređivali smo majke s GD i njihovu novorođenčad s majkama koje ga nisu imale kao i međusobno u dva razdoblja s odmakom od 3 godine. Novorođenčad majki sa dijabetesom 2015. i 2018.godine (262) u KBC Osijek su ispitanici. Kontrolna skupina (262) su prvo živorođeni nakon ispitanika u 2015. i 2018.godini. Rezultati su prikazani u tablicama, apsolutnim i relativnim frekvencijama, a značajnost razlika hi-kvadrat testom s 95-postotnim intervalom pouzdanosti. Statistička značajnost je prihvaćena uz  $p < 0,05$ . Majke sa GD češće imaju razna akutna stanja kao i druge kronične bolesti. Njihova novorođenčad češće je hipertrofična, hipoglikemična, hipokalcemična u odnosu na kontrolu skupinu. Također češće imaju potrebu za oksigenacijom i duljom hospitalizacijom kao i carskim rezom. Sve je ovo značajno smanjeno u 2018. godini kada su djeca kraće boravila u bolnici. Boljom skrbi za majke tijekom trudnoće i boljom kontrolom njihove glikemije značajno su smanjene komplikacije u njihove novorođenčadi te je perinatalni ishod takve novorođenčadi bolji.