https://doi.org/10.46389/rjd-2023-1137
www.rjdnmd.org

Rom J Diabetes Nutr Metab Dis
2023; volume 30, issue 1, pages 16-22

Original Article

Perinatal outcomes of pregnancy with gestational diabetes in a secondary care hospital in Tamil Nadu, India

Pramitha Lankala [1], Anne George Cherian [1] *, Cherryl Tryphena [1], Tobey Ann Marcus [1], Vinod Joseph Abraham [1], Jasmine Prasad [1]

[1] Department of Community Health, Christian Medical College and Hospital, Vellore, Tamil Nadu, India

* Correspondence to: Anne George Cherian, Department of Community Health, Christian Medical College and Hospital, Vellore, Tamil Nadu, India. Phone: 04162284207 ; E-mail: annegc97@yahoo.co.in

Received: 27 March 2022 / Accepted: 2 December 2022

Abstract

The prevalence of gestational diabetes has been reported as 17.9% in Tamil Nadu. Women with GDM are at a higher risk of developing pregnancy complications and adverse outcomes. This study was conducted to look at various outcomes of infants of diabetic mothers to enable better management and focus on prevention. This was a hospital-based non-concurrent cohort study. Women diagnosed with gestational diabetes using the IADSPG guidelines were identified and the outcomes of their neonates were studied. The association between various factors and poor outcomes was estimated using the Chi-square test and odds ratio. The prevalence of GDM was 24.2%, with an increase in maternal age and obesity. LGA (Large-for-Gestational-Age) babies were more in the group with diabetes. This was statistically significant with both GDM (RR 3.39) and Pregestational diabetes (RR 8.93). Among the neonates with GDM or pregestational diabetes, the RR for perinatal asphyxia was 0.98 (0.61–1.58) and 2.07 (0.52–8.28), respectively. There were more neonates with hypoglycemia as well as jaundice in the groups being treated with drugs. The risk of neonatal complications increases when diabetic women are on drugs for glycemic control than those on a diet alone. Our study's overall incidence of neonatal complications was lower than most studies.

Keywords: gestational diabetes, neonatal, maternal, outcomes, secondary care.

Introduction

Diabetes is a major public health problem. The world health organization (WHO) has predicted that between 1995 and 2025, there will be a 35% increase in the worldwide prevalence of diabetes [1]. In India, with prevalence rates reported to be between 4.6% and 14% in urban areas and 1.7% and 13.2% in rural areas [2], has an estimated 62 million people with type 2 diabetes mellitus, which is expected to go up to 79.4 million by 2025 [2]. It is not surprising to see a parallel increase in the prevalence of Gestational Diabetes mellitus (GDM), as 14% of all pregnancies have developed GDM and amounts to the vast majority of all cases of diabetes in pregnancy [3]. The prevalence of gestational diabetes has been reported at 17.9% in Tamil Nadu [4]. It is estimated that about 4 million women are affected by GDM in India at any given time [5].

The landmark trial about hyperglycemia in pregnancy and adverse outcomes (HAPO) highlighted the continuous nature of the association between hyperglycemia and adverse fetal outcomes [6]. Women with GDM are at a higher risk of developing pregnancy complications and adverse outcomes, including infant macrosomia, neonatal hypoglycemia, low Apgar score and Caesarean delivery [7]. Poor maternal glycaemic control in the periconceptional period increases the risk of congenital malformations in cases of GDM [8] and women with diabetes in pregnancy (type 1, type 2 and gestational) are at increased risk of adverse pregnancy outcomes. Adequate glycemic control before and during pregnancy is crucial in improving the outcomes [9]. It is well-established that the treatment of GDM reduces the risk of serious perinatal complications [10].

Management of diabetes in pregnancy and its complications imposes a huge economic burden on society;

hence effective strategies are urgently needed to control this epidemic. There is insufficient data available on the outcome of IDMs, especially from developing countries. This study was conducted to compare various outcomes among neonates born to pregnant women with diabetes and correlate the neonatal outcomes with various treatments (diet alone/OHA/insulin) in those women in a secondary hospital setting. This study aims at looking at various outcomes of infants of diabetic mothers to enable better management and focus on prevention.

Material and methods

This was a hospital-based non-concurrent cohort study. The Community Health department of Christian Medical College (CMC), Vellore, has been addressing the health issues of a rural block for more than 50 years and functions through community outreach clinics. Monthly doctor-run antenatal outreach clinics cover pregnant women in 82 villages. The program is supported by a 140 bedded secondary care hospital called Community Health and Development (CHAD).

The study period was from August 2017 to March 2020. We analyzed the information from all pregnant women who gave birth in the CHAD hospital. The study was approved by the Institutional review board Christian medical college (IRB Min no: 14056).

Women underwent testing for GDM during antenatal clinic visits and were diagnosed using modified International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria. In 2017, selective screening was followed, which meant that only those with high-risk factors were tested for GDM. From 2018 onwards, universal screening for GDM was being followed.

Women with GDM controlled with medical nutritional therapy were induced past dates as other women with no risk factors. Those who were on oral hypoglycemic agents (OHAs) and had well-controlled sugars were induced after 39 weeks, while those who were on insulin were induced between 38 and 39 weeks if they had well-controlled sugars.

The weight of each baby and the gestational age was recorded. They were grouped as appropriate for gestational age (AGA), large for gestational age (LGA) and small for gestational age (SGA) following the intergrowth 21 charts.

Neonatal outcome variables that were included in the analysis: neonatal hypoglycemia (which was defined as neonatal glucose ≤45mg/dl during the first 24h after birth [11], macrosomia (baby weighing >4 kg) [12], perinatal asphyxia, defined by a 5-min Apgar score <7, neonatal jaundice requiring treatment [13], maturity (Preterm <37 weeks), Congenital anomalies and neonatal deaths. Using the Chi-square test and odds ratio, the association between various factors and poor outcomes was estimated.

Results

The total number of deliveries in CHAD during the study period from 1st July 2017 to 31st March 2020 was 11,586. GTT or AC/PC was available for 6273 women during this period, of which 1519 (24.2%) were detected to have gestational diabetes (GDM) and 67 (1.1%) were diagnosed with pregestational diabetes mellitus. GTT was done in 5926 women and 279 were diagnosed based on an AC/PC and 68 were diagnosed in another hospital and referred.

Among the women with gestational diabetes and pregestational diabetes, there were 964 who were managed with medical and nutritional therapy alone, 576 who needed oral hypoglycemic agents and 46 who needed insulin in addition to oral hypoglycemic agents.

In the age group less than 21 years, 87.1% of the women did not have GDM. This proportion decreased to 46.8% in the age group of more than 35 years. The Chi-square value for trends was significant, with a p-value of <0.001. As the gravidity increased, a higher number of women were detected with GDM as well as pregestational diabetes. The Chi-square value for trends was significant, with a p-value of <0.001. The proportion of women with GDM in the obese group was highest (33.5%) and a similar proportion (1.7%) in those with pregestational diabetes, with the Chi-square value for trends being significant with a p-value of <0.001. Table 1 is a description of the study population.

Among the 6273 deliveries, there were 1242 (19.8%) Caesarean sections, of which 710 (12.4%) were primary Caesarean sections. Among the deliveries, 853 (13.6%) were instrumental deliveries and 31 were vaginal breech deliveries. Women with GDM, as well as those with pregestational diabetes, had a higher risk of undergoing LSCS (Lower segment Caesarean section) compared to those with normal blood sugars. This was significant with the RR of 1.23 (1.1–1.37) and 2.34 (1.76–3.09), respectively.

Between the mothers with GDM and those without GDM, the indications for primary LSCS (failed induction, failure to progress and CPD) were similar. Among the women with pre-gestational diabetes, there was a

Table 1: Description of study population.

Variable	Category	GDM No (%)	Pregestational diabetes No (%)	No GDM No (%)	Total No (%)
Age group (n=6,273)	<21 years	108 (12.7)	2 (0.2)	740 (87.1)	850 (13.6)
	21–25 years	503 (18.5)	14 (0.5)	2,196 (80.9)	2,713 (43.2)
	26–30 years	622 (30.8)	25 (1.2)	1,373 (68)	2,020 (32.2)
	31–35 years	238 (41.1)	15 (2.6)	326 (56.3)	579 (9.2)
	>35 years	48 (43.2)	11 (9.9)	52 (46.8)	111 (1.8)
Gravida (n=6,273)	G1	689 (21.9)	19 (0.6)	2,434 (77.5)	3,139 (50)
	G2	517 (25.7)	28 (1.4)	1,465 (72.9)	2,010 (32.1)
	G3 & above	316 (28.1)	20 (1.8)	788 (70.1)	1,124 (17.9)
BMI (n=5,967)	Undernourished (<18.5)	7 (10.9)	0 (0)	57 (89.1)	64 (1.1)
	Normal (18.5–24.99)	349 (17.6)	8 (0.4)	1,630 (82)	1,987 (33.3)
	Overweight (25–29.99)	577 (24.9)	26 (1.1)	1,712 (74)	2,315 (38.8)
	Obese (≥30)	536 (33.5)	28 (1.7)	1,037 (64.8)	1,601 (26.8)

higher proportion undergoing LSCS for failed induction (25%) compared to 16.3% in those without GDM and 18.1% among those with GDM.

Those who needed insulin, in addition to oral hypoglycemic agents for treatment, had a higher relative risk for a Caesarean section. (RR 2.28, 95% CI 1.67–3.12)

Among the babies born, 445 (7.1%) were born preterm and 30 (0.5%) were born less than 32 weeks. Table 2 shows the gestational age at delivery.

There were 876 (14%) babies born weighing less than 2.5 kg and 71 babies weighing more than 4 kg. The difference in the incidence of macrosomia among mothers with GDM or pregestational diabetes (1.9%) and those without GDM (0.9%) was statistically significant (p-value 0.002). There were 30 (0.5%) with very low birth weight and 834 (13.3%) with low birth weight.

The babies were then classified according to the intergrowth 21 charts. Small for gestation comprised 6.5% of the births and 0.6% were large for gestation.

Large for gestational age babies were more in the group with diabetes (Table 3). This was statistically significant with an RR of 3.39 (1.74, 6.64) in those with GDM and an RR of 8.93 (2.1, 38.01) in those with pregestational diabetes.

While comparing those being managed with OHAs alone, there was no significant difference in growth in the groups, but when insulin was being used for management, there was a significant increase in the number of small for gestational age babies [RR2.51 (1.14, 5.52)] as well as large for gestational age babies [RR 6.83 (1.96-23.87)]; this is evident in Table 4.

Perinatal mortality increased in pregestational diabetes. This is statistically significant with a p-value of <0.001 (Table 5).

There were 3 (6.5%) perinatal deaths in the group being treated with insulin compared to 8 (1.4%) in the group being treated with oral hypoglycemic agents alone and 13 (1.4%) in the group only on MNT. Being

Table 2: Maturity of the neonates

GDM status	Maturity		P-value	RR (95% CI)
	<37 weeks No (%)	37 weeks & above No (%)		
No GDM (n=4,687)	306 (6.5%)	4,381 (93.5%)		1
GDM (n=1,519)	130 (8.6%)	1,389 (91.4%)	0.009	1.31 (1.08, 1.6)
DM (n=67)	9 (13.4%)	58 (86.6%)	0.041	2.06 (1.1, 3.81)

https://doi.org/10.46389/rjd-2023-1137

Table 3: Growth of the fetus.

GDM status	Growth			RR (95% CI) & P-value	
	Small for gestation No (%)	Large for gestation No (%)	Appropriate for gestation No (%)	Small for gestation *vs.* appropriate for gestation	Large for gestation *vs.* appropriate for gestation
No GDM (n=4,687)	328 (7%)	16 (0.3%)	4,343 (99.6%)	1	1
GDM (n=1,519)	74 (4.9%)	18 (1.2%)	1427 (92.7%)	0.7 (0.55, 0.89) (P-value=0.004)	3.39 (1.74, 6.64) (P-value<0.001)
DM (n=67)	6 (9%)	2 (3%)	59 (88.1%)	1.32 (0.61, 2.84) (P-value=0.461)	8.93 (2.1, 38.01) (P-value=0.025)

treated with insulin significantly increases the risk of perinatal death [RR 4.84 (1.43–16.38)].

Among the neonates with GDM or pregestational diabetes, the RR for perinatal asphyxia was 0.98 (0.61–1.58) and 2.07 (0.52–8.28), respectively. Neonates born to mothers on drugs (OHA and INSULIN) had an increased risk of asphyxia as compared to those born to mothers on a diet alone with (OR 1.77–11.69) and a significant p-value of <0.001.

Among the neonates being monitored postnatally, a significant number had hypoglycemia and clinical jaundice. This is shown in Table 6.

Among those neonates with clinical jaundice, bilirubin was checked for 2152 babies and there were more babies in the group with GDM and pregestational diabetes who had hyperbilirubinemia [RR of 1.66 (1.29– 2.14) and 3.76 (2.26-6.25)].

There were more neonates with hypoglycemia as well as jaundice in the groups being treated with OHA as well as the combined OHA and insulin group when compared to those being treated with just MNT. These trends are statistically significant.

Among the neonates whose mothers had either GDM or pregestational diabetes, there were 17 (1.07%) with anomalies of which there were 4 (0.3%) neonates with CVS anomalies, 6 (0.4%) with CTEV, 1 with cleft lip/cleft palate, 1 with Downs syndrome, 1 with renal anomaly and 4 with other anomalies. Among neonates

Table 4: Growth in different groups of GDM.

GDM status	Small for gestation	Large for gestation		RR (95% CI)	RR (95% CI)
	Small for gestation No (%)	Large for gestation No (%)	Appropriate for gestation No (%)	Small for gestation *vs.* appropriate for gestation	Large for gestation *vs.* appropriate for gestation
Diet alone (n=954)	53 (5.5%)	10 (1%)	901(93.5%)	1	1
Diet & OHA (n=569)	21 (3.6%)	7 (1.2%)	548 (95.1%)	0.66 (0.40, 1.09)	1.15 (0.44, 3.00)
Diet, OHA & insulin (n=46)	6 (13%)	3 (6.5%)	37 (80.4%)	2.51 (1.14, 5.52)*	6.83 (1.96, 23.87)

Note: * – Statistically significant.

Table 5: Perinatal mortality.

GDM status	Perinatal outcome		P-value	RR (95% CI)
	Perinatal death No (%)	Live No (%)		
No GDM (n=4,687)	65 (1.4%)	4,622 (98.6%)	-	1
GDM (n=1,519)	20 (1.3%)	1,499 (98.7%)	0.900	0.95 (0.58, 1.56)
DM (n=67)	4 (6%)	63 (94%)	0.016	4.31 (1.61, 11.48)

Table 6: Hypoglycemia and jaundice in newborns.

	Hypoglycemia				Clinical jaundice			
GDM status	Yes No (%)	No/no indication for screening No (%)	P-value	RR (95% CI)	Yes No (%)	No No (%)	P-value	RR (95% CI)
No GDM (n=4,630)	60 (1.3%)	4,570 (98.7%)	-	1	534 (11.5%)	4,095 (88.5%)	-	1
GDM (n=1,504)	61 (4.1%)	1,443 (95.9%)	<0.001	3.13 (2.2, 4.45)	322 (21.4%)	1,182 (78.6%)	<0.001	1.86 (1.64, 2.1)
DM (n=65)	10 (15.4%)	55 (84.6%)	<0.001	11.87 (6.37, 22.14)	28 (43.1%)	37 (56.9%)	<0.001	3.73 (2.79, 4.99)

whose mothers did not have GDM, there were 31 (0.6%) with congenital anomalies. There were 6 (0.1%) with CNS anomalies, 5 (0.1%) with CTEV, 4 each with cleft lip/cleft palate and gastrointestinal anomalies, 3 with renal anomalies, 2 with Downs syndrome, 1 with CVS anomaly and 6 with other anomalies.

Neonates of mothers with GDM/DM had a higher chance of being admitted to the nursery.

Discussion

Globally, Gestational Diabetes Mellitus (GDM) is rising; it affects an estimated 15% of pregnant women [14]. Our group's prevalence was 24.2%, which was higher than that reported by Seshiah *et al*. which was 17% from the same region (Tamil Nadu). However, our study does not truly reflect that of the general population as it is not a community-based study. Such high prevalence is also possibly because our setup is a secondary care hospital with referrals of high-risk mothers from primary health centers.

Advanced maternal age is a known risk factor for GDM [15]. There was a significant difference and positive correlation in the prevalence of GDM with higher maternal age and higher gravidity (p<0.001). There was an increased risk of GDM in the obese group compared to the normal weight, which was correlated to a meta-analysis where high maternal weight is associated with a substantially higher risk of GDM [15].

Among the diabetic women in our study, 19.8% underwent a Caesarean section. This rate was similar to other studies where Caesarean delivery was strongly associated with diabetes in pregnancy [16, 17]. We found that women with GDM/pregestational diabetes had a significant risk of undergoing LSCS with RR (1.23/2.34) compared to nondiabetic women.

Outcomes of neonate

Macrosomia and large for gestational age

The macrosomia incidence was higher in the diabetic group than nondiabetic. This was statistically significant with both GDM (RR 3.39) and pregestational diabetes (RR 8.93). Findings from the Hyperglycemia and Adverse Pregnancy Outcomes study show a strong linear relationship between maternal glucose concentration and large for gestational age (LGA) fetuses [6].

Preterm

Preterm deliveries were significantly higher in the diabetic group compared to non-diabetics (Table 2). The link between GDM and spontaneous preterm birth is still controversial. Hedderson *et al*., showed in a large cohort that GDM was an independent risk factor for spontaneous preterm birth [18]. On the other hand, Yogev *et al*. found that the rate of spontaneous preterm delivery was not increased in GDM compared to non-GDM patients [19]. Hence, we need further studies and a well-structured metanalysis to determine the association.

Hypoglycemia

As mentioned in previous studies, the prevalence of hypoglycemic episodes in IDM is as high as 40% [20]. In our study, neonatal hypoglycemia was significantly associated with both GDM and pregestational diabetes (p<0.001). Contrary to previous studies [21], the incidence of neonatal hypoglycemia was similar with either OHAs or insulin treatments in the diabetic group. This trend was similar to another study done by Voormolen *et al*. [22].

The incidence of neonatal hypoglycemia was higher in neonates born to diabetic mothers treated with

https://doi.org/10.46389/rjd-2023-1137

drugs compared to those mothers who were managed with MNT alone, which was very significant. This probably reflects the uncontrolled maternal glucose levels needing drugs causing postnatal hypoglycemia.

Neonatal jaundice

Hyperbilirubinemia occurs in 11 to 29% of infants of mothers with diabetes [23]. In our analysis, a higher number of neonates born to mothers with GDM had clinical jaundice. Again in the diabetic group, neonatal jaundice was significantly higher in the group treated with drugs than with MNT alone.

Perinatal mortality

The overall risk of perinatal deaths was higher in women with diabetes when compared to those without diabetes, more so among those with pregestational diabetes ($p<0.016$). Similar results were mentioned in a study done by Rosenstein *et al*. [24]. Diabetic women treated with insulin had an increased risk of perinatal deaths with RR 4.84 (95% CI 1.43–16.38). Perinatal asphyxia was also higher in neonates born to diabetic mothers treated with drugs compared to those on a diet alone.

Pregestational diabetes (PGD) is one of the known leading causes, with up to a nine-fold increase in congenital disabilities, compared with the rate seen in nondiabetic pregnancies [25]. In our group, congenital anomalies among neonates born to diabetic women were 1.07% (17/1519), more than those born to nondiabetics 0.6% (31/4754). Among the various anomalies, cardiac anomalies were more common in those born to diabetic women. The frequency of anomalies was much lower than those mentioned in previous studies. This could be attributed to the well-controlled glucose levels in our group of diabetic mothers in the first trimester.

The nursery admission rate among neonates born to diabetic women was significantly higher ($p<0.001$) than those born to nondiabetic women. This can be explained partially by the unit policy of routinely monitoring the neonates of diabetic mothers for the first 24 hours for hypoglycemia in the nursery. Though the chance of being admitted to a nursery was high, the number of babies being transferred to a higher center was not statistically significant.

The outcomes of women in this cohort would be slightly different as this is a secondary hospital setup where patients will not have the facility to monitor sugars rigorously.

Conclusions

We observed that infants of mothers with diabetes are at increased risk for mortality and morbidity compared with infants born to mothers without diabetes. The risk of neonatal complications increased more when diabetic women were on drugs for glycemic control than those on a diet alone. Our study's overall incidence of neonatal complications was lower than most studies, probably reflecting good glycemic control and the unit policy's effectiveness in managing maternal diabetes and early postnatal feeding. The incidence of gestational diabetes and pre-gestational diabetes complicating pregnancy is rising. Good control of the glucose level in the antenatal period and careful monitoring and feeding in the immediate postnatal period of the babies helps reduce the immediate postnatal metabolic complications of these neonates. Optimal care is based on prevention, early recognition, and effective treatment of common complications expected in IDM. Breastfeeding among mothers with diabetes should be encouraged irrespective of their mode of delivery. We acknowledge several limitations of this study primarily because it is a non-concurrent observational study prone to several potential biases. We will need further studies to look at these outcomes in similar resource-constrained settings.

Conflict of interest

The authors declare no conflict of interest.

References

1. Ang C, Howe D, Lumsden M. Diabetes. In: James DK, Steer PJ, Weiner CP and Gonik B, eds. High Risk Pregnancy Management options, third edition. Philadelphia. Saunders. 2005: 9861004 - Google Search [Internet]. [cited 2021 5th August].
2. Anjana RM, Pradeepa R, Deepa M, Datta M, Sudha V, Unnikrishnan R, *et al*. prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural India: phase I results of the Indian Council of Medical Research-INdia DIABetes (ICMR-INDIAB) study. Diabetologia. 2011 Dec;54(12):3022–7.
3. Cloherty-and-Starks-Manual-of-Neonatal-Care-2021-.pdf [Internet]. [cited 2021 5th August]. Available from: http://seciss.facmed.unam.mx/wp-content/uploads/2021/02/Cloherty-and-Starks-Manual-of-Neonatal-Care-2021-.pdf
4. Seshiah V, Balaji V, Balaji MS, Sanjeevi CB, Green A. Gestational diabetes mellitus in India. J Assoc Physicians India. 2004 Sep;52:707–11.

5. Mohanty SK, Srivastava A. Out-of-pocket expenditure on institutional delivery in India. Health Policy Plan. 2013 May 1;28(3):247–62.
6. Catalano PM, McIntyre HD, Cruickshank JK, McCance DR, Dyer AR, Metzger BE, *et al.* The hyperglycemia and adverse pregnancy outcome study: associations of GDM and obesity with pregnancy outcomes. Diabetes Care. 2012 Apr;35(4):780–6.
7. Simmons D. Epidemiology of Diabetes in Pregnancy. In: A Practical Manual of Diabetes in Pregnancy [Internet]. John Wiley & Sons, Ltd; 2017 [cited 2021 5th August]. p. 1–16. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1002/9781119043805.ch1
8. Allen VM, Armson BA, GENETICS COMMITTEE, MATERNAL FETAL MEDICINE COMMITTEE. Teratogenicity associated with pre-existing and gestational diabetes. J Obstet Gynaecol Can JOGC J Obstet Gynecol Can JOGC. 2007 Nov;29(11):927–34.
9. Kliegman R, Stanton B, St. Geme JW, Schor NF, Behrman RE, Nelson WE. Nelson textbook of pediatrics [Internet]. 2016 [cited 2021 5th August]. Available from: https://www.clinicalkey.com/dura/browse/bookChapter/3-s2.0-C20120035867
10. Crowther CA, Hiller JE, Moss JR, McPhee AJ, Jeffries WS, Robinson JS, *et al.* Effect of treatment of gestational diabetes mellitus on pregnancy outcomes. N Engl J Med. 2005 Jun 16;352(24):2477–86.
11. Hay WW, Raju TNK, Higgins RD, Kalhan SC, Devaskar SU. Knowledge Gaps and Research Needs for Understanding and Treating Neonatal Hypoglycemia: Workshop Report from Eunice Kennedy Shriver National Institute of Child Health and Human Development. J Pediatr. 2009 Nov;155(5):10.1016/j.jpeds.2009.06.044.
12. Macrosomia: ACOG Practice Bulletin Summary, Number 216. Obstet Gynecol. 2020 Jan;135(1):246–8.
13. full-guideline-245411821.pdf [Internet]. [cited 2021 5th August]. Available from: https://www.nice.org.uk/guidance/cg98/evidence/full-guideline-245411821
14. Ogurtsova K, da Rocha Fernandes JD, Huang Y, Linnenkamp U, Guariguata L, Cho NH, *et al.* IDF Diabetes Atlas: Global estimates for the prevalence of diabetes for 2015 and 2040. Diabetes Res Clin Pract. 2017 Jun;128:40–50.
15. Chu SY, Callaghan WM, Kim SY, Schmid CH, Lau J, England LJ, *et al.* Maternal obesity and risk of gestational diabetes mellitus. Diabetes Care. 2007 Aug;30(8):2070–6.
16. Gorgal R, Gonçalves E, Barros M, Namora G, Magalhães A, Rodrigues T, *et al.* Gestational diabetes mellitus: a risk factor for non-elective cesarean section. J Obstet Gynaecol Res. 2012 Jan;38(1):154–9.
17. Remsberg KE, McKeown RE, McFarland KF, Irwin LS. Diabetes in pregnancy and cesarean delivery. Diabetes Care. 1999 Sep;22(9):1561–7.
18. Hedderson MM, Ferrara A, Sacks DA. Gestational diabetes mellitus and lesser degrees of pregnancy hyperglycemia: association with increased risk of spontaneous preterm birth. Obstet Gynecol. 2003 Oct;102(4):850–6.
19. Yogev Y, Langer O. Spontaneous preterm delivery and gestational diabetes: the impact of glycemic control. Arch Gynecol Obstet. 2007 Oct;276(4):361–5.
20. Stanescu A, Stoicescu S. Neonatal hypoglycemia screening in newborns from diabetic mothers - Arguments and controversies-. J Med Life. 2014;7(Spec Iss 3):51–2.
21. Ijäs H, Vääräsmäki M, Morin-Papunen L, Keravuo R, Ebeling T, Saarela T, *et al.* Metformin should be considered in the treatment of gestational diabetes: a prospective randomised study. BJOG Int J Obstet Gynaecol. 2011 Jun;118(7):880–5.
22. Voormolen DN, Wit L de, Rijn BB van, DeVries JH, Heringa MP, Franx A, *et al.* Neonatal Hypoglycemia Following Diet-Controlled and Insulin-Treated Gestational Diabetes Mellitus. Diabetes Care. 2018 Jul 1;41(7):1385–90.
23. Cordero L, Treuer SH, Landon MB, Gabbe SG. Management of infants of diabetic mothers. Arch Pediatr Adolesc Med. 1998 Mar;152(3):249–54.
24. ROSENSTEIN MG, CHENG YW, SNOWDEN JM, NICHOLSON JA, DOSS AE, CAUGHEY AB. The Risk of Stillbirth and Infant Death Stratified by Gestational Age in Women with Gestational Diabetes. Am J Obstet Gynecol. 2012 Apr;206(4):309.e1-309.e7.
25. Temple R, Aldridge V, Greenwood R, Heyburn P, Sampson M, Stanley K. Association between outcome of pregnancy and glycaemic control in early pregnancy in type 1 diabetes: population based study. BMJ. 2002 Nov 30;325(7375):1275–6.

https://doi.org/10.46389/rjd-2023-1137