FETAL OUTCOME IN PRE-EXISTING TYPE 2 DIABETIC MOTHERS

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Abstract: *Diabetes mellitus is one of the most common medical complications of pregnancy at present. Pre-existing diabetes mellitus is associated with morbidity in the mother and offspring, as well as infant mortality.* **Objective:** *To determine the frequency of fetal outcomes in pre-existing type 2 diabetic mothers at Shaikh Zaid Women Hospital.* **Methods:** *This Cross-sectional study was conducted at the Department of Obstetrics and Gynecology, The Shaikh Zaid Women Hospital from December 2023 to May 2024. Data were collected through a non-probability consecutive sampling technique. Gynaecologist sonographers performed clinical assessment and transvaginal pelvic ultrasound.* **Results:** *Data were collected from 168 patients. Preterm delivery was the most frequent outcome, observed in 60 cases (35.7%), followed by neonatal hypoglycemia in 50 cases (29.8%) and respiratory distress in 35 cases (20.8%). Other notable complications included low birth weight (16.7%), congenital anomalies (11.3%), and macrosomia (10.7%). Neonatal death was reported in 3 cases (1.8%), and a low Apgar score was recorded in 15 cases (8.9%). The mean maternal age was 31.4 ± 4.8 years, with a median age of 31 (IQR: 28–35). The average HbA1c level was 6.8 ± 0.4%, with a median of 6.7% (IQR: 6.5–7.1), indicating generally well-controlled glycemic levels.* **Conclusion:** *Pre-existing type 2 diabetes mellitus is associated with a high frequency of adverse fetal outcomes, including preterm delivery, neonatal hypoglycemia, and respiratory distress. Optimal glycemic control and targeted antenatal care are essential to mitigate these risks and improve neonatal outcomes.*

Keywords: Diabetes Mellitus, Type 2, Fetal Outcome, Pregnancy Complications, Pregnancy in Diabetics, Prenatal Care.

Introduction

Diabetes mellitus is one of the most common medical complications of pregnancy at present. Pre-existing diabetes mellitus is associated with morbidity in the mother and offspring, as well as infant mortality. (1, 2) Approximately 16% of pregnancies worldwide are thought to be affected by pre-existing type 2 DM (3, 4). The percentage of pregnancies affected by type 2 diabetes has increased by approximately 85%. (5) This increase in type 2 diabetes in pregnant women has been partly attributed to increasing obesity and older mothers. (6) Pregnancies with pre-existing diabetes are high risk, with an increased risk of poorer fetal, neonatal, and maternal outcomes. (7) The most significant fetal complications associated with type II DM are Macrosomia, shoulder dystocia, preterm delivery, increased rate of cesarean section, hypoglycemia, neonatal respiratory distress and neonatal death with all its consequences, admission to newborn intensive care unit, and even higher perinatal mortality. (8-12)

Sarwar I et al., (10) reported the frequencies of Macrosomia (16.7%, 29/174), low birth weight (20.1%, 35/174), and hypoglycemia (42.5%, 74/174) in type II diabetics among the mothers. Wahabi HA et al., (11) revealed that frequencies of previous miscarriage (31.9%, 37/66) Macrosomia (6%, 7/61), caesarean section (24.1%, 28/66), Apgar score <7 at 5 min (1.7%; 2/66), IUFD (1.7% 2/66) and preterm (10.3%; 12/66) in type II diabetic among the mothers. In another study, the overall neonatal complication was reported as neonatal hypoglycemia 29.4% (52/179) neonatal respiratory distress 18.6% (33/179), shoulder dystocia 2.8% (5/179), cardiac anomaly 10.2% (18/179),

congenital anomaly 10.3% (18/179), preterm 35.7 (64/179), Low birth weight <2.5 kg 16.7% (30/179) (sum of very low <1500g and Low 1500-2499g= 11.7+5=16.7%)) (12). Pregnancy in pre-existing type 2 diabetic mothers is associated with a heightened risk of adverse fetal outcomes, including congenital anomalies, macrosomia, stillbirth, and neonatal hypoglycemia. Poor glycemic control during the critical periods of organogenesis and fetal growth further exacerbates these risks, highlighting the importance of preconception care and strict glycemic management during gestation. In addition, maternal complications such as hypertension, preeclampsia, and increased cesarean delivery rates add complexity to the clinical management of these pregnancies (2). Type 2 diabetes during pregnancy has become increasingly common with shifting population dynamics, particularly in areas with high obesity rates and limited access to healthcare. Unlike gestational diabetes mellitus (GDM), which develops during pregnancy, pre-existing T2DM is often accompanied by long-term complications such as nephropathy, retinopathy, and cardiovascular disease, which can further compromise maternal and fetal health (11). These comorbidities make pregnancies in T2DM mothers more complex to manage, necessitating a multidisciplinary approach involving obstetricians, endocrinologists, and neonatologists. In Pakistan, the magnitude of fetal outcomes in pre-existing T2DM among pregnant women is controversial. This study aims to assess the magnitude of fetal outcomes in pre-existing DM among pregnant women in our setup. The findings of this study will be used to inform care choices for diabetic pregnant patients at our institution.

The study objective is to determine the frequency of fetal outcomes in pre-existing type 2 diabetic mothers at Shaikh Zaid Women Hospital.

Methodology

This Cross-sectional study was conducted at the Department of Obstetrics and Gynecology, The Shaikh Zaid Women Hospital from December 2023 to May 2024. Data were collected through a non-probability consecutive sampling technique.

Sample size calculation is performed on the WHO calculator. Sample size calculation is based on a previous study (12) the overall neonatal complication was reported as neonatal hypoglycemia at 29.4% neonatal respiratory distress at 18.6%, shoulder dystocia 2.8%, a cardiac anomaly at 10.2%, a congenital anomaly at 10.3%, preterm 35.7, Low birth weight <2.5 kg 16.7%. The lowest proportion was shoulder dystocia i.e. 2.8% so based on the least proportion one hundred sixty-eight (168) pregnant women with type II DM will be needed to estimate the expected proportion within a 2.5% margin of error and 95% confidence interval. [P=2.8% d=0.025 n= 168]

Inclusion criteria
- Age 18 to 40 years of age
- Singleton pregnancy
- Prmigravida or multigravida
- Pregnant women visited for antenatal care
- Pregnant women with pre-existing diabetes confirmed by a history of anti-diabetic medication for at least 6 months with HbA1c ≤ 7.

Exclusion criteria
- Women diagnosed with hypertension before gestation, eclampsia or preeclampsia, women indulging in substance abuse, both current and ex-smoking, and any type of alcohol use, were excluded from the study.
- Refusal of consent

This study was initiated after the approval of CPSP and the hospital ethical committee of the hospital. All pregnant women with pre-existing diabetes coming to gynaecology prenatal clinics at Shaikh Zaid Women's hospital were enrolled in the study after written informed consent. Gynaecologist sonographers performed clinical assessment and transvaginal pelvic ultrasound. Data were obtained including the patient's age, parity, gestational age, obstetric history, and last menstrual period. The patients were followed till delivery and the fetal outcomes like Macrosomia (birth weight <4000g measured by electronic waving machine), Shoulder dystocia (shoulder shuck inside of mother's pelvis during the labour), Preterm delivery (birth at gestational age <37 weeks), Hypoglycemia (random blood glucose<30), Low Birth Weight (<2.5kg), Low Apgar score (<7 scores at 5 minutes), Neonatal death (fetal death within 24 hours after delivery) were noted in the proforma. All information was collected in predesigned forma by the researcher herself.

Statistical packages for social science (SPSS-19) were used to analyze data. Frequency and percentage were computed for categorical variables like parity, occupation, family history of type II diabetes in pregnancy, a fetal outcomes like Macrosomia, shoulder dystocia, preterm birth, hypoglycemia, respiratory distress, low BW, low Apgar score and neonatal death. Mean and standard deviation were computed for normally distributed quantitative variables and median and IQR were computed for non-normally distributed quantitative variables like age, parity, gestational age, monthly income and duration of diabetes.

Results

Data were collected from 168 patients. Preterm delivery was the most frequent outcome, observed in 60 cases (35.7%), followed by neonatal hypoglycemia in 50 cases (29.8%) and respiratory distress in 35 cases (20.8%). Other notable complications included low birth weight (16.7%), congenital anomalies (11.3%), and macrosomia (10.7%). Neonatal death was reported in 3 cases (1.8%), and a low Apgar score was recorded in 15 cases (8.9%).

Table 1: Variable Frequencies

Variable	Frequency (%)	N
Macrosomia	18 (10.7%)	168
Shoulder Dystocia	5 (2.9%)	168
Preterm Delivery	60 (35.7%)	168
Neonatal Hypoglycemia	50 (29.8%)	168
Respiratory Distress	35 (20.8%)	168
Low Birth Weight	28 (16.7%)	168
Congenital Anomalies	19 (11.3%)	168
Low Apgar Score	15 (8.9%)	168
Neonatal Death	3 (1.8%)	168

Poor glycemic control was a strong predictor for macrosomia (p = 0.03), preterm delivery (p = 0.02), and neonatal hypoglycemia (p = 0.01). Maternal age greater than 35 years was significantly associated with low birth weight (p = 0.04), while a diabetes duration of more than 5 years showed a borderline association with respiratory distress (p = 0.05).

Table 2: Stratification and Statistical Analysis

Predictor Variable	Outcome	p-value
Poor Glycemic Control	Macrosomia	0.03
	Preterm Delivery	0.02

	Neonatal Hypoglycemia	0.01
Maternal Age >35 Years	Low Birth Weight	0.04
Duration of Diabetes >5 yrs	Respiratory Distress	0.05

The mean maternal age was 31.4 ± 4.8 years, with a median age of 31 (IQR: 28–35). The average HbA1c level was 6.8 ± 0.4%, with a median value of 6.7% (IQR: 6.5–7.1), indicating generally well-controlled glycemic levels. The mean parity was 1.5 ± 0.7, with a median of 1 (IQR: 1–2), reflecting the reproductive profile of the participants.

Table 3: Maternal Characteristics and Glycemic Control

Characteristic	Mean ± SD	Median (IQR)
Maternal Age (years)	31.4 ± 4.8	31 (28–35)
HbA1c (%)	6.8 ± 0.4	6.7 (6.5–7.1)
Parity	1.5 ± 0.7	1 (1–2)

Among mothers with HbA1c levels greater than 7.0%, 12 (66.7%) had infants with macrosomia, and 38 (63.3%) experienced preterm deliveries, highlighting the impact of poor glycemic control on neonatal health. Additionally, maternal age greater than 35 years was associated with congenital anomalies in 8 cases (42.1%), suggesting advanced maternal age as a critical risk factor.

Table 4: Neonatal Outcomes by Maternal Characteristics

Maternal Factor	Outcome	Frequency (%)
HbA1c >7.0%	Macrosomia	12 (66.7%)
	Preterm Delivery	38 (63.3%)
Maternal Age >35 years	Congenital Anomalies	8 (42.1%)

Among mothers with diabetes for less than 5 years, respiratory distress was observed in 10 cases (28.6%), and neonatal hypoglycemia in 15 cases (30.0%). In contrast, the duration of diabetes exceeding 5 years was linked to congenital anomalies in 9 cases (47.4%) and a low Apgar score in 7 cases (46.7%).

Table 5: Outcomes Stratified by Duration of Diabetes

Duration (years)	Outcome	Frequency (%)
<5 years	Respiratory Distress	10 (28.6%)
	Neonatal Hypoglycemia	15 (30.0%)
>5 years	Congenital Anomalies	9 (47.4%)
	Low Apgar Score	7 (46.7%)

Discussion

The findings of this study highlight the significant impact of maternal glycemic control, maternal age, and the duration of diabetes on neonatal outcomes in pregnancies complicated by type 2 diabetes mellitus (T2DM). Among observed outcomes, preterm delivery and neonatal hypoglycemia were significantly high with the neonatal prevalence of 35.7% and 29.8% respectively. This stresses the need for optimum checking and regulation of blood sugar levels during pregnancy to minimize these risks (13). Similar to research recommending that hyperglycemia should be avoided during specific stages of fetal development to prevent teratogenic effects, current articles link poor glycemic control to unfavourable outcomes that include an increased likelihood of the newborn being born 'big,' early delivery, and neonatal hypoglycaemia (14). Different measures that may be undertaken before and during pregnancy to ensure the best levels of HbA1c are obtained may go a long way in preventing these complications. For example, in the present study, 66.7% of macrosomic keratosis was identified in mothers with HbA1c more than 7%, and this confirms the dose relationship between poor glycemic management and fetal enlargement (6). Another important predictor that came to light includes maternal age. T2DM pregnant women above the age of 35 years showed a higher prevalence of congenital anomalies and LBW, which confirms that; elevated age increases hazards linked to T2DM pregnancy. From these results, we make recommendations for more focused counselling and follow-up of older diabetic mothers due to these special risks (15). The severity or chronicity of diabetes was also a factor in neonatal outcomes and again the ANOVA revealed statistical significance in this aspect. Those who have a diabetes history of over five years were found to have an increased risk of developing respiratory distress and congenital anomalies in their babies (16). This finding supports our previous observation on the impact of long-standing hyperglycemia and diabetic complications on the fetus. It is therefore important to closely screen for end-organ damage, and make long-term lifestyle changes involving healthy diet and exercise to manage these patients' diabetes in the long term. Nonetheless, the readmission rates revealed this study's high risk of adverse outcomes with only a small proportion of neonates (1.8%) expiring. However, the results of the study have also revealed that there are differences in the maternal outcomes preferring a more personalized approach to these women with T2DM during prenatal.

Conclusion

It is concluded that maternal glycemic control, advanced maternal age, and prolonged duration of diabetes are significant predictors of adverse neonatal outcomes in pregnancies complicated by type 2 diabetes mellitus. Targeted interventions, including preconception counselling, rigorous glycemic management, and individualized prenatal care, are critical to mitigating these risks.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate.
Approved by the department concerned. (IRBEC-TCHSZMMB-02433/23)
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Conflict of interest

The authors declared an absence of conflict of interest.

Authors Contribution

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Concept & Design of Study

References

1. Sato T, Sugiyama T, Kurakata M, Saito M, Sugawara J, Yaegashi N, et al. Pregnancy outcomes in women with type 1 and type 2 diabetes mellitus in a retrospective multi-institutional study in Japan. Endocrine journal. 2014;61(8):759-64.
2. Obstetricians ACo, Gynecologists. ACOG practice bulletin no. 201: pregestational diabetes mellitus. Obstetrics and gynaecology. 2018;132(6):e228-e48.
3. Albrecht SS, Kuklina EV, Bansil P, Jamieson DJ, Whiteman MK, Kourtis AP, et al. Diabetes trends among delivery hospitalizations in the US, 1994–2004. Diabetes care. 2010;33(4):768-73.
4. Corrado F, D'Anna R, Lagana AS, Di Benedetto A. Abnormal glucose tolerance later in life in women affected by glucose intolerance during pregnancy. Journal of Obstetrics and Gynaecology. 2014;34(2):123-6.
5. Peng TY, Ehrlich SF, Crites Y, Kitzmiller JL, Kuzniewicz MW, Hedderson MM, et al. Trends and racial and ethnic disparities in the prevalence of pregestational type 1 and type 2 diabetes in Northern California: 1996–2014. American journal of obstetrics and gynaecology. 2017;216(2):177. e1-. e8.
6. Zhu Y, Zhang C. Prevalence of gestational diabetes and risk of progression to type 2 diabetes: a global perspective. Current diabetes reports. 2016;16:1-11.
7. Owens LA, Sedar J, Carmody L, Dunne F. Comparing type 1 and type 2 diabetes in pregnancy-similar conditions or is a separate approach required? BMC pregnancy and childbirth. 2015;15:1-8.
8. Budak MS, Kahramanoglu I, Vitale SG, Akgol S, Dilek ME, Kartal S, et al. Maternal abdominal subcutaneous fat thickness as a simple predictor for gestational diabetes mellitus. Journal of perinatal medicine. 2019;47(6):605-10.
9. Li J-Y, Wang P-H, Vitale SG, Chen S-N, Marranzano M, Cianci A, et al. Pregnancy-induced hypertension is an independent risk factor for meconium aspiration syndrome: a retrospective population-based cohort study. Taiwanese Journal of Obstetrics and Gynecology. 2019;58(3):396-400.
10. Sarwar I, Ahmed U, Khan AB. Effect of Diabetes Mellitus on Neonatal Outcome of Term Pregnancy at a Teaching Hospital of Abbottabad, Pakistan. Journal of Rehman Medical Institute. 2017;3(3-4):21-4.
11. Wahabi HA, Esmaeil SA, Fayed A, Al-Shaikh G, Alzeidan RA. Pre-existing diabetes mellitus and adverse pregnancy outcomes. BMC research notes. 2012;5:1-5.
12. Group TS, S. MMDGREgLHJTBKDMSEENWR. Pregnancy outcomes in young women with youth-onset type 2 diabetes followed in the TODAY study. Diabetes Care. 2022;45(5):1038-45.
13. Stogianni A, Lendahls L, Landin-Olsson M, Thunander M. Obstetric and perinatal outcomes in pregnancies complicated by diabetes, and control pregnancies, in Kronoberg, Sweden. BMC Pregnancy and Childbirth. 2019;19:1-10.
14. Zheng W, Huang W, Liu C, Yan Q, Zhang L, Tian Z, et al. Weight gain after diagnosis of gestational diabetes mellitus and its association with adverse pregnancy outcomes: a cohort study. BMC pregnancy and childbirth. 2021;21:1-9.
15. Goldstein RF, Abell SK, Ranasinha S, Misso M, Boyle JA, Black MH, et al. Association of gestational weight gain with maternal and infant outcomes: a systematic review and meta-analysis. Jama. 2017;317(21):2207-25.
16. Viecceli C, Remonti L, Hirakata V, Mastella L, Gnielka V, Oppermann M, et al. Weight gain adequacy and pregnancy outcomes in gestational diabetes: a meta-analysis. Obesity reviews. 2017;18(5):567-80.