

Effects of Type 2 Diabetes on Pregnant Women and Newborns.

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Abstract: Type 2 diabetes during pregnancy is increasingly common and is associated with significant risks for both maternal and neonatal health outcomes as well as Understanding these risks can help improve management and care strategies, and the aim of the study was a analyze the impact of type 2 diabetes on maternal complications and newborn health outcomes, emphasizing the necessity for effective education and management interventions as well as Study Design were This prospective cohort study evaluated 122 pregnant women aged 18-45 years, diagnosed with type 2 diabetes before pregnancy in addition to Data was collected at various prenatal visits, focusing on maternal health outcomes, neonatal health outcomes, and the need for diabetes education, also Statistical analyses, including descriptive statistics and regression analyses, were conducted using SPSS version 26. The results which found were Maternal complications included gestational hypertension (32.8%), pre-eclampsia (8.2%), and cesarean delivery (36.9%) in addition to Newborns presented with low birth weight (16.4%) and macrosomia (24.6%). At follow-up, 8.2% of newborns showed developmental delays, where approximately 49.2% of mothers expressed a need for nutritional counseling and 45.1% for diabetes management training.Finally, in Type 2 diabetes significantly impacts maternal and newborn health. Effective management strategies, combined with educational support, are essential for improving health outcomes for mothers and their children.

Keywords: Pregnant, Women, Newborns, Type 2 Diabetes, Pregnancy, Hypertension.

INTRODUCTION

Pregnancy with diabetes should be planned. This is the most ideal case for the attending physician; for patients with type 1 diabetes, it is advisable to switch to an insulin pump even before planning a pregnancy, at least 6 months before the planned pregnancy, and wait for stable compensation and the absence of complications progression. With type 2 diabetes, it is also advisable to switch to insulin therapy at the stage of pregnancy planning since taking hypoglycemic tablets during pregnancy itself is contraindicated (Egan, A. M, *et al.*, 2015; Feig, D. S, *et al.*, 2020). At the stage of pregnancy planning, it is necessary to achieve stable compensation (achievement of target glucose and glycated hemoglobin levels) and the absence of severe vascular complications - primarily from the kidneys and vision. Diabetic nephropathy, already existing before pregnancy, can greatly complicate this pregnancy, up to the development of renal failure (ACOG Practice Bulletin No. 2018; Newman, C, *et al.*, 2023). The most common complications of diabetes are stillbirth, miscarriage, preterm birth, high blood pressure, and preeclampsia and. For the baby's health, the risks are directly linked to the mother's blood sugar level, where High blood sugar levels early in pregnancy are associated with the risk of birth defects. Later in pregnancy, high blood sugar can lead to conditions such as macrosomia, which is associated with complications during delivery

and the risk of caesarean delivery. These babies are also at risk of obesity and developing type 2 diabetes later in life (Murphy, H. R, *et al.*, 2021). Women with type 1 diabetes are also at risk of giving birth to a child with a predisposition to diabetes, but the probability of this occurring is only 6%. The hormonal changes that occur during pregnancy are associated with an increased production of a large number of steroid hormones. Some of these, such as cortisol and progesterone, have a significant effect on cell receptors, increasing their resistance to insulin. This leads to elevated blood glucose levels and requires a significant increase in insulin production from the pancreas. In cases where the pancreas' compensatory capabilities are insufficient, glucose metabolism spirals out of control, and a condition called gestational diabetes develops (Ringholm, L, *et al.*, 2018; Phelps, R. L, *et al.*, 1981).

This condition is very common. Between 3 and 10% of pregnant women are at risk of developing pathological insulin resistance, leading to gestational diabetes (Parsons, J. A, *et al.*, 1992). Unlike diabetes diagnosed before pregnancy, pathological insulin resistance that develops during pregnancy does not cause fetal abnormalities and, in most cases, does not require insulin treatment (Parsons, J. A, *et al.*, 1992). However, untreated, gestational diabetes can significantly complicate the course of pregnancy (Ryan, E. A, *et al.*, 1985;

Chiefari, E., et al., 2017; HAPO Study Cooperative Research Group. Metzger, et al., 2018;). Typically, type 1 or 2 diabetes does not negatively affect a woman's fertility. If a woman with diabetes has difficulty conceiving, she often develops an additional condition, such as polycystic ovary syndrome (PCOS). This hormonal imbalance causes menstrual irregularities and can lead to infertility (Egan, A. M, et al., 2017; Salinas-Roca, B, et al., 2022). If PCOS is associated with type 2 diabetes and obesity, weight loss may actually have a positive effect. Once a woman reaches normal weight, her metabolism and menstrual cycles often return to normal (Mansur, J. L, et al., 2022).

METHODOLOGY

Study Design

This research employed a prospective cohort study to determine the impact of type 2 diabetes on neonatal and maternal outcomes during pregnancy where in. This was carried out for 18 months in a high-risk obstetric clinic, where 122 pregnant women with type 2 diabetes were recruited as a cohort; however, They were aged 18-45 years and at least 16 weeks gestation at recruitment. Additionally Inclusion criteria were a known diagnosis of type 2 diabetes before pregnancy and willingness to take part in the study; women with gestational diabetes or other complications of pregnancy before pregnancy were excluded.

Data Collection

Data were collected at several time points during the prenatal care visits of the participants. Data collected were as follows were: Demographic information: Age, ethnicity, socioeconomic status, and previous medical history were obtained by structured interview and medical records, but Maternal Health Outcomes: Clinical results like blood pressure, body mass index (BMI), and HbA1c levels were recorded during routine follow-ups Complications like gestational hypertension, pre-eclampsia, and cesarean sections were collected from medical records of the participants. Newborn Health Outcomes were evaluated at birth for weight, length, and congenital anomalies, and 6-month postpartum follow-up was done to evaluate developmental milestones and overall health in addition to

Follow-Up for Maternal and Newborn Health were. The postpartum complications were tracked in the first 6 weeks after birth by follow-up visits and telephone interviews as well as The results that were measured were the development of complications in the newborns and mothers, blood sugar control during pregnancy, and educational needs for diabetes control during pregnancy.

Statistical Analysis

Statistical analysis was done using SPSS (Statistical Package for the Social Sciences) version 26. Descriptive statistics were determined to explain clinical outcomes and demographic factors, and Continuous variables like HbA1c and age were expressed as mean $\pm$ standard deviation (SD), while categorical variables like the incidence of complications were expressed as frequencies and percentages despite of analyzing correlations among type 2 diabetes complications and maternal/newborn outcomes, chi-square tests for categorical variables and Student's t-tests for continuous variables were employed and For all the tests, a p-value of <0.05 was deemed to be statistically significant. Multivariable logistic regression analyses were run to assess the risk factors for maternal and newborn adverse outcomes, adjusting for confounding effects of age, BMI, and diabetes duration which the models were constructed stepwise, adding significant covariates in the final mode Furthermore, sensitivity analyses were carried out to test the robustness of findings.

RESULTS

The Features and specifications of data indicating the ages of the participants reveal a notable distribution across different age groups. The majority of women were between 25 and 34 years (41%), followed by the 35 to 44 range (32.8%), suggesting that type 2 diabetes is increasingly prevalent in women of reproductive age where this results of age demographic highlights the need for targeted prenatal care and diabetes education focused on older reproductive-age women, who possibly face heightened risks of pregnancy complications due to age-related factors and existing metabolic conditions.

Table 1: Demographics of Study Participants

Demographic Factor	Number of Patients (n=122)	Percentage (%)
Age (18-24 years)	10	8.2
Age (25-34 years)	50	41.0
Age (35-44 years)	40	32.8
Age (45+ years)	22	18.0

The number of diabetes complications seen in the current cohort is alarming. 24.6% were found with hypertension, and 12.3% suffered from neuropathy and. Hypertension, especially gestational hypertension, is a leading contributor to poor maternal and fetal outcomes where Neuropathy, in a worst-case scenario, could limit the individual's self-management of their diabetes, potentially

increasing their risk for poor glycemic control. However, The heterogeneity of the data underscores the importance of early and regular screening for diabetes-related complications in pregnant women and the need for comprehensive management in respect of managing hypertension and other complications during pregnancy.

Table 2: Prevalence of Type 2 Diabetes Complications

Complication	Number of Patients (n=122)	Percentage (%)
Hypertension	30	24.6
Neuropathy	15	12.3
Retinopathy	10	8.2
Kidney Disease	8	6.6
Cardiovascular Issues	5	4.1

Type 2 diabetes significantly affected maternal health: 32.8% experienced gestational hypertension, and 36.9% did not forget to note they had an elective and/or emergent cesarean delivery. Additionally, the Reason for Cesarean delivery includes complications and macrosomia; this was anticipated. Again, as a reminder, the independent risk factor of pre-eclampsia (8.2%)

indicated the necessity for vigilant and monitored surveillance of hypertensive disorders in those the diabetic population where. Accordingly, these findings highlight a significant gap in optimizing prenatal care and monitoring plans for pregnant women with type 2 diabetes to improve maternal outcomes.

Table 3: Maternal Health Effects

Health Effect	Number of Patients (n=122)	Percentage (%)
Gestational Hypertension	40	32.8
Pre-eclampsia	10	8.2
Increased Infection Risk	15	12.3
Cesarean Delivery	45	36.9

The health of newborns showed varying outcomes, with 16.4% classified as low birth weight and 24.6% as macrosomic, even that Both conditions present significant health risks; low birth weight is associated with increased mortality and long-term developmental issues, while macrosomia increases the likelihood of birth trauma and cesarean delivery while that The necessity for tailored prenatal nutrition and glycemic control strategies is evident, as these factors play vital roles in mitigating adverse newborn outcomes. Importantly, the incidence of respiratory distress and the need for neonatal intensive care further reveal the complex interplay between maternal

diabetes and infant health as well as Congenital anomalies, though relatively low in incidence, are critical concerns in pregnancies complicated by diabetes, with 4.1% of newborns exhibiting cardiovascular defects. This emphasizes the teratogenic effects of poorly controlled diabetes, particularly during the first trimester when organogenesis occurs then. The data imply that stringent glycemic control before and during early pregnancy could reduce the risk of congenital malformations, reinforcing the need for preconception counseling in women with type 2 diabetes.

Table 4: Newborn Health Outcomes and Anomaly Type

Outcome	Number of Newborns (n=122)	Percentage (%)
Low Birth Weight	20	16.4
Macrosomia	30	24.6
Respiratory Distress	10	8.2
Neonatal Intensive Care	15	12.3
Anomaly Type	Number of Newborns (n=122)	Percentage (%)
Cardiovascular Defects	5	4.1

Neural Tube Defects	3	2.5
Gastrointestinal Defects	2	1.6
Urinary Tract Defects	2	1.6

Table 5: Maternal Glycemic Control During Pregnancy

Glycemic Control Level	Number of Patients (n=122)	Percentage (%)
Well Controlled	40	32.8
Moderately Controlled	50	41.0
Poorly Controlled	32	26.2

The incidence of postpartum complications such as infection (16.4%) and mental health issues (12.3%) reflects ongoing health challenges faced by women following childbirth. This highlights the significance of comprehensive postpartum care beyond immediate delivery and indicates the importance of mental health support following the physical and emotional toll that managing diabetes during pregnancy can entail where in. These results affirm the need for integrated care models that address both physical and psychological components of recovery in the postpartum period for women with type 2 diabetes where also At the

6-month follow-up, 8.2% of newborns showed developmental delays, while 79.5% exhibited no issues. Developmental milestones are crucial indicators of early childhood well-being, and the observed delays may be linked to the complexities introduced during pregnancy with maternal diabetes despite of. This illustrates the necessity of early intervention programs and monitoring systems to identify developmental risks early on. Subsequent assessments should maintain a focus on tracking the developmental trajectories of infants born to mothers with type 2 diabetes to ensure timely support.

Table 6: Postpartum Complications and Follow-Up on Newborns' Health at 6 Months

Complication	Number of Patients (n=122)	Percentage (%)
Infection	20	16.4
Hemorrhage	5	4.1
Mental Health Issues	15	12.3
Health Issues	Number of Newborns (n=122)	Percentage (%)
Developmental Delays	10	8.2
Weight Issues	15	12.3
No Issues	97	79.5

The respondents indicated a considerable desire for education, with approximately half (49.2%) asking for nutritional counselling and 45.1% asking for diabetes management training. This indicates a severe gap in the delivery of education to diabetic women in pregnancy, suggesting that

educational interventions need to be structured, and by providing educational interventions focused on nutrition and diabetes management, healthcare providers can strengthen women to use the tools to manage their pregnancy, their health and their diabetes.

Table 7: Education and Support Needs

Support Type	Number of Patients (n=122)	Percentage (%)
Nutritional Counseling	60	49.2
Diabetes Management Training	55	45.1
Mental Health Support	25	20.5

Long-term monitoring recommendations indicate that a large number of participants (65.6%) wish to engage in ongoing blood sugar monitoring. This indicates that participants valued ongoing diabetes management and a degree of information about the chronic nature of their disease. Moreover, pediatric follow-ups for newborns (73.8%) demonstrate

some level of understanding about the long-lasting effects of maternal diabetes on child health. In this respect, long-term monitoring strategies with a focus on maternal and child health outcomes will reduce risks and enhance the quality of life for both mother and child.

Table 8: Long-term Monitoring Recommendations

Recommendation	Number of Patients (n=122)	Percentage (%)
Regular Blood Sugar Monitoring	80	65.6
Annual Health Check-ups	60	49.2
Pediatric Follow-Up for Newborns	90	73.8

DISCUSSION

In recent years, there has been considerable interest in the relationship between type 2 diabetes mellitus (GDM) and maternal and neonatal health. The findings of this study confirm previous studies showing that type 2 diabetes poses a significant risk to maternal and neonatal health where. This study aims to shed light on underlying trends, particularly with regard to demographic factors, the impact of maternal health neonatal health, and the need for health education programs, all of which have been reported in the literature. Our study showed a significant increase in the incidence of type 2 diabetes among women of reproductive age, particularly in the 25-34 age group. This supports the findings of Bellamy et al. (2009) (Bellamy, L., *et al.*, 2009), who reaffirmed the greater prevalence of diabetes among younger age groups. Similarly, the risk of maternal hypertension, which occurred in 32.8% of the study sample, is consistent with the findings of a broader review by Ye et al. (2018), which reported that pregnant women with diabetes are two to three times more likely to develop hypertensive disorders during pregnancy and according to Several justifications have been proposed for this relationship, including the need for careful monitoring of blood pressure and blood glucose levels during pregnancy where The high rate of cesarean sections observed in our study (36.9%) is consistent with the findings of Catalano (Catalano, P. M. 2010) who found increased rates of surgery in pregnancies complicated by diabetes which is high blood pressure and complications of asymmetric fetal growth necessitate cesarean sections, to ensure the health of both mother and infant. Our findings regarding the incidence of postpartum complications, such as infection and psychological illness, are consistent with the research by (V., Babenko, T. F., *et al.*, 2020). according to Vasilenko et al. (2020), which emphasizes the need for comprehensive postpartum care that includes physical recovery and mental health however The high rate of neonatal complications in our study, including low birth weight (16.4%) and fetal macrosomia (24.6%), confirms evidence from researchers studying gestational diabetes mellitus (GDM), such as the American College of Obstetricians and

Gynecologists (ACOG, 2020), which emphasizes the complex relationship between maternal blood glucose levels and fetal growth additionally to fetal macrosomia is a commonly observed phenomenon and is associated with several adverse outcomes, including birth trauma, prolonged labor, and an increased need for cesarean sections (Kc *et al.*, 2015) and The strong association between glycemic control and the occurrence of such complications suggests that developing better management strategies will be essential to enhance not only maternal health outcomes but also the well-being of the child (Owens, L. A., *et al.*, 2015; Oyen, N., *et al.*, 2016). Furthermore, the findings regarding congenital malformations, despite their low incidence of 4.1%, demonstrate the potentially severe risks of diabetes during pregnancy also according to Studies confirm that uncontrolled blood sugar levels can lead to teratogenic effects, especially during the first trimester of pregnancy (Corcoy *et al.*, 2016) which is analysis indicates the paramount importance of controlling blood sugar levels early enough, a finding confirmed by research showing that preconception care effectively reduces the incidence of congenital malformations (Hofmeyr *et al.*, 2015) with that One notable finding of our research was the high interest (49.2%) among participants in receiving nutritional education and advice on diabetes control where in This need for educational resources was supported by previous research in which Walsh et al. (2016) found that providing women with knowledge about diabetes control can effectively reduce pregnancy-related complications (Pectasides, M., and Kalva, S. 2011; Reece, E. A., and Homko, C. J. 2011; Ringholm, L., *et al.*, 2011; Ringholm, L., *et al.*, 2020; Seah, J. M., *et al.*, 2021). discovered Our research findings demonstrate that structured education programs can facilitate confidence and diabetes behaviors, which translates into better health outcomes for both mothers and children.

CONCLUSION

In conclusion, our results correspond closely with the growing body of literature examining the multifaceted effects of type 2 diabetes on maternal and newborn health in addition to The demographic trends and the associated

complexities regarding both maternal and neonatal health outcomes underscore the need for more adequate access to healthcare for pregnant women with diabetes as well as in this study refer to Education and supportive management programs are crucial components towards improving health outcomes for this population which Ongoing research and policy evolution will continue to minimize risk, address care gaps, and protect the health of mothers and their newborns in light of diabetes in pregnancy.

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