Original Research

Impact of Gestational Diabetes and Pre-existing Diabetes in Fetal Outcome among Pregnancy Cases of Rangpur

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Abstract

Introduction: *Diabetes in pregnancy, including gestational and pre-gestational diabetes, presents significant risks to both maternal and fetal health. Understanding the impact of these conditions on pregnancy outcomes is crucial for developing effective management strategies.*
Methods*: This observational comparative study involved 300 pregnant women at Rangpur Medical College Hospital, divided into three groups: pre-gestational diabetic (Group A), gestational diabetic (Group B), and non-diabetic control (Group C). Data on socio-demographic characteristics, obstetric profiles, mode of delivery, maternal complications, and fetal outcomes were collected and analyzed.*
Result: *The study meticulously analyzed socio-demographic characteristics, revealing no significant differences across the groups. In obstetric profiles, Group A (Pre-Gestational Diabetic) had a notably lower mean gestational age at delivery (36.06 ± 2.71 weeks) compared to Group B (Gestational Diabetic) and Group C (Control), with mean ages of 37.34± 1.12 and 38.46±1.13 weeks, respectively. Maternal complications were significantly higher in Group A at 47%, compared to 25% in Group B and 12% in Group C. Fetal outcomes showed marked variations: Group A had 95% stable births, 5% stillbirths, and 60% of neonates with Apgar scores ≤7 at 5 minutes. In contrast, Group B had 96% stable births, 4% stillbirths, and 27% of neonates with Apgar scores ≤7, while Group C reported 100% stable births and 11% with Apgar scores ≤7. Birth weight distribution indicated 24% of neonates in Group A weighed <2 kg, compared to 5% in Group B and 4% in Group C. NICU admissions were highest in Group A (44%), followed by Group B (29%) and Group C (11%). Perinatal complications like birth asphyxia (38% in Group A, 16% in Group B, 6% in Group C), hypoglycemia (22% in Group A, 10% in Group B, 4% in Group C), and hyperbilirubinemia (16% in Group A, 12% in Group B, 0% in Group C) were also significantly higher in diabetic groups.*
Conclusion: *The presence of gestational or pre-gestational diabetes in mothers significantly impacts fetal outcomes and increases the risk of maternal complications. This study highlights the need for specialized care and vigilant monitoring in pregnancies complicated by diabetes to improve health outcomes for mothers and babies.*

Introduction

Diabetes Mellitus, a complex group of metabolic diseases, is primarily characterized by chronic hyperglycemia resulting from insulin secretion or action defects. This condition is known to cause long-term damage to various organs, including the eyes, kidneys, nerves, heart, and blood vessels[1]. The intersection of diabetes with pregnancy, inherently a diabetogenic state, poses significant challenges in obstetrical care. Globally, the incidence of diabetes-related complications during pregnancy is on the rise, with gestational diabetes mellitus (GDM) representing a substantial proportion of these cases[2]. Defined by the World Health Organization as carbohydrate intolerance leading to hyperglycemia of varying severity first identified during pregnancy, GDM's prevalence is a growing concern worldwide[3]. In specific regions, such as Saudi Arabia and Bangladesh, the prevalence of pre-gestational diabetes mellitus (Pre-GDM) and GDM is notably high, underscoring the need for focused research in these areas[4,5]. The hormonal changes during pregnancy, particularly the increase in hormones like human placental lactogen and cortisol, exacerbate insulin resistance, a key factor in the development of GDM[6]. Pregestational and gestational diabetes not only share commonalities in insulin resistance but also in genetic susceptibility, further complicating their management and impact on pregnancy[7]. The interplay between Human Leucocytic Antigen G (HLA–G) and Nuclear factor kB (NF- kB) has been identified as a critical factor in the onset of GDM[8]. The degree of maternal hyperglycemia and its timing during pregnancy are crucial determinants of both maternal and fetal outcomes, with early uncontrolled hyperglycemia being particularly detrimental[9]. The implications of GDM extend beyond immediate pregnancy outcomes, encompassing a range of fetal and maternal morbidities and long-term health issues for both the mother and the child. Maternal complications can include conditions like pre-eclampsia and polyhydramnios, while fetal complications range from macrosomia to various metabolic challenges[10]. The risk of congenital anomalies is notably linked to glycemic control during critical early pregnancy stages[11]. Long-standing pregestational diabetes can lead to vascular complications, adversely affecting the uteroplacental unit and potentially leading to intrauterine growth restriction (IUGR) and maternal hypertension[12]. Diabetes also disrupts lipid metabolism, which can have significant implications for fetal development[13]. Furthermore, women with a history of GDM face a heightened risk of developing diabetes in later life, with a substantial recurrence risk in subsequent pregnancies, particularly among high-risk groups [14]. This study is conducted to investigate the maternal and fetal outcomes in pregnancies complicated by pre-gestational and gestational diabetes mellitus. By adopting an observational comparative approach, this research aims to enhance our understanding of the impact of these diabetic conditions on fetal outcomes, with a particular focus on the region of Rangpur. The insights gained from this study are expected to contribute significantly to clinical practice, offering guidance for interventions aimed at improving feto-maternal health outcomes.

Methods

This cross-sectional analytical study was conducted in the Department of Obstetrics and Gynecology at Rangpur Medical College Hospital, Rangpur. A total of 300 patients were selected for this observational comparative study using a purposive sampling technique. The participants were divided into three distinct groups: Group A (pre-gestational diabetic), Group B (gestational diabetic), and Group C (non-diabetic control), each comprising 100 patients. The study focused on pregnant women after 28 weeks of gestation, diagnosed with gestational diabetes mellitus (GDM) and pre-gestational diabetes mellitus (Pre-GDM), as well as those showing symptoms and signs suggestive of these conditions, later confirmed through relevant investigations. All participants were admitted to the obstetric ward during the study period at Rangpur Medical College & Hospital, Rangpur. Data collection was conducted using a specifically designed questionnaire to record all relevant parameters under study. This process was initiated after providing proper counseling to the patients and obtaining written consent from either the patient or her legal guardian. The inclusion criteria for the study were a gestational age greater than 28 weeks, diagnosed cases of GDM and Pre-GDM admitted for delivery at Rangpur Medical College Hospital, newly diagnosed cases, and singleton pregnancy. The exclusion criteria for mothers with Pre-GDM and GDM included multiple pregnancies, patients with any medical or surgical illness (such as renal disease, liver disease, or endocrine disorder) that could affect blood sugar levels, and non-compliant patients. For control mothers, the exclusion criteria were similar, with the addition of those not willing to participate in the study. Data analysis was performed using SPSS software. Statistical significance was determined at a p-value of less than 0.05. This methodological approach was designed to ensure a comprehensive and comparative analysis of the maternal and fetal outcomes in pregnancies complicated by pre-gestational and gestational diabetes mellitus, as well as in non-diabetic control cases.

Results

The age distribution showed that in Group A, 4% were under 25 years, 65% were between 25-29 years, and 31% were 30 years or older.

Table 1: Distribution of baseline socio-demographic characteristics among the participants (N=300)

Variables	Group A	Group B	Group C	P value
	n (%)	n (%)	n (%)	
Age (in year)				
<25	4 (4%)	16 (16%)	18 (18%)	0.069
25-29	65 (65%)	59 (59%)	59 (59%)	
≥30	31 (31%)	25 (25%)	23 (23%)	
Mean±SD	28.62±2.11	27.90± 2.04	27.56± 2.65	0.064
Education				
Illiterate	8 (8%)	8 (8%)	15 (15%)	0.866
Below SSC	55 (55%)	59 (59%)	41 (41%)	
SSC	23 (23%)	22 (22%)	23 (23%)	
HSC	9 (9%)	9 (9%)	20 (20%)	
Graduate and above	5 (5%)	2 (2%)	1 (1%)	
Occupation				
Housewife	84 (84%)	80 (80%)	88 (88%)	0.860
Service Holder	6 (6%)	4 (4%)	4 (4%)	
Day Laborer	8 (8%)	11 (11%)	5 (5%)	
Others	2 (2%)	5 (5%)	3 (3%)	
Socio-economic status				
Lower	47 (47%)	48 (48%)	60 (60%)	0.365
Middle	41 (41%)	40 (40%)	32 (32%)	
Higher	12 (12%)	12 (12%)	8 (8%)	
Residence				
Rural	72 (72%)	72 (72%)	83 (83%)	0.464
Urban	28 (28%)	28 (28%)	17 (17%)	
Family history				
Present	71 (71%)	65 (65%)	11 (11%)	<0.001
Absent	29 (29%)	35 (35%)	89 (89%)	

The age distribution showed that in Group A, 4% were under 25 years, 65% were between 25-29 years, and 31% were 30 years or older. In Group B, these percentages were 16%, 59%, and 25% respectively, while in Group C, they were 18%, 59%, and 23%. The mean ages with standard deviation were 28.62±2.11 for Group A, 27.90±2.04 for Group B, and 27.56±2.65 for Group C, with no statistically significant difference (p=0.064ns). Regarding education, 8% of Group A, 8% of Group B, and 15% of Group C were illiterate. Those with education below SSC comprised 55% of Group A, 59% of Group B, and 41% of Group C. SSC level education was reported by 23% in each group, while 9% of Groups A and B and 20% of Group C had completed HSC. Only a small fraction, 5% in Group A, 2% in Group B, and 1% in Group C, were graduates or above. The differences in educational levels across the groups were not statistically significant (p=0.866ns).

In terms of occupation, the majority of participants in all groups were housewives, accounting for 84% in Group A, 80% in Group B, and 88% in Group C. Service holders were 6% in Group A, 4% in both Group B and C. Day laborers constituted 8% of Group A, 11% of Group B, and 5% of Group C. Other occupations were reported by 2% in Group A, 5% in Group B, and 3% in Group C, with no significant difference in occupational distribution (p=0.860ns). Socio-economic status showed that 47% of Group A, 48% of Group B, and 60% of Group C were from the lower socio-economic stratum. The middle stratum comprised 41% of Group A, 40% of Group B, and 32% of Group C, while the higher stratum included 12% in each of Groups A and B, and 8% in Group C. These differences were not statistically significant (p=0.365ns). Regarding residence, 72% of participants in both Groups A and B, and 83% in Group C, were from rural areas. Urban residents comprised 28% of Groups A and B, and 17% of Group C, with no significant difference (p=0.464ns). A notable finding was the presence of a family history of diabetes. It was reported by 71% of Group A, 65% of Group B, but only 11% of Group C, showing a statistically significant difference (p<0.001s). In terms of parity, 27% of Group A were primiparous, compared to 12% in Group B and 20% in Group C. The majority were multiparous, comprising 73% in Group A, 88% in Group B, and 80% in Group C, with no significant difference in parity distribution (p=0.206ns). Regarding gestational age at delivery, 16% of Group A delivered between 28-32 weeks, compared to 3% in Group B and none in Group C. Deliveries between 33-36 weeks were reported by 29% of Group A, 20% of Group B, and 7% of Group

C. A majority, 55% of Group A, 77% of Group B, and 93% of Group C, delivered after 36 weeks.

Table 2: Distribution of obstetric profile among the participants (N=300)

Variables	Group A n (%)	Group B n (%)	Group C n (%)	P value
Parity				
Primi-parous	27 (27%)	12 (12%)	20 (20%)	0.206
Multi-parous	73 (73%)	88 (88%)	80 (80%)	
Gestationam Age Delivery (week)				
28-32	16 (16%)	3 (3%)	0 (0%)	0.045
33-36	29 (29%)	20 (20%)	7 (7%)	
<36	55 (55%)	77 (77%)	93 (93%)	
Mean±SD	36.06 ± 2.71	37.34± 1.12	38.46±1.13	0.001
Past obstetric history				
H/O GDM	38 (38%)	18 (18%)	8 (8%)	0.001
H/O HTN	18 (18%)	8 (8%)	10 (10%)	0.266
H/O congenital anomaly baby	10 (10%)	2 (2%)	0 (0%)	0.026
H/O macrosomia	8 (8%)	2 (2%)	0 (0%)	0.068
H/O IUFD	14 (14%)	2 (2%)	0 (0%)	0.014
H/O stillbirth	2 (2%)	0 (0%)	0 (0%)	0.365
H/O abortion	20 (20%)	6 (6%)	4 (4%)	0.015
ANC				
Regular	77 (77%)	64 (64%)	56 (56%)	0.046
Irregular	19 (19%)	31 (31%)	36 (36%)	
None	4 (4%)	5 (5%)	8 (8%)	

The mean gestational ages at delivery with standard deviation were 36.06 ± 2.71 for Group A, 37.34± 1.12 for Group B, and 38.46±1.13 for Group C, showing a statistically significant difference (p=0.001s). In terms of past obstetric history, 38% of Group A had a history of GDM, compared to 18% in Group B and 8% in Group C, showing a significant difference (p=0.001s). The history of hypertension (HTN) was reported by 18% in Group A, 8% in Group B, and 10% in Group C (p=0.266ns). Congenital anomalies in previous babies were reported by 10% of Group A, 2% of Group B, and none in Group C (p=0.026ns). Macrosomia history was noted in 8% of Group A, 2% of Group B, and none in Group C (p=0.068ns). Intrauterine fetal death (IUFD) history was present in 14% of Group A, 2% in Group B, and none in Group C (p=0.014ns). Stillbirth history was reported by 2% in Group A and none in the other groups (p=0.365ns). A history of abortion was noted in 20% of Group A, 6% in Group B, and 4% in Group C, showing a significant difference (p=0.015s). Antenatal care (ANC) patterns showed that 77% of Group A had regular ANC, compared to 64% in Group B and 56% in Group C, with a significant difference (p=0.046s). Irregular ANC was reported by 19% in Group A, 31% in Group B, and 36% in Group C. A small percentage, 4% in Group A, 5% in Group B, and 8% in Group C, did not receive any ANC.

Table 3: Distribution of mode of delivery among the participants (N=300)

Mode of Delivery	Group A n (%)	Group B n (%)	Group C n (%)	P value
Normal Vaginal Delivery	38 (38%)	48 (48%)	80 (80%	<0.001s
Cesarean Section	62 (62%)	52 (52%)	20 (20%)	

In Group A, 38% of the participants had a normal vaginal delivery, while a higher percentage, 62%, underwent cesarean section. Group B showed a slightly different pattern, with 48% experiencing normal vaginal delivery and 52% having cesarean sections. In stark contrast, Group C, the control group, had a significantly higher rate of normal vaginal deliveries at 80%, with only 20% undergoing cesarean sections. The difference in the mode of delivery across the three groups was statistically significant (p<0.001s).

Table 4: Distribution of presence of maternal complication among the participants (N=300)

Maternal Complications	Group A n (%)	Group B n (%)	Group C n (%)	P value
Present	47 (47%)	25 (25%)	12 (12%)	<0.001
Absent	62 (62%)	75 (75%)	88 (88%)	

In Group A, which consisted of pre-gestational diabetic patients, 47% experienced maternal complications, while 53% did not. For Group B, encompassing gestational diabetic patients, the incidence of maternal complications was lower, with 25% reporting complications and 75% without any. Notably, Group C, the control group, had the lowest incidence of maternal complications, with only 12% of the participants experiencing complications and a significant majority of 88% having no complications. The variation in the presence of maternal complications across the groups was statistically significant (p<0.001s).

Table 5: Distribution of fetal outcome among the participants (N=300)

Variables	Group A	Group B	Group C	P value
	n (%)	n (%)	n (%)	
Fetal Outcome				
Stable birth	95 (95%)	96 (96%)	100 (100%)	0.344
Still birth	5 (5%)	4 (4%)	0 (0%)	
Apgar score at 5 min				
≤ 7	60 (60%)	27 (27%)	11 (11%)	<0.001
≥ 7	40 (40%)	73 (73%)	89 (89%)	
Birth weight of neonate (kg)				
<2	24 (24%)	5 (5%)	4 (4%)	
2-4	76 (76%)	84 (84%)	93 (93%)	0.001
>4	0 (0%)	11 (11%)	3 (3%)	
Need for NICU				
No	56 (56%)	71 (71%)	89 (89%)	<0.000
Yes	44 (44%)	29 (29%)	11 (11%)	
Perinatal Complications				
Birth asphyxia	38 (38%)	16 (16%)	6 (6%)	<0.001
Hypoglycemia	22 (22%)	10 (10%)	4 (4%)	0.019
Hyperbilirubinemia	16 (16%)	12 (12%)	0 (0%)	0.017
Congenital anomaly	2 (2%)	0 (0%)	0 (0%)	0.753
Perinatal Death	4 (4%)	2 (2%)	0 (0%)	0.566

In terms of stable births, Group A had 95% stable births, Group B had 96%, and Group C reported 100% stable births. The incidence of stillbirths was 5% in Group A, 4% in Group B, and 0% in Group C, although these differences were not statistically significant (p=0.344ns). Regarding the Apgar score at 5 minutes, 60% of neonates in Group A had a score of ≤7, compared to 27% in Group B and 11% in Group C. Conversely, 40% of Group A, 73% of Group B, and 89% of Group C had scores of ≥7, indicating a significant difference (p<0.001s). The birth weight of neonates also varied significantly across the groups. In Group A, 24% of neonates weighed <2 kg, compared to 5% in Group B and 4% in Group C. The majority of neonates in all groups weighed between 2-4 kg (76% in Group A, 84% in Group B, and 93% in Group C). Notably, 11% of neonates in Group B and 3% in Group C weighed >4 kg, while none in Group A fell into this category (p=0.001s). The need for Neonatal Intensive Care Unit (NICU) admission was highest in Group A (44%), followed by Group B (29%) and Group C (11%), showing a significant difference (p<0.000s). In terms of perinatal complications, birth asphyxia was reported in 38% of Group A, 16% of Group B, and 6% of Group C, indicating a significant difference (p<0.001s). Hypoglycemia occurred in 22% of Group A, 10% of Group B, and 4% of Group C (p=0.019ns). Hyperbilirubinemia was present in 16% of Group A, 12% of Group B, and none in Group C (p=0.017ns). Congenital anomalies were reported in 2% of Group A and were absent in Groups B and C (p=0.753ns). Perinatal death occurred in 4% of Group A, 2% of Group B, and none in Group C, but these differences were not statistically significant (p=0.566ns).

Discussion

The baseline socio-demographic characteristics of the 300 participants in this study, spanning across Group A (Pre-Gestational Diabetic), Group B (Gestational Diabetic), and Group C (Control), revealed no significant differences in age, education, occupation, socio-economic status, and residence. This aligns with the findings of Jubrael et al., who reported that gestational diabetes mellitus (GDM) prevalence is influenced by factors such as older age, obesity, higher parity, and history of recurrent miscarriage, rather than by basic socio-demographic factors[15]. The lack of significant differences in these basic socio-demographic characteristics in our study suggests that the impact of gestational and pre-gestational diabetes on pregnancy outcomes may be more strongly influenced by clinical factors than by socio-demographic ones. The obstetric profile showed a higher prevalence of pre-gestational and gestational diabetes in multiparous women, which is consistent with the literature indicating that higher parity is a risk factor for GDM[15]. The gestational age at delivery was significantly different among the groups, with Group A having a lower mean gestational age. This finding is crucial as it suggests that pre-gestational diabetes may lead to earlier deliveries, a factor that can impact neonatal outcomes. A significant history of GDM, hypertension, and other obstetric complications was noted in Group A, aligning with the findings of Sofiah et al., who observed that GDM mothers often have a history of pregnancy-induced hypertension and macrosomia[16]. The higher incidence of past obstetric complications in Group A highlights the need for careful monitoring and management in pregnancies complicated by pre-gestational diabetes. The mode of delivery also varied significantly across the groups, with a higher rate of cesarean sections in the diabetic groups, especially in Group A. This is in line with the general trend observed in diabetic pregnancies, where the rate of cesarean delivery is often higher due to various obstetric complications[16]. Our study found significant variations in maternal complications across the groups, with Group A (Pre-Gestational Diabetic) experiencing the highest rate of complications (47%), followed by Group B (Gestational Diabetic) at 25%, and Group C (Control) at 12%. This trend is consistent with the literature, which indicates that gestational diabetes mellitus (GDM) is associated with a higher risk of adverse maternal outcomes[17]. The elevated risk in pre-gestational diabetic patients underscores the need for heightened surveillance and management in this group. The incidence of stable births was high across all groups, with a slightly lower rate in the diabetic groups. This finding aligns with the general understanding that while GDM increases the risk of complications, effective management can lead to favorable outcomes[18]. The occurrence of stillbirths, although not statistically significant, was higher in the diabetic groups, echoing the findings of Jin et al., who reported an association between high blood pressure in early pregnancy and adverse outcomes such as stillbirth[19]. The Apgar scores at 5 minutes post-delivery revealed a higher percentage of neonates in the diabetic groups with scores ≤7, indicating a need for immediate medical attention. This is in line with the literature, which suggests that GDM can impact neonatal health, necessitating closer monitoring and intervention [18]. The birth weight distribution showed a higher percentage of neonates weighing <2 kg in Group A, while Group B had a higher percentage of neonates weighing >4 kg. These findings highlight the diverse impact of diabetes on fetal growth, with GDM often leading to larger babies due to hyperglycemia[18]. NICU admissions were highest in Group A, followed by Group B and Group C, indicating more severe neonatal complications in diabetic pregnancies. This is supported by the study of Glick et al., which discusses the increased risk of adverse fetal outcomes, including the need for NICU care, in pregnancies complicated by diabetes[20]. In terms of perinatal complications, birth asphyxia, hypoglycemia, and hyperbilirubinemia were more prevalent in the diabetic groups, especially Group A. These complications are well-documented in the literature as common issues in diabetic pregnancies (18).

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

Conclusion

This study's analysis of 300 pregnant women reveals a clear impact of gestational and pre-gestational diabetes on fetal outcomes and maternal complications. Notably, mothers with pre-gestational diabetes (Group A) experienced the highest rate of complications, followed by those with gestational diabetes (Group B), and the control group (Group C). This trend highlights the increased risk and need for specialized care in diabetic pregnancies. Significant differences were observed in fetal outcomes, particularly in birth weight variations and the necessity for NICU admission, with diabetic groups showing greater adverse outcomes. Although the increase in stillbirths in diabetic groups was not statistically significant, it aligns with known risks associated with diabetes in pregnancy. The study emphasizes the importance of early detection and proactive management of diabetes in pregnancy to mitigate risks and improve health outcomes for both mothers and babies. It underscores the need for targeted interventions and vigilant monitoring in managing pregnancies complicated by diabetes, reinforcing the critical role of specialized care in these scenarios.

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