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Comparative Analysis of Maternal Complications in Gestational and Pre-gestational Diabetic Pregnancies

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Abstract

Background: Diabetes during pregnancy, including gestational diabetes mellitus (GDM) and pre-gestational diabetes mellitus (PGDM), is associated with increased maternal morbidity. While both conditions pose risks, comparative data on maternal complications remain limited. This study compares maternal complications among non-diabetic pregnant women, those with GDM, and those with PGDM to identify differences in complication rates and inform risk-specific clinical care. ***Methods:*** This prospective cross-sectional observational study was conducted at Bangabandhu Sheikh Mujib Medical University (BSMMU) and BIRDEM Hospital, Dhaka, Bangladesh, from January 2004 to December 2005. A total of 150 pregnant women were enrolled and divided into three equal groups: Group A (non-diabetic), Group B (pregestational diabetes mellitus, PGDM), and Group C (gestational diabetes mellitus, GDM). Data were collected through questionnaires, clinical assessments, and medical records. Maternal complications during pregnancy, labor, and postpartum were recorded. Statistical analysis used SPSS, employing Chi-square and t-tests; p-values less than 0.05 were considered significant. ***Results:*** Maternal complications were significantly higher in diabetic groups (66% in GDM, 68% in PGDM) compared to non-diabetics (28%). Cesarean delivery was more frequent in PGDM (60%) and GDM (52%) than in non-diabetics (20%). Postpartum complications, particularly wound infection and endometritis, were more prevalent in the PGDM group. Intra-partum interventions, such as instrumental and operative deliveries, were also higher among diabetic pregnancies. ***Conclusion:*** Both GDM and PGDM significantly increase maternal complication rates, with PGDM posing a higher risk. Early screening, strict glycemic control, and multidisciplinary management are essential for improving maternal outcomes.

Keywords: Gestational diabetes mellitus, pre-gestational diabetes, maternal complications, pregnancy outcome.

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INTRODUCTION

Diabetes in pregnant women represents a major international healthcare concern because it creates numerous negative maternal health outcomes. Both gestational diabetes mellitus (GDM) and pre-gestational diabetes mellitus (PGDM) have become significant factors for maternal morbidity because of rising obesity rates combined with inactive lives and late pregnancy onset [1,2]. GDM and PGDM create difficulties for maternal prenatal care and childbirth support and increase the chances of metabolic disease development for both mothers and their children [3]. Medical resources are insufficient in low- and middle-income countries because they lack both access to healthcare and effective screening systems [4].

Maternal blood glucose elevation during pregnancy leads to a condition called GDM that produces multiple pregnancy complications such as pregnancy-induced hypertension alongside polyhydramnios, which results in increased need for

cesarean deliveries [5,6]. PGDM poses unique complications because of women who enter pregnancy with types 1 or 2 diabetes since the chronic hyperglycemic state impacts overall maternal vessels alongside placental operations [7]. A national research study by Murphy *et al.*, presented findings that pregnant women with diabetes experienced exceptional rates of birth complications and hypertension disorders, and obstetric interventions compared to diabetic-free mothers [8].

Legitimate research on perinatal outcomes exists, but insufficient work analyzes maternal complications and their comparison between GDM and PGDM in parallel studies. Numerous studies have shown diabetic pregnancies lead to more operative deliveries and higher rates of hypertension, but exclusive analysis of maternal outcomes remains limited, particularly for South Asian communities [9,10]. The condition of maternal healthcare in Bangladesh presents a need for comprehensive research about GDM and PGDM because screening programs for GDM do not exist consistently across urban and rural areas.

Studies demonstrate that GDM and PGDM present risks. However, there is insufficient knowledge about how the conditions independently affect maternal morbidities, including urinary tract infections and postpartum hemorrhage and endometritis, and wound infections in various regional settings. The study by Cheung *et al.*, revealed that women with early pregnancy hyperglycemia, regardless of GDM diagnosis, face raised risks for adverse pregnancy outcomes, thus questioning treatment thresholds in high-risk groups [11].

This study evaluated maternal health complications across non-diabetic pregnant women, together with women having GDM and PGDM who received care at the same tertiary medical center. This study focuses on the maternal health effects of pregnant diabetes to create a more complex understanding of diabetes-related maternal risks independent from fetal or neonatal influences. This evaluation examines maternal complications occurrence between pregnant women who have gestational or pre-existing diabetes and those who do not have diabetes to assist with case stratification and clinical care strategy development.

Objective

The objective of this study was to compare the incidence of maternal complications among pregnant women with gestational diabetes, pre-gestational diabetes, and those without diabetes.

METHODOLOGY & MATERIALS

This prospective cross-sectional observational study was conducted in the Department of Obstetrics and Gynecology at Bangabandhu Sheikh Mujib Medical University (BSMMU) and Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM), Dhaka, Bangladesh, from January 2004 to December 2005. A total of 150 pregnant women were enrolled in three equal groups: Group A with 50 non-diabetic pregnant women; Group B with 50 pregnant women with pre-existing diabetes mellitus (PDM); and Group C with 50 women with gestational diabetes mellitus (GDM). Participants were selected using predefined inclusion and exclusion criteria to assess maternal outcomes associated with diabetic status during pregnancy.

Sample Selection

Inclusion Criteria:

- Pregnant women aged 18–40 years.
- Singleton pregnancies.
- Confirmed diagnosis of gestational diabetes mellitus (GDM) or pre-existing diabetes mellitus (PDM) according to WHO criteria (for Groups B and C).
- Willingness to provide informed written consent.

Exclusion Criteria:

- Women with multiple gestations.
- Known chronic comorbidities (e.g., hypertension, renal disease, thyroid disorders).
- History of recurrent pregnancy loss or known congenital fetal anomalies.
- Unwillingness to participate or provide informed consent.

Data Collection Procedure: Data were collected from 150 pregnant women at BSMMU and BIRDEM using a structured questionnaire. Information included socio-demographic characteristics, obstetric and family history, pregnancy details, and delivery dates confirmed by ultrasonography. Anthropometric measurements and blood pressure were recorded. Blood glucose levels were assessed using World Health Organization (WHO) criteria to diagnose gestational diabetes mellitus (GDM) and pre-existing diabetes mellitus (PDM). Diabetic patients received multidisciplinary care, including dietary counseling and insulin therapy when needed. Clinical follow-up continued through delivery and postpartum, documenting maternal complications. Data accuracy was ensured through monitoring and verification with medical records and laboratory results.

Ethical Consideration:

The study protocol was approved by the Ethical Committee of Bangabandhu Sheikh Mujib Medical University. Written informed consent was obtained from participants after they were provided with information about the study objectives, procedures, and confidentiality measures. Participation was voluntary, and respondents could withdraw at any time without affecting their medical care. Patient confidentiality was maintained throughout the study. The study adhered to

the ethical principles outlined in the Declaration of Helsinki.

Statistical Analysis:

Data analysis was conducted using Statistical Package for Social Sciences (SPSS) version 20.0. Descriptive statistics summarized demographic and clinical variables. Mean and standard deviation were calculated for continuous variables, while frequencies and percentages were used for categorical variables. A comparative analysis between groups utilized the Chi-square test for categorical variables and the independent samples t-test for continuous variables. A p-value < 0.05 was considered statistically significant.

RESULTS

Table 1: Gestational age and mode of delivery of the respondents (n=150)

Characteristics		Group A (n=50)		Group B (n=50)		Group C (n=50)	
		No.	%	No.	%	No.	%
Gestational age	Mean±SD	38.98±1.35		35.50±4.08		36.34±4.55	
Mode of delivery	Vaginal	40	80.0	18	36.0	23	46.0
	Cesarean section	10	20.0	30	60.0	26	52.0
	Abortion/induced abortion/missed abortion	0	0.0	2	4.0	1	2.0

Mean gestational age was highest in Group A (38.98 ± 1.35 weeks), followed by Group C (36.34 ± 4.55 weeks) and Group B (35.50 ± 4.08 weeks). Vaginal delivery was most common in Group A (80%), while cesarean section predominated in Group B (60%) and Group C (52%). Abortion outcomes occurred in Group B (4%) and Group C (2%), but not in Group A.

Table 2: Present Pregnancy Complications Among Study Groups

Complications	Group A (n=50)		Group B (n=50)		Group C (n=50)	
	No.	%	No.	%	No.	%
Present (any)	14	28	33	66	34	68
Abortion	0	0	2	4	1	2
UTI	6	12	13	26	15	30
Polyhydramnios	0	0	5	10	5	10
Preterm Delivery	2	4	9	18	7	14
Congenital Malformation	0	0	2	4	2	4
PIH / Pre-eclampsia	3	6	6	12	10	20
Vulvovaginitis	3	6	7	14	5	10
PROM	0	0	1	2	0	0
Oligohydramnios	0	0	1	2	0	0
Absent	36	72	17	34	16	32

Complications during pregnancy were observed in 28% of Group A, 66% of Group B, and 68% of Group C. UTI was more frequent in diabetic groups—26% in Group B and 30% in Group C—compared to 12% in Group A. Polyhydramnios occurred in 10% of diabetic groups and was absent in controls. Preterm delivery affected 18% of Group B and 14% of Group C, versus 4% in Group A. PIH/pre-eclampsia was highest in Group C (20%), followed by Group B (12%) and Group A (6%). Congenital malformations, vulvovaginitis, PROM, and oligohydramnios were reported only in diabetic groups. The highest rate of complications was observed in Group A (72%), compared to Group B (34%) and Group C (32%).

Table 3: Intra-partum Maternal Complications Among Study Groups

Complications	Group A (N=50)		Group B (N=48)		Group C (N=49)	
	No.	%	No.	%	No.	%
Cervical Tear	0	0.0	2	4.2	2	4.1
Vaginal Tear	1	2.0	1	2.1	2	4.1
Instrumental Delivery	0	0.0	2	4.2	3	6.1
Shoulder Dystocia	0	0.0	0	0	0	0
Operative Delivery	10	20.0	30	60	27	54

Intra-partum complications were higher in diabetic groups. Operative deliveries occurred in 60% of Group B and 54% of Group C, versus 20% in Group A. Instrumental deliveries were more frequent in Group C (6.1%) and Group B (4.2%), but absent in Group A. Vaginal tears occurred in all groups, slightly higher in Group C (4.1%). Cervical tears affected 4.2% of Group

B and 4.1% of Group C, with none in Group A. No shoulder dystocia was reported.

Table 4: Post-partum Maternal Complications Among Study Groups

Complications	Group A (N=50)		Group B (N=48)		Group C (N=49)	
	No.	%	No.	%	No.	%
Present (any)	3	6.0	9	18.8	9	18.4
Primary PPH	2	4.0	2	4.2	2	4.1
UTI	1	2.0	3	6.3	1	2.1
Endometritis	0	0.0	3	6.3	0	0
Mastitis	0	0.0	3	6.3	1	2.1
Wound Infection	0	0.0	5	10.4	6	12.2
Others	0	0.0	1	2.1	1	2
Absent	47	94.0	39	81.3	40	81.6

Postpartum complications affected 18.8% of Group B and 18.4% of Group C, versus 6% in Group A. Wound infection was most common, affecting 12.2% of Group C and 10.4% of Group B, but absent in Group A. Endometritis and mastitis occurred only in diabetic groups. PPH rates were similar across groups, ranging from 4.0% to 4.2%. UTIs were more frequent in Group B (6.3%) compared to Group A (2.0%) and Group C (2.1%). Most women in Group A (94%) experienced no postpartum complications, compared to 81.3% in Group B and 81.6% in Group C.

DISCUSSION

This research evaluates the differences in maternal complications that affect women who have gestational diabetes mellitus (GDM) or pre-gestational diabetes mellitus (PGDM) and those without diabetes. The research data demonstrate that maternal risks occur more frequently among both GDM and PGDM patients than non-diabetic mothers. Maternal pregnancy complications were identified in 66% of GDM cases, together with 68% of PGDM cases, but only affected 28% of the control population. Intra-partum complications involving operative deliveries, along with instrumental procedures, appeared more frequently in diabetic patient groups. Postpartum infection of the wound and endometritis developed more frequently among diabetic women, especially those with PGDM.

Studies have confirmed that both GDM and PGDM pregnancies lead to higher maternal morbidity rates during pregnancy. The findings by Karkia *et al.*, regarding preterm birth and cesarean delivery, along with hypertensive disorders in diabetic pregnancies, matched the elevations recorded in this study's preeclampsia rate (20% in PGDM vs. 6% in controls) and cesarean delivery rate (60% in PGDM vs. 20% in controls) [12]. An analysis by Gualdani *et al.*, produced results showing that GDM and PGDM independently increased the incidence of operative deliveries and hypertensive disorders among 200,000 singleton births [13].

This study documented that pregnant woman with PGDM suffered a slightly greater number of complications than women with GDM, but both groups experienced more complications than the control group. According to Malaza et al.'s systematic review, PGDM women face higher risks of preeclampsia and cesarean section than those with GDM [14]. The longer duration of hyperglycemia, together with vascular changes in women diagnosed with gestational diabetes mellitus prior to pregnancy, causes additional obstetric complications [1].

The diabetic pregnancy groups, including GDM and PGDM, demonstrated increased urinary tract infection rates at 26% and 30%, respectively, then the control group at 12%. Sultana reported that diabetic pregnant women showed increased rates of urinary tract infections (UTIs) and genital tract infections due to hyperglycemia-related immunosuppression combined with glycosuria that promoted bacterial growth [15]. The bacterial infections enhance maternal health complications and simultaneously elevate the probabilities of early birth and negative baby health results.

Both the GDM (10%) and PGDM (10%) groups exhibited a high incidence of polyhydramnios, as documented in existing studies. Ornoy *et al.*, stated that fetal hyperglycemia-induced excessive fetal urination develops into polyhydramnios mainly during poorly controlled diabetic pregnancies [1]. The present investigation demonstrated that diabetes in pregnant women led to higher rates of preterm labor, together with placental abruption and operative deliveries.

The diabetic groups, together, accounted for 22.6% of postpartum wound infections, with PGDM at 12.2% and GDM at 10.4%; the control group showed no cases of infections. Oros Ruiz *et al.*, demonstrated that diabetic pregnancies present elevated wound-related complication risks because of delayed wound healing and suppressed immune response in their research [16]. Endometritis and mastitis conditions did not appear in non-diabetic women, yet emerged most frequently in

PGDM cases, similar to the results documented by Murphy *et al.,* in their UK national cohort study [8].

The occurrence of preterm delivery was substantially higher among individuals with GDM (18%) and PGDM (14%) compared to controls at 4%, according to this study. In contrast, research by Yang *et al.,* found a similar correlation linking GDM to elevated preterm birth rates [17]. The early need to perform labor induction and cesarean section procedures for diabetic pregnancy complications appears to be the reason behind this connection.

The study showed no cases of shoulder dystocia development regardless of patient group, despite research findings linking macrosomia fetuses to diabetic pregnancy complications [18, 19]. The differences in results might stem from participants having tight blood sugar control, along with reduced numbers of participants, which prevented the detection of uncommon complications.

The clinical implications discovered in this research provide important information for medical practice. The rising level of maternal complications, starting with PGDM, then GDM, emphasizes the need for thorough prenatal monitoring and quick glucose intolerance examinations. Research by Reitzle *et al.,* demonstrates that achieving proper glycemic control, in conjunction with multidisciplinary treatment, reduces the medical risks associated with diabetic pregnancies [20]. Careful monitoring of patients during labor and the postpartum period remains essential for women with GDM and PGDM to efficiently detect and control issues that include infection and hemorrhage, and operative wound dehiscence.

Data shows that women with PGDM experienced 60% of all cesarean sections, and individuals with GDM underwent 52% of all cesarean procedures, which matches worldwide statistics. Surgical births occurred more frequently in diabetic pregnancies according to Mahalakshmi *et al.,* because of fetal macrosomia or failure to progress or fetal distress [21]. The need for cesarean delivery in essential medical situations exists, but increases the patients' risk for complications, including postoperative infections and thromboembolic events, and prolonged recovery time, so health providers should use it properly, combined with complete postpartum support.

This research confirms existing evidence by establishing that diabetes during pregnancy at any stage produces elevated maternal complication risks either through gestational diabetes mellitus or through preexisting diabetes mellitus. PGDM shows higher risks than GDM because of its chronic nature, together with systemic effects of pre-existing diabetes. Early recognition combined with individualized antenatal services needs to be followed by active postpartum supervision to achieve optimal maternal outcomes during diabetic pregnancies.

Limitations and recommendations

The study is limited by its single-center design and small sample size, which affects generalizability. Potential confounders, such as glycemic control, BMI, and comorbidities, were not stratified. Future multicenter studies with larger cohorts and longitudinal follow-up are needed to validate findings and explore neonatal outcomes. Clinical guidelines should emphasize preconception counseling, diabetes screening in pregnancy, and individualized care protocols. Strengthening postpartum follow-up can address long-term maternal health. Policy interventions promoting awareness and preventive care may reduce diabetes-related pregnancy complications.

CONCLUSION

This study demonstrates that both gestational and pre-gestational diabetes are significantly associated with increased maternal complications during pregnancy, labor, and the postpartum period, with pre-gestational diabetes presenting a higher risk profile. The findings underscore the crucial importance of early diagnosis, glycemic control, and vigilant antenatal monitoring to mitigate these risks. Integration of multidisciplinary care strategies is essential to optimize maternal outcomes. These insights contribute to the growing evidence base advocating for tailored clinical approaches in diabetic pregnancies, reinforcing the importance of diabetes screening and management as integral components of obstetric care.

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