Magnitude Of Cesarean Section And Associated Factors Among Diabetic Mothers In A Tertiary Hospital, BSMMU: A Cross-Sectional Study

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KEYWORDS

Cesarean Section, Diabetic Mothers, Gestational Diabetes Mellitus and Obstetric Risk Factors

ABSTRACT:

Background: Cesarean section (CS) rates are rising globally, particularly among high-risk pregnancies complicated by diabetes mellitus (DM), which significantly increases maternal and neonatal morbidity. In Bangladesh, gestational diabetes affects 10–14% of pregnancies, often leading to complications such as macrosomia and preeclampsia that heighten CS risk. Diabetic mothers are two to three times more likely to undergo CS due to factors like poor glycemic control, obesity, and fetal distress.
Aim of the study: This study aims to assess the magnitude of cesarean section and identify the associated maternal, obstetric, and fetal factors among diabetic mothers.
Methods: This cross-sectional study was conducted at Department of Fetomaternal Medicine, BSMMU, Dhaka, including 100 diabetic pregnant women (GDM, type 1, or type 2) admitted for delivery. The study duration was (duration), from June 2023 to May 2024. Women with multiple pregnancies, incomplete records, or without diabetes were excluded. Data were collected using structured questionnaires and hospital records, covering socio-demographics, obstetric history, diabetes type, glycemic control, delivery mode, and neonatal outcomes. The primary outcome was the mode of delivery. Bivariate and multivariable logistic regression analyses were performed using SPSS version 26 to identify factors associated with cesarean section. Statistical significance was set at $p < 0.05$, with results presented as adjusted odds ratios and 95% confidence intervals.
Results: Among 100 diabetic pregnant women, 65% underwent cesarean section (CS), while 35% had vaginal deliveries. Most participants were aged 25–34 (58.33%) and from urban areas (70%). Multigravida and multiparous women comprised 60% and 63.33%, respectively, with 74.17% attending at least four ANC visits. Gestational diabetes mellitus was the most common (56.67%), and insulin was the primary glycemic control method (33.33%). Prior CS (25%) and fetal distress (11.67%) were leading CS indications. Favorable neonatal outcomes were observed, though 15% required NICU admission. Significant CS predictors included previous CS, poor glycemic control, and macrosomia ($p < 0.05$).
Conclusion: This study highlights a high cesarean section rate among diabetic mothers, primarily linked to prior CS, poor glycemic control, and macrosomia. Despite generally favorable neonatal outcomes, improved prenatal diabetes management and individualized care are essential to reduce unnecessary CS and enhance maternal and neonatal health in high-risk pregnancies.

INTRODUCTION

Cesarean section (CS) is one of the most common obstetric surgical procedures performed worldwide, often serving as a critical intervention to prevent adverse maternal and neonatal outcomes. Globally, CS rates have steadily increased over the past few decades, raising concerns about their appropriateness and the factors contributing to their rise, especially in high-risk pregnancies such as those complicated by diabetes mellitus (DM) [1,2]. Diabetes during pregnancy, whether pre-gestational or gestational, significantly contributes to maternal and perinatal morbidity, with a strong association reported between diabetes and the likelihood of cesarean delivery [3,4]. Diabetes mellitus complicates approximately 3–10% of pregnancies globally, and the prevalence is notably higher in South Asia, particularly Bangladesh, due to increasing rates of obesity, sedentary lifestyles, and genetic predisposition [5]. In Bangladesh, gestational diabetes mellitus (GDM) is reported to affect about 10–14% of pregnancies, though underdiagnosis remains a challenge due to limited antenatal screening [6]. The physiological and metabolic alterations in diabetic pregnancies often lead to complications such as fetal macrosomia, polyhydramnios, preeclampsia, and shoulder dystocia, all of which increase the indication for cesarean delivery [7]. Several studies have shown that diabetic mothers have two to three times higher odds of undergoing CS compared to their non-diabetic counterparts [8]. This is due to multiple interrelated factors, including poor glycemic control, maternal obesity, hypertensive disorders, and fetal growth abnormalities [9]. Moreover, elective cesarean sections are more common in diabetic pregnancies even in the absence of obstetric complications, often driven by concerns over labor complications and medico-legal issues. Being a premier tertiary-level referral center in Bangladesh, handles a considerable number of high-risk pregnancies, including those complicated by diabetes. However, there is a paucity of local data evaluating the magnitude and determinants of CS specifically among diabetic mothers in this setting. Understanding the prevalence of CS and its associated factors among this population is essential for formulating targeted obstetric care strategies, optimizing delivery outcomes, and reducing unnecessary surgical interventions. Previous research has identified several predictors of CS in diabetic pregnancies, including maternal age, parity, body mass index (BMI), type and duration of diabetes, glycemic control, and fetal indications such as macrosomia and non-reassuring fetal heart rate patterns [8,10]. However, these factors often vary by region, healthcare access, and institutional protocols. In low- and middle-income countries (LMICs) like Bangladesh, disparities in maternal healthcare access and a lack of standardized guidelines for diabetic pregnancy management further complicate the decision-making process regarding mode of delivery [11]. Given this background, this study aims to assess the magnitude of cesarean section and identify the associated maternal, obstetric, and fetal factors among diabetic mothers attending a tertiary care hospital, in Bangladesh.

METHODOLOGY & MATERIALS

This cross-sectional study was conducted at Fetomaternal Medicine Department, BSMMU, Dhaka, Bangladesh from June 2023 to May 2024. The study population comprised 100 diabetic pregnant women (gestational diabetes mellitus, type 1, or type 2 diabetes) admitted for delivery at BSMMU during the study period. Both elective and emergency admissions were included.

Inclusion Criteria:

- Pregnant women diagnosed with any diabetes (GDM, type 1, or type 2).
- Delivered at BSMMU during the study period.
- Provided informed written consent.

Exclusion Criteria:

- Non-diabetic pregnant women.
- Women with multiple pregnancies.
- Incomplete or missing medical records.

Data Collection Procedure:

Data were collected using a pretested, structured questionnaire and a checklist. Information was gathered through patient interviews, clinical records, antenatal cards, and delivery registers. The questionnaire captured a range of details, including sociodemographic characteristics, obstetric and medical history, type of diabetes, methods of glycemic control, mode of delivery, indications for Cesarean section, and neonatal outcomes. The primary study variable was the mode of delivery (Cesarean section or vaginal delivery). In contrast, independent variables included age, residence, education, occupation, gravidity, parity, number of antenatal care (ANC) visits, history of previous Cesarean section, gestational age at delivery, type of diabetes, glycemic control methods, presence of macrosomia, and neonatal outcomes.

Operational Definitions:

In this study, *Gestational Diabetes Mellitus (GDM)* is characterized by glucose intolerance first recognized during pregnancy, irrespective of hyperglycemia. *Poor Glycemic Control* denotes consistently elevated maternal blood glucose levels above the clinically recommended targets despite therapeutic interventions, including dietary modifications, physical activity, or pharmacologic treatment. *Macrosomia* is defined as a neonatal birth weight equal to or exceeding 4000 grams, which is associated with increased risks of delivery complications and adverse neonatal outcomes.

Data Analysis:
Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0. Descriptive statistics were used to summarize categorical variables as frequencies and percentages. Bivariate and multivariable logistic regression analyses were conducted to identify factors associated with Cesarean section. Adjusted Odds Ratios (AORs) with 95% Confidence Intervals (CIs) and p-values were reported. A p-value <0.05 was considered statistically significant.

RESULTS
The findings of this study reveal a high rate of Cesarean Section (CS) among diabetic mothers, with 65% undergoing CS compared to 35% who had vaginal deliveries (Table 3). Key socio-demographic characteristics included a predominance of mothers aged 25–34 years (58.33%) and a majority from urban areas (70%) (Table 1). Obstetric history showed that most participants were multigravida (60%) and multiparous (63.33%), with 74.17% attending at least four antenatal care (ANC) visits (Table 2). Prior CS (25%) and fetal distress (11.67%) were the leading indications for CS (Figure 1). Regarding diabetic status, gestational diabetes mellitus (GDM) was the most common (56.67%), and insulin was the most used glycemic control method (33.33%) (Table 4). Neonatal outcomes were largely favorable, with 96.67% live births, although 8.33% had an APGAR score <7 at 5 minutes, and 15% required NICU admission (Table 5). Multivariable analysis identified previous CS (AOR = 3.72; 95% CI: 1.52–9.10; p = 0.004), poor glycemic control (AOR = 2.18; 95% CI: 1.01–4.73; p = 0.047), and macrosomia (AOR = 3.46; 95% CI: 1.02–11.72; p = 0.045) as significant predictors of CS (Table 6).

Table 1: Socio-Demographic characteristics of diabetic mothers (n = 120)

Variables	Frequency (n)	Percentage (%)
Age group (years)		
<25	22	18.33
25–34	70	58.33
≥35	28	23.33
Residence		
Urban	84	70.00
Rural	36	30.00
Education level		
No formal education	18	15.00
Primary	30	25.00
Secondary	46	38.33
Higher	26	21.67
Occupation		
Housewife	92	76.67
Employed	18	15.00
Self-employed	6	5.00
Others	4	3.33

Table 2: Obstetric and antenatal characteristics of diabetic mothers

Variables	Frequency (n)	Percentage (%)
Gravida		
Primigravida	48	40.00
Multigravida	72	60.00
Parity		
Nulliparous	44	36.67
Multiparous	76	63.33
ANC visits ≥4	89	74.17

History of previous CS	38	31.67
Gestational age at delivery		
Preterm (<37 weeks)	26	21.67
Term (≥37 weeks)	94	78.33

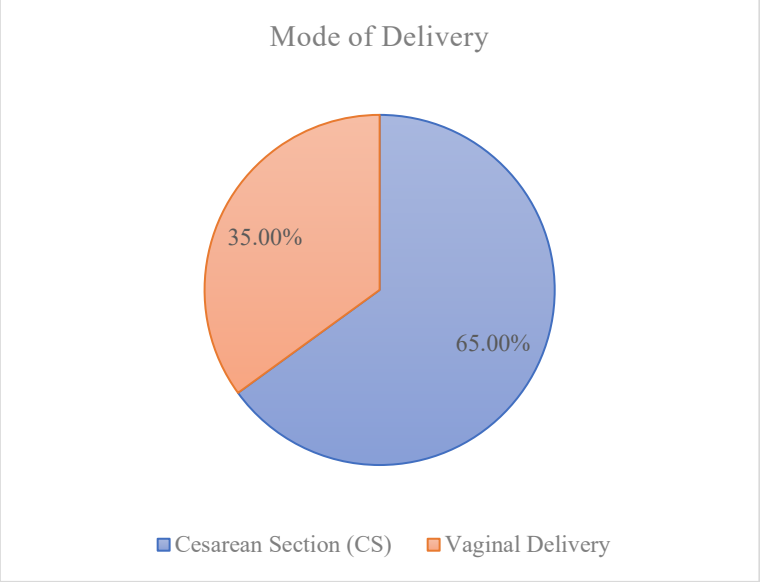

Figure 1: Distribution of Mode of Delivery among Diabetic Mothers

Table 4: Indications for cesarean section among diabetic mothers

Indication	Frequency (n)	Percentage (%)
Previous CS	30	25.00
Fetal distress	14	11.67
Cephalopelvic disproportion	10	8.33
Failed induction	8	6.67
Macrosomia	9	7.50
Malpresentation	4	3.33
Others (e.g., placenta previa)	3	2.50

Table 5: Distribution of diabetes types and glycemic control methods

Variable	Frequency (n)	Percentage (%)
Type of diabetes		
GDM	68	56.67
Type 1	12	10.00
Type 2	40	33.33
Glycemic control method		
Diet	20	16.67
Oral medications	30	25.00
Insulin	40	33.33
Combined	30	25.00

Table 6: Neonatal outcomes among infants born to diabetic mothers

Variable	Frequency (n)	Percentage (%)
Birth weight		
<2500 g (Low birth weight)	26	21.67
≥2500 g	94	78.33
APGAR score <7 at 5 min	10	8.33
NICU admission	18	15.00
Neonatal outcome		

Alive	116	96.67
Stillbirth/Neonatal death	4	3.33

Table 7: Multivariable logistic regression analysis of factors associated with cesarean section

Variable	AOR (95% CI)	p-value
Previous CS	3.72 (1.52–9.10)	0.004
Poor glycemic control	2.18 (1.01–4.73)	0.047
Macrosomia	3.46 (1.02–11.72)	0.045
ANC <4 visits	1.69 (0.72–3.94)	0.223
Age ≥35	1.94 (0.92–4.08)	0.082

DISCUSSION

This cross-sectional study assessed the prevalence of Cesarean Section (CS) and its associated factors among diabetic mothers at a tertiary care hospital in Bangladesh. The findings revealed that 65% of diabetic mothers underwent CS, which is substantially higher than the World Health Organization (WHO) recommended optimal rate of 10–15% [12]. This high CS rate among diabetic mothers may reflect concerns over fetal and maternal complications commonly associated with diabetes during pregnancy. Our findings are consistent with similar studies conducted in developed and developing countries. A study in Ethiopia reported a CS prevalence of 63.3% among diabetic mothers [13], while studies in India and Saudi Arabia also found elevated CS rates in this population, ranging from 60% to 70% [14,15]. These consistently high rates indicate a global pattern where diabetic pregnancies are often managed through surgical delivery due to perceived or real risks. Previous CS emerged as the most frequent indication (25%) for repeat CS in our study (Table 4). This supports evidence from other studies where a history of CS significantly predicts subsequent CS delivery [16]. In our logistic regression analysis, the previous CS increased the odds of undergoing another nearly fourfold (AOR = 3.72, p = 0.004) (Table 7). This aligns with research indicating that fear of uterine rupture or medico-legal concerns often lead clinicians to opt for repeat CS, particularly in high-risk populations like diabetic mothers [17]. Poor glycemic control was also significantly associated with CS (AOR = 2.18, p = 0.047), echoing findings from a Nigerian study where inadequate glucose regulation led to higher obstetric intervention rates [18]. Poor glycemic control contributes to complications such as macrosomia, preeclampsia, and fetal distress, which are frequently cited reasons for CS. In our sample, 33.33% of mothers used insulin, and 25% used combined therapies (Table 5), suggesting a substantial proportion needed intensive management to control glucose levels. Macrosomia (birth weight ≥4000g) significantly increased the odds of CS (AOR = 3.46, p = 0.045), which is well-documented in literature as a strong predictor of surgical delivery due to the increased risk of shoulder dystocia, birth trauma, and prolonged labor [19]. Although only 7.5% of our CS indications were directly attributed to macrosomia (Table 4), its statistical association with CS suggests it may be more implicit in influencing delivery decisions. Similar findings were reported in an extensive cohort study in the United States, where macrosomic fetuses of diabetic mothers were 2–3 times more likely to be delivered via CS [20]. Although factors like advanced maternal age (≥35 years) and fewer ANC visits (<4) were not statistically significant in our regression model (Table 7), their trends warrant attention. Advanced maternal age has been linked to increased CS rates in several studies, likely due to a higher incidence of pregnancy complications and comorbidities [21]. Likewise, fewer ANC visits may reflect suboptimal monitoring and late detection of complications, potentially resulting in emergency CS. Ensuring adequate antenatal care can play a pivotal role in improving outcomes, especially in diabetic pregnancies. Neonatal outcomes in this study were generally favorable, with 96.67% of neonates born alive, although 15% required NICU admission and 8.33% had a low APGAR score at 5 minutes (Table 6). These findings highlight the importance of managing glycemic control and fetal growth to minimize neonatal complications. Prior studies have reported similar NICU admission rates among neonates of diabetic mothers, especially those with poor glycemic control or preterm delivery [22]. The high rate of CS in our study underscores a critical public health concern. While surgical delivery may be warranted in many cases, over-reliance on CS can lead to increased maternal morbidity, prolonged hospital stay, and higher healthcare costs [1]. There is a pressing need for individualized care plans, strict glucose monitoring, and multidisciplinary collaboration among obstetricians, endocrinologists, and neonatologists to reduce unnecessary CS while ensuring safety.

Limitations of the study

The study did not evaluate long-term maternal or neonatal outcomes, and laboratory parameters such as HbA1c levels were not uniformly assessed. Psychosocial and provider-related factors influencing delivery decisions were not explored, which could have provided a more comprehensive understanding of the high cesarean section rate among diabetic mothers.

CONCLUSION AND RECOMMENDATIONS

This study revealed a high prevalence of cesarean section (65%) among diabetic mothers at a tertiary care hospital, significantly exceeding WHO recommendations. Key factors associated with increased CS rates included previous cesarean delivery, poor glycemic control, and fetal macrosomia. While neonatal outcomes were generally favorable, a notable proportion required NICU admission. These findings underscore the need for improved prenatal management of diabetes, with emphasis on glycemic control and early identification of high-risk pregnancies. Tailored antenatal care, multidisciplinary collaboration, and adherence to evidence-based guidelines are essential to reduce unnecessary cesarean deliveries while ensuring optimal maternal and neonatal health outcomes in diabetic pregnancies.

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REFERENCES

1. Betrán AP, Ye J, Moller AB, Zhang J, Gülmezoglu AM, Torloni MR. The increasing trend in caesarean section rates: global, regional and national estimates: 1990-2014. PloS one. 2016 Feb 5;11(2):e0148343.
2. Boerma T, Ronsmans C, Melesse DY, Barros AJ, Barros FC, Juan L, Moller AB, Say L, Hosseinpoor AR, Yi M, Neto DD. Global epidemiology of use of and disparities in caesarean sections. The Lancet. 2018 Oct 13;392(10155):1341-8.
3. Langer O, Yogev Y, Xenakis EM, Brustman L. Overweight and obese in gestational diabetes: the impact on pregnancy outcome. American journal of obstetrics and gynecology. 2005 Jun 1;192(6):1768-76.
4. Yogev Y, Visser GH. Obesity, gestational diabetes and pregnancy outcome. InSeminars in Fetal and Neonatal Medicine 2009 Apr 1 (Vol. 14, No. 2, pp. 77-84). WB Saunders.
5. Islam JY, Zaman MM, Bhuiyan MR, Haq SA, Ahmed S, Al-Qadir AZ. Prevalence and determinants of hyperglycaemia among adults in Bangladesh: results from a population-based national survey. BMJ open. 2019 Jul 1;9(7):e029674.
6. Jesmin S, Akter S, Akashi H, Al-Mamun A, Rahman MA, Islam MM, Sohael F, Okazaki O, Moroi M, Kawano S, Mizutani T. Screening for gestational diabetes mellitus and its prevalence in Bangladesh. Diabetes research and clinical practice. 2014 Jan 1;103(1):57-62.
7. Metzger BE, Coustan DR, Trimble ER. Hyperglycemia and adverse pregnancy outcomes. Clinical chemistry. 2019 Jul 1;65(7):937-8.
8. Gascho CL, Leandro DM, Ribeiro T, Silva JC. Predictors of cesarean delivery in pregnant women with gestational diabetes mellitus. Revista Brasileira de Ginecologia e Obstetrícia/RBGO Gynecology and Obstetrics. 2017 Feb;39(02):060-5.
9. Catalano PM. Obesity, insulin resistance and pregnancy outcome. Reproduction (Cambridge, England). 2010 May 10;140(3):365.
10. Wahabi HA, Esmaeil SA, Fayed A, Al-Shaikh G, Alzeidan RA. Pre-existing diabetes mellitus and adverse pregnancy outcomes. BMC research notes. 2012 Dec; 5:1-5.
11. Biswas A, Dalal K, Abdullah AS, Gifford M, Halim MA. Maternal complications in a geographically challenging and hard to reach district of Bangladesh: a qualitative study. F1000Research. 2016 Sep 28; 5:2417.
12. WHO H. WHO statement on caesarean section rates. Geneva, Switzerland. 2015 Apr.
13. Eshetu B, Balis B, Daba W, Mekonnen B, Getachew T, Roga EY, Habte S, Bekele H, Ketema I, Debella A. Magnitude of cesarean-section and associated factors among diabetic mothers in Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia: A cross-sectional study. Frontiers in Public Health. 2022 Sep 16; 10:888935.
14. Dudhwadkar AR, Fonseca MN. Maternal and fetal outcome in gestational diabetes mellitus. Int J Reprod Contracept Obstet Gynecol. 2016 Oct 1;5(10):3317-21.
15. Al-Hakeem MM. Pregnancy outcome of gestational diabetic mothers: experience in a tertiary center. Journal of family and community medicine. 2006 May 1;13(2):55-9.
16. Lumbiganon P, Laopaiboon M, Gülmezoglu AM, Souza JP, Taneepanichskul S, Ruyan P, Attygalle DE, Shrestha N, Mori R, Hinh ND, Bang HT. Method of delivery and pregnancy outcomes in Asia: the WHO global survey on maternal and perinatal health 2007–08. The Lancet. 2010 Feb 6;375(9713):490-9.
17. Guise JM, Eden K, Emeis C, Denman MA, Marshall N, Fu RR, Janik R, Nygren P, Walker M, McDonagh M. Vaginal birth after cesarean: new insights. Evidence report/technology assessment. 2010 Mar(191):1.
18. Ifunanya NJ, Idzuinya OB, Okwuchukwu OV, Chibuzor UD, Chukwu IC, Nobert OC, Uchenna OV. Evaluation of Pregnancy Outcomes among Women with Pregnancies Complicated by Diabetes Mellitus in

Abakaliki, South-East, Nigeria. Journal of Diabetes Mellitus. 2019 Aug 9;9(3):69-76.
19. Zhu WW, Yang HX, Wang C, Su RN, Feng H, Kapur A. High prevalence of gestational diabetes mellitus in Beijing: effect of maternal birth weight and other risk factors. Chinese medical journal. 2017 May 5;130(09):1019-25.
20. Schneider S, Hoeft B, Freerksen N, Fischer B, Roehrig S, Yamamoto S, Maul H. Neonatal complications and risk factors among women with gestational diabetes mellitus. Acta obstetricia et gynecologica Scandinavica. 2011 Mar;90(3):231-7.
21. Khalil A, Syngelaki A, Maiz N, Zinevich Y, Nicolaides KH. Maternal age and adverse pregnancy outcome: a cohort study. Ultrasound in Obstetrics & Gynecology. 2013 Dec;42(6):634-43.
22. Yessoufou A, Moutairou K. Maternal diabetes in pregnancy: early and long-term outcomes on the offspring and the concept of "metabolic memory". Journal of Diabetes Research. 2011;2011(1):218598.