ISSN (Print): 2663-9491 ISSN (Online): 2789-6897

Original Article

Association between Maternal Diabetes Mellitus and the Risk of Premature Birth

DOI: dx.doi.org

Shaila Sharmin[1*]

Received: 19 November 2024
Accepted: 28 November 2024
Published: 15 December 2024

Published by:
Gopalganj Medical College,
Gopalganj, Bangladesh

*Corresponding Author

ABSTRACT

Introduction: *Hyperglycemia in pregnancy (HIP), both Diabetes mellitus (DM) and gestational DM (GDM) are the most common medical complications of pregnancy and they carry a significant risk to the fetus and the mother. Prematurity, congenital malformations, and perinatal morbidity remain common compared with the offspring of non-diabetic pregnancies.* ***Methods & Materials:*** *This case-control study was conducted in the Dept. of Obstetrics and Gynecology, BIRDEM General Hospital from 1st November 2019 to 30th November 2020 on 150 pregnant women (DM-50, GDM-50, and Non-DM non-GDM-50). Data were collected via structured sheets and analyzed with SPSS and Excel, with quantitative data as mean/standard deviation and qualitative data as frequency/percentage.* ***Result:*** *In the present study, most of the participants in all Group-1 [28 (70.0%)], Group-2 [31 (77.5%)], and Group-3 [27 (67.5%)] received ANC regularly. family history of diabetes, history of miscarriage, and BOH, were common risk factors. In normal vaginal deliveries, prolonged labor is found more whereas in LUCS, it was observed that Previous CS is found more in Group-3, while Macrosomia and Malpresentation are found more in Group-2 and Group-1, and fetal disease was found more in Group-2. In this study frequency of premature birth was significantly higher in the DM group (27.5%) & GDM (20.0%) than those in the normal group (7.5%).* ***Conclusion:*** *Pregnancy with DM and GDM is significantly linked to higher rates of preterm birth, a leading cause of neonatal death. Early diabetes screenings are essential for timely detection, prevention, and management.*

Keywords: *Gestational Diabetes Mellitus (GDM), Premature Birth, Hyperglycemia in Pregnancy (HIP)*

(The Insight 2024; 7(1): 316-325)

1. *Resident Surgeon, Department of Obstetrics & Gynaecology, BIRDEM General Hospital (Woman & Children), Dhaka, Bangladesh*

INTRODUCTION

Diabetes is a worldwide disease whose numerous complications are causing medical professionals to become increasingly concerned. In 2014, 422 million persons worldwide were expected to have diabetes, up from 108 million in 1980. It is estimated that pregnancy-related diabetes raises the risk of fetal, neonatal, and long-term problems for the progeny. Pregestational diabetes, type 1 or type 2 diabetes identified before pregnancy, and gestational diabetes, or diabetes identified during pregnancy, are the two types of maternal diabetes. Pregnancy-related hyperglycemia (HIA) was expected to have affected 20.4 million, or 15.8%, of live births to women in 2019. Of these, 83.6% resulted from gestational diabetes mellitus (GDM), 7.9% from diabetes that was discovered before becoming pregnant, and 8.5% from diabetes (both type 1 and type 2) that was discovered during pregnancy[1]. Another study found that the prevalence of gestational diabetes mellitus, or diabetes diagnosed during pregnancy, was almost 11.5%[2]. The outcome is typically correlated with the mother's diabetes severity and the beginning and length of her pregnancy-related glucose intolerance. Pregnancy-related hyperglycemia (HIP) is the most prevalent medical issue that poses a serious risk to both the mother and the baby. When compared to the offspring of non-diabetic pregnancies, prematurity, congenital abnormalities, and perinatal morbidity are nevertheless common. However, Microvascular diabetes problems, early pregnancy loss, pre-eclampsia, polyhydramnios, premature labor, and preterm birth are among the risks that diabetic mothers face[3]. Women with diabetes continue to experience a high prevalence of preterm births. Premature delivery is prevalent generally, at 24%[4]. Blood sugar levels that are outside of intended safe ranges can cause several difficulties, including respiratory distress syndrome (RDS), cardiovascular problems, and fetal development complications. The worldwide burden of newborn health is prematurity. Preterm birth accounts for 28% of all early neonatal fatalities that are not related to congenital abnormalities[5,6]. Compared to children born at term 8, preterm-born children have increased incidences of cerebral palsy, sensory deficiencies, learning impairments, and respiratory diseases[6,7]. Preterm delivery is associated with high rates of morbidity that frequently persist into later life, causing significant medical, psychological, and financial consequences[6,7]. The gestational age has a direct correlation with the severity of preterm problems. There have been reports of preterm birth rates ranging from 5.6% to 11.6% of live births[6,8-10]. Furthermore, even though the etiology of preterm birth is believed to be multifactorial, the exact circumstances leading up to the birth are yet unknown. Medical disorders of the mother or foetus, genetic effects, exposure to the environment, infertility therapies, behavioral and socioeconomic variables, and iatrogenic prematurity are among the causative factors associated with preterm birth. 45–50% of preterm births are thought

to be idiopathic, 30% to be caused by premature rupture of the membranes, and the remaining 15-20% to be caused by medically necessary or voluntary preterm deliveries[6,10,11]. There is epidemiological research on the risk factors for GDM and DM, and they are frequently tainted by confounding variables. These include being overweight or obese, gaining too much weight during pregnancy, eating a Westernized diet, being of a different ethnicity, having genetic polymorphisms, being an older mother, having a low or high birthweight in the uterus, having a family history of gestational diabetes mellitus, and having other insulin-resistant diseases like PCOS[12]. Furthermore, based on trustworthy data, premature birth rates are rising in practically every nation. Prematurity is the primary cause of mortality for newborns and, among children under five, ranks second in terms of cause of death after pneumonia. Over 10% of newborns are born prematurely. Therefore, this study aimed to see the association between maternal diabetes mellitus and the risk of premature birth at tertiary hospitals in Bangladesh.

METHODS & MATERIALS

This case-control study was carried out in the Dept. of Obstetrics and Gynecology, BIRDEM General Hospital from 1st November 2019 to 30th November 2020 on 150 pregnant women following approval of the protocol. Women with GDM (Group 1, n=50), women with DM (Group 2, n=50), and Women without DM/ GDM (Group 3, n=50) were included among the inclusion criteria. Patients who were critically sick, e.g., with heart disease, or renal failure were excluded from the study. Informed written consent was obtained from each patient and data were collected in a pretested structured data collection sheet. Data was edited and analyzed with the help of the computer program SPSS and Microsoft Excel—quantitative data expressed as mean and standard deviation and qualitative data as frequency and percentage.

RESULTS

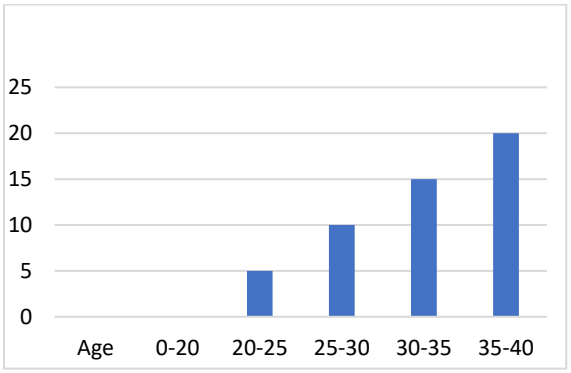

Figure – 1: Distribution of Study Subjects According to Their Age (*n*=150)

Figure 1 depicts the age distribution of the patients. Mean age was 26.7 (SD±5.9) years. Age distribution resembles normal distribution where the numbers of middle-aged patients were high in contrast to early age groups.

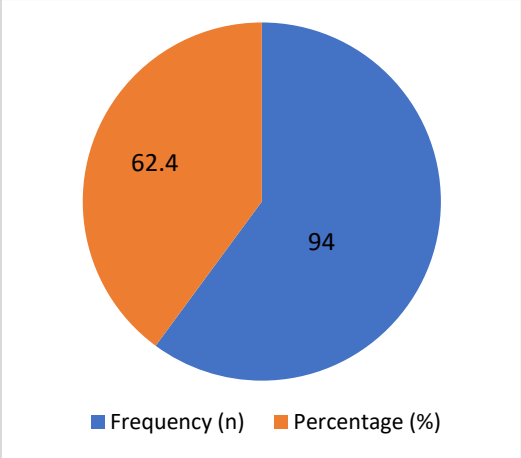

Figure – 2: Distribution of Study Subjects According to Their Residence (*n*=150)

The figure in the parentheses indicates the corresponding percentage; n=Number of the study population. **Figure 2** shows 94 (62.4%) patients came from urban areas and 56 (37.3%) from rural areas.

Table I shows the occupation status of the patients. Large numbers of respondents were housewives, daily workers, and service holders.Table illustrates that, most of the participants in all Group-1 [28 (70.0%)], Group-2 [38(76.0%)] and Group-3 [37(74.0%)] received ANC regularly. There was no statistically significant difference between the groups. The table shows obstetrics history. Most of the women in both groups were primigravida (62%). Multi gravida (two or more gravida) was seen in (38.0%) of mothers. The p-value is 0.271. The result is not significant at $p<.05$. Table I explains that in all groups majority of the participants in GDM (group 1) and DM (group 2) were obese, 58.0% & 70.0% respectively. The *p*-value was calculated to be, 0.048; which explains that there was a significant statistical difference in the groups.

Table – I: Distribution of the Study Subjects According to Basic Characteristics (*n*=150)

Basic Characteristics of Study Population	Frequency (n=150) & Percentage (%)			X^2	*p*-value
	Group-1 (*n*=50)	Group-2 (*n*=50)	Group-3 (*n*=50)		
Distribution According to Occupation					
Service Holder	3(6.0)	6(12.0)	6(12.0)	0.000	0.542
Housewife	16(32.0)	17(34.0)	17(34.0)		0.956
Unemployed	6(12.0)	6(12.0)	10(20.0)		0.509
Study	8(16.0)	7(14.0)	2(4.0)		0.242
Day Laborer	9(18.0)	8(16.0)	10(20.0)		0.855
Garment employed	8(16.0)	6(12.0)	5(10.0)		0.242
Distribution According to ANC					
Regular	35(70.0)	38(76.0)	37(74.0)	3.864	0.925
Irregular	15(30.0)	12(24.0)	13(26.0)		

Total	50(100.0)	50(100.0)	50(100.0)		
Distribution According to Obstetrics History					
Primi	31(62.0)	32(64.0)	30(60.0)	0.175	0.271
Multi	19(38.0)	18(36.0)	20(40.0)		
Total	50(100.0)	50(100.0)	50(100.0)		
Distribution According to BMI (kg/m2)					
≥25.0	29(58.0)	35(70.0)	18(36.0)	8.683	0.048
<25.0	21(42.0)	15(30.0)	32(64.0)		
mean±SD	26.1±5.8	26.5±6.1	25.1±5.1		

Data were expressed as frequency and percentage and Mean±SD; n=number of study subjects, SD= Standard deviation. *One-way ANOVA was done to find out the level of significance.

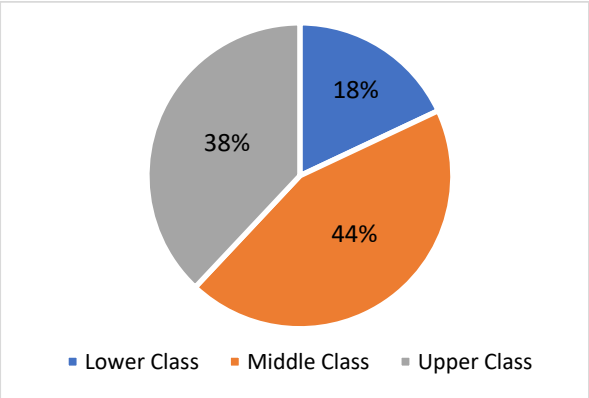

Figure – 3: Socioeconomic Status of the Study Subjects (*n*=150)

The figure in the parentheses indicates the corresponding percentage; n=number of the study population. According to operational definition, socioeconomically patience is grouped into 3 classes. Among the patients, 18% were from low socioeconomic status which is followed by the middle class 44% and the remaining upper class 38% (**Figure 3**).

Family History of diabetes was found as a strong risk factor for GDM & DM and significantly associated with GDM & DM in this study. About twenty-eight percent of women with GDM answered 'yes' when they were asked whether any in their immediate relations like parents, siblings, children, uncles, and aunts, grant parents have a known history of diabetes. The association of other risk factors or maternal complications during the last pregnancy is shown in **Table II**. Among the all-risk factors History of miscarriage, BOH.

Table – II: Distribution of the study subjects according to risk factors (*n*=150)

Risk Factors	Frequency (n=150) & Percentage (%)				X^2	*p*-value
		Group-1 (*n*=50)	Group-2 (*n*=50)	Group-3 (*n*=50)		
History of miscarriage	Present	8(16.0)	9(18.0)	3(6.0)	2.582	0.096
	Absent	42(84.0)	41(82.0)	47(94.0)		
Family H/O	Present	14(28.0)	11(22.0)	0	0.178	0.058

DM, GDM	Absent	36(72.0)	39(78.0)	50(100)		
Previous BOH	Present	15(30.0)	12(24.0)	19(38.0)	0.07	0.162
	Absent	35(70.0)	38(76.0)	31(62.0)		
Previous LBW/VLBW baby	Present	10(20.0)	16(32.0)	13(26.0)	5.043	0.088
	Absent	40(80.0)	34(68.0)	37(74.0)		

The table shows that among 50 cases of each group, Group 1 consisted of 11 patients, Group 2 consisted of 9 patients and Group 3 consisted of 16 patients in NDV. While considering normal vaginal deliveries, it was observed that prolonged labor is found more in Group 1 and Group 2, while assisted delivery and retained placenta are found more in Group -3. On the other hand, among 50 cases of each group, Group 1 consisted of 39 patients, Group 2 consisted of 41 patients and Group 3 consisted of 34 patients in LUCS. Moreover, while considering LUCS, it was found that Previous CS is found more in Group 3, while Macrosomia and Malpresentation are found more in Group 2 and Group 1. Whereas, fetal disease was found more in Group 2 (**Table III**).

Table III: Distribution of the Study Subjects According to Delivery Outcome

Delivery Outcome	**Frequency (n) & Percentage (%)**		
NVD	**Group-1 (*n*=11)**	**Group-2 (*n*=9)**	**Group-3 (*n*=16)**
Assisted Delivery	2(18.0)	3(33.3)	6(37.5)
Prolonged Labour	6(54.0)	5(55.5)	4(25.0)
Retained Placenta	3(27.0)	1(11.1)	6(37.5)
LUCS	**Group-1 (*n*=39)**	**Group-2 (*n*=41)**	**Group-3 (*n*=34)**
Previous CS	16(32.0)	11(22.0)	18(36.0)
Macrosomia	4(8.0)	8(16.0)	2(4.0)
Malpresentation	7(14.0)	6(12.0)	6(12.0)
Fetal disease	12(24.0)	16(32.0)	8(16.0)

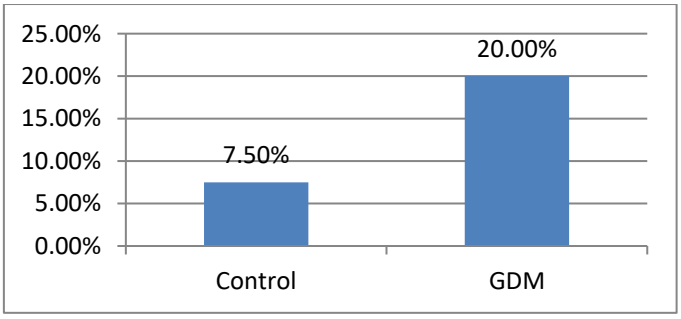

Figure – 4: Frequency of Premature Birth Between the Control (Group-3, n=50) and GDM Patients (Group-1, *n*=50)

Figure 4 shows that the frequency of premature birth was significantly higher in the GDM group than those in the normal group [20.0% vs 7.5%, $p<0.001$]. The difference was statistically significant.

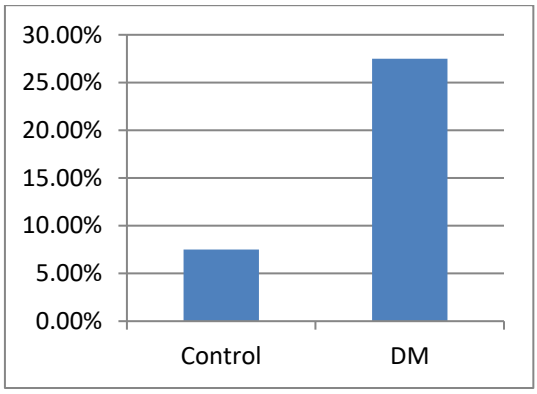

Figure – 5: Frequency of Premature Birth Between the Control (Group-3, n=50) and DM Patients (Group-2, *n*=50)

A chi-square test was done to find out the level of significance. **Figure 5** shows that the frequency of premature birth was significantly higher in the DM group than in the normal group [27.5% vs 7.5%, $p<0.001$]. The difference was statistically significant.

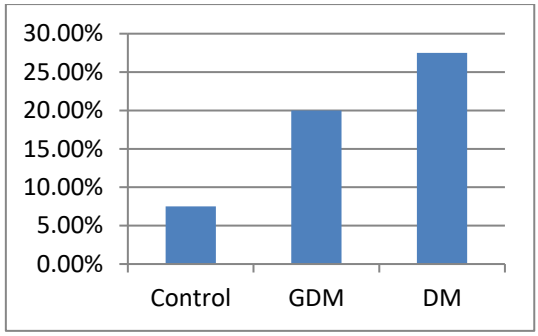

Figure – 6: Association of Premature Birth with GDM Patients (Group 1) DM Patients (Group 2, n=50) with Control (Group 3, *n*=50)

DM group, subjects with type 2 diabetes mellitus (n=50); GDM group, subjects with gestational DM (n=50); Control group, subjects with normal *n*=50 (**Figure 6**).

Table IV shows that frequencies of premature birth were significantly higher in the both DM and GDM groups than in the normal group. However, the frequency of premature birth in group 1 and group 2 showed statistically non-significant differences.

Table – IV: Association of premature birth between GDM patients (group 1), DM patients (group 2, n=50), and control (group 3, *n*=50)

Premature Birth	Frequency (*n*) & Percentage (%)			Gr 1 Vs Gr 2		Gr 1 vs Gr 3		Gr 2 vs Gr 3	
	Group-1 (*n*=50)	Group-2 (*n*=50)	Group-3 (*n*=50)	X2	p	X2	p	X2	p
Present	8	11	3	0.5789	0.45	2.528	0.11	5.262	0.02
Absent	42	39	47						

DISCUSSION

In the present study, a total of 150 cases were recruited in the study group. According to the questionnaire, the history of all the 150 selected cases was taken, and the clinical examination was carried out meticulously. In this study group, the Mean±SD of age was calculated to be, (27.31±6.60) for Group 1, (27.29 ± 6.0) for Group 2 and (25.28±5.30) for Group 3. Findings consistent with the result of other studies, a total of 7,786 individuals aged 35 years or over participated in the study. The mean age of the respondents was 51.4 years[13]. In another study average age of study participants was 28.9 years (± 6.1). In this study, 37.3% of patients came from rural, 62.6% from urban areas. A large number of respondents were housewives, daily workers, and service holders. Among them, the majority of participants were married or living with a partner (86.5%), and the unemployed were 67.8% of patients. Besides, the overall prevalence of GDM was 15.8%. The prevalence of mid-pregnancy obesity was 24.5%. Compared to women without GDM, women with GDM were significantly older (p=0.013), more likely to report a family history of diabetes (p=0.005), and had higher mid-pregnancy BMI[14]. Considering socioeconomic status among all the study patients the middle class is 44% comprising the major percentage of the patients, which is followed by the upper class 38% and the remaining lower class 18%. In the current study, a family History of diabetes was found as a strong risk factor for GDM & DM. The associations of other risks were obesity, history of miscarriage, and previous bad obstetric history. Mode of delivery revealed, Groups 1 & 2 LUCS rate was as 78% and 82%, but in group 3 rate was 68%. On evaluation of fetal outcome, among the cases, 8 (20.0%) of the babies in group 1, 11 (27.5%) in group 2, and 3 (7.5%) of babies in group 3 developed prematurity. The difference was statistically significant. Other fetal complications were birth asphyxia, macrosomia, hypoglycemia, and Hyperbilirubinaemia. Studies related to this issue found that a family history of diabetes was present in 58% of GDM patients and 42% of known diabetic patients (p>0.05). 52.6% of GDM patients had no complications and delivered uneventfully (p<0.05). While considering the delivery outcome of the current study it was found that among 50 cases of each group, Group 1 consisted of 11 patients, Group 2 consisted of 9 patients and Group 3 consisted of 16 patients. While considering normal vaginal deliveries, it was observed that prolonged labor is found more in Group 1 and Group 2, while assisted delivery and retained placenta are found more in Group -3. On the other hand, among 50 cases of each group, Group 1 consisted of 39 patients, Group 2 consisted of 41 patients and Group 3 consisted of 34 patients. Moreover, while considering LUCS, it was observed that Previous CS is found more in Group 3, while Macrosomia and Malpresentation are found more in Group 2 and Group 1. Whereas, fetal disease was found more in Group 2. Macrosomia was the most frequent complication (26.3%) of the GDM group and 29% of known diabetic patients.

Operative delivery was high 44% is known diabetic patients as compared to 33% of GDM patients but not statistically significant[15]. Additionally, the overall prevalence of prematurity was 22 (18.3%) found in this study. Among the cases, 8 (20.0%) of the babies in group 1, 11 (27.5%) in group 2, and 3 (7.5%) of babies in group 3 developed prematurity. The difference was statistically significant. A similar study of Lepercq J et al. reported that the prevalence of premature birth in women with diabetes ranges from 22 to 45%[4]. The results of this study showed that the women with GDM and DM had a higher rate of adverse outcomes and neonates of mothers with GDM had significant premature delivery. Therefore, proper detection during ANC and proper management are recommended.

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. Besides the study was conducted in a tertiary care hospital which may not represent a primary or secondary centre.

Conclusion

This study has shown that diabetes-complicating pregnancy is associated with a high risk of adverse outcomes like premature birth. In this study frequency of premature birth was significantly higher in the DM group (27.5%) & GDM (20.0%) than in the normal group (7.5%). The results suggest that rural and suburban women with increasing age or who have a family history of diabetes higher risk for GDM. Women diagnosed with GDM at an early pregnancy were more likely to be treated with insulin. The study also shows that the incidence of pregnancy complications like polyhydramnios, UTI, preeclampsia, and hypertensive disorder is increased in these cases. The study confirms the increased rate of LUCS in DM & GDM cases, the indications being not only GDM but also the associated risk factors like PIH and IUGR, big baby, etc. The neonatal metabolic complications like hypoglycemia, hypocalcemia, hyperbilirubinemia, and RDS, poor feeding contributed to admission to NICU and hence, prolonged hospital stay.

Conflict of Interest

The authors declare no conflict of interest.

Ethical Approval

The study was approved by the Institutional Ethics Committee.

Ethical Approval

The study was approved by the Institutional Ethics Committee.

Recommendation

Screening for Diabetes is a must before pregnancy. Pregnant women at their first antenatal checkup need to be screened for gestational diabetes. Also, pregnant women with DM and GDM should be carefully monitored as they are at higher risk of Preterm delivery and adequate preventive measures to be taken.

REFERENCES

1. *Williams R, Colagiuri S, Almutairi R, Montoya P, Basit A, Beran D, et al. IDF Diabetes Atlas, 9th Edition. International Diabetes Federation, 2019: 1-176.*
2. *Lee, K.W., Ching, S.M., Ramachandran, V. et al. Prevalence and risk factors of gestational diabetes mellitus in Asia: a systematic review and meta-analysis. BMC Pregnancy Childbirth 18, 494 (2018).*
3. *Abourawi FI. Diabetes mellitus and pregnancy. Libyan J Med, September 2006; 1(1): 28-41*
4. *Lepercq J, Coste J, Theau A, Dubois-Laforgue D, Timsit J. Factors Associated With Preterm Delivery in Women With Type 1 Diabetes- A cohort study. Diabetes Care 27:2824-2828, 2004*
5. *E. G. Deryabina, G. V. Yakornova, L. A. Pestryaeva & N. D. Sandyreva (2016) Perinatal outcome in pregnancies complicated with gestational diabetes mellitus and very preterm birth: case-control study, Gynecological Endocrinology, 32:sup2, 52-55*
6. *Beck S, Wojdyla D, Say L, et al. The worldwide incidence of preterm birth: a systematic review of maternal mortality and morbidity. Bull World Health Organ 2010;88:31-8*
7. *World Health Organization. Born too soon: the global action report on preterm birth. Geneva: World Health Organization; 2012*
8. *Goldenberg RL, Culhane JF, Iams JD, et al. Epidemiology and causes of preterm birth. Lancet 2008;371:75-84*
9. *Ananth CV, Friedman AM, Gyamfi-Bannerman C. Epidemiology of moderate preterm, late preterm, and early term delivery. Clin Perinatol 2013;40:601-10*
10. *Villar J, Papageorghiou AT, Knight HE, et al. The preterm birth syndrome: a prototype phenotypic classification. Am J Obstet Gynecol 2012;206:119-23*
11. *Hedderson MM, Ferrara A, Sacks DA. Gestational diabetes mellitus and lesser degrees of pregnancy hyperglycemia: association with increased risk of spontaneous preterm birth. Obstet Gynecol 2003;102:850-6*
12. *Plows J, Stanley J, Philip N, Reynolds C and Vickers MH. The Pathophysiology of Gestational Diabetes Mellitus. Int. J. Mol. Sci. 2018, 19, 3342;*
13. *Rahman MS, Akter S, Abe SK, Islam MR, Mondal MN, Rahman JA, Rahman MM. Awareness, treatment, and control of diabetes in Bangladesh: a nationwide population-based study. PLoS One. 2015 Feb 18;10(2):e0118365*
14. *Larrabure-Torrealva GT, Martinez S, Luque-Fernandez MA, Sanchez SE, Mascaro PA, Ingar H, Castillo W, et al. Prevalence and risk factors of gestational diabetes mellitus: findings from a universal screening feasibility program in Lima, Peru. BMC Pregnancy Childbirth. 2018 Jul 18;18(1):303.*
15. *Wasim T, Amer W, & Majrooh A. FETO MATERNAL OUTCOME IN PREGNANT PATIENTS WITH DIABETES. Annals of King Edward Medical University, 2015; 21(2), 108.*