# Maternal and Fetal Outcomes in Diabetic Pregnant Women

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## ABSTRACT

**Objective:** To assess maternal and fetal outcomes in Jordanian women with known Diabetes Mellitus or Gestational Diabetes.

**Methods:** A retrospective medical record review was conducted on 234 pregnant women who were followed at the National Center for Diabetes Endocrinology and Genetics and Gynecological Department in Jordan University Hospital between 2004 and 2009. A total of 148 subjects had Gestational Diabetes Mellitus and 86 had known diabetes mellitus (Type 1 = 28, Type 2 = 58).

**Results:** Caesarean section was more frequent in Gestational Diabetes Mellitus subjects than in Diabetes Mellitus group (47.3% vs. 44.2%). The frequency of pre-term delivery tends to be higher in Diabetes Mellitus group than Gestational Diabetes Mellitus group (9.3% vs. 8.1%). Abortion was more common in Diabetes Mellitus group than Gestational Diabetes Mellitus group (11.6% vs.4%). Macrosomia, hypoglycemia, hypocalcaemia, polycythemia and congenital malformation were more common in Diabetes Mellitus group than Gestational Diabetes Mellitus group.

**Conclusion:** The results showed that Diabetes Mellitus group witnessed more abortion and pre-term delivery compared to Gestational Diabetes Mellitus groups. The caesarean section was higher in Gestational Diabetes Mellitus compared to Diabetes Mellitus group. Gestational Diabetes Mellitus group had better fetal outcome than the Diabetes Mellitus group, indicating that Diabetes Mellitus (type 1, type 2) in pregnancy is a serious condition.

**Key words:** Diabetes Mellitus (type 1, type 2), Gestational Diabetes, Maternal and fetal outcomes

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## Introduction

Gestational Diabetes Mellitus (GDM) is defined as glucose intolerance that first occurs or is identified during pregnancy.[1] The frequency of this condition is rising and occurs in 1 to 14% of all pregnancies, depending on varying characteristics of the population. Although gestational diabetes mellitus is a recognized marker for an increased risk of subsequent diabetes, its clinical significance with respect to various adverse pregnancy outcomes has been uncertain.[2,4] Women with gestational diabetes who have very elevated fasting blood glucose levels appear to be at an increased risk for fetal macrosomia and perinatal complications if treatment is not provided.[5] Type 1 diabetes occurs due to a lack of pancreatic islet beta cells caused by autoimmune destruction and resulting in an absence of insulin; while Type 2 diabetes occurs due to insulin resistance and beta cell dysfunction and is likely to be the result of interactions between genetic, environmental and immunological factors including diet, physical

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activity and obesity.[3] Women diagnosed with diabetes prior to pregnancy (pre-existing diabetes) will experience an increase in insulin demands during pregnancy.[4] Diabetes can have significant impacts on maternal, fetal and neonatal outcomes. The presence of diabetes can increase the risk of stillbirth by five times, and the risk of neonatal death by three times.[5] Studies have shown perinatal mortality rates are two to three times higher amongst babies of diabetic women as opposed to the general population. Also higher rates of congenital anomalies in babies of women with diabetes have been reported compared to the general population.[6,7] The recent Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study, however, described a strong continuous association between maternal glucose concentrations and increasing birth weight, cord-blood serum C-peptide levels, and other markers of perinatal complications, even at glucose concentrations below those that are usually diagnostic of gestational diabetes mellitus.[6]

Several professional organizations have recommended screening for gestational diabetes mellitus for most pregnant women despite little evidence that the identification and treatment of mild carbohydrate intolerance during pregnancy confer a benefit.[1,7] The Australian Carbohydrate Intolerance Study in Pregnant Women (ACHOIS), a large, randomized trial of treatment for gestational diabetes mellitus, concluded that treatment reduces serious perinatal complications and may also improve health-related quality of life.[8] Despite these findings, the 2008 guidelines of the U.S. Preventive Services Task Force again concluded that current evidence is insufficient to assess the balance between benefit and harm with respect to the screening and treatment of gestational diabetes mellitus.[9] The objective of this study is to assess maternal and fetal outcomes in Jordanian women with known Diabetes Mellitus or Gestational Diabetes.

## Methods

A retrospective medical records review was conducted in all diabetic pregnant women who were followed at the National Center for Diabetes Endocrinology & Genetics and Gynecological Department in Jordan University Hospital between 2004 and 2009. The total number was 234 diabetic pregnant women, 148 subjects had Gestational Diabetes Mellitus (GDM) and 86 subjects had known Diabetes Mellitus (DM) (Type 1 = 28, Type 2 = 58). In the Gynecological Department, all pregnant women with high risk factors or fasting blood sugar > 95 mg/dl, oral glucose tolerance test (OGTT) was performed (100-g oral glucose tolerance test in pregnant women, if two or more readings of the followings are abnormal FBS > 95 mg/dl, 1-hr > 180 mg/dl, 2-hr > 155 mg/dl, 3-hr > 140 mg/dl, OGTT is considered positive) and patients referred to the diabetic clinic to be followed as GDM patient, if its negative, reassessment at 24 to 28 weeks of gestational age was done. In diabetic clinic fasting blood sugar, one hour post prandial blood glucose (PPBG), HbA1c, blood pressure urine for protein, and fundoscopy were checked. The goal of our management was: FBG < 95mg/dl, 1 hr PPBG < 140mg/dl and 2 hrs PPBG < 120mg/dl., HbA1c (normal nonpregnant reference value 4.2–6.2%).

All pregnant diabetic women (type 1, type 2, and GDM) were followed monthly in the first and second trimester and every two weeks in third trimester. Patients were treated with diet or insulin injection (3 or more injection per day) all pregnant diabetic women delivered in Obstetric Department in Jordan University Hospital. New-born babies were referred to the neonate care unit. The course of the fetal outcome was assessed regarding hyperbilirubinemia, hypoglycemia, hypocalcaemia, polycythemia, macrosomia and congenital malformation. The course of the pregnancy outcome was assessed regarding cesarean section, pre-term delivery, pre-eclampsia and abortions. Chi-Square analyses were performed to test for differences in proportions of categorical variables between both groups, the significance of observed association was tested by the chi-square test. $P<0.05$ was considered as the cut-off value for significance.

## Results

Maternal features of the study group showed that the ages of GDM and DM (Type 1, Type 2) were nearly similar. The GDM in previous pregnancy was frequently more for current GDM women compared to DM. The family history of DM is more in GDM group than DM group.

**Table I:** Maternal features of the study group

| | GDM (n=148 | DM Type 1 (n=28) Type 2 (n=58) | P-value | Total (n=234) |
|---|---|---|---|---|
| Mean Age | 34.5±3.2 | 33.8±5.4 | 0.8 | 34.2 ±5.6 |
| GDM in previous pregnancy | 62(41.9%) | 30(34.9%) | 0.454 | 92(43.8%) |
| Family History of DM | 118(79.9%) | 66(76.7%) | 0.704 | 184(78.6%) |
| History of Baby wt > 4 kg | 52(35.1%) | 18(20.9%) | 0.105 | 70(29.9%) |
| History of Pre-eclampsia | 20(13.5%) | 10(11.6%) | 0.768 | 30(12.8%) |
| History of abortion, Still birth, Intrauterine Fetal Death | 82(55.4%) | 34(39.5%) | 0.0978 | 116(49.6%) |

**Table II:** Diabetic Profile of Both Groups

| | GDM group n=148 | DM group n=86 | P-value |
|---|---|---|---|
| F.B.G* Mean mg/dl ±SD | 107.7 + 36.0 | 122.2 + 41.84 | 0.050 |
| HbA1c | 5.5% + 1.80 | 6.1% + 1.59 | 0.099 |

*FBG<95 mg/dl **HbA1c normal value: 4.2-6.2

**Table III:** Frequency of maternal outcome in GDM and DM groups

| | GDM n = 148 | DM n=86 | Total n = 234 |
|---|---|---|---|
| Caesarian section | 70 (47.3%) | 38 (44.2%) | 108(46.1%) |
| Pre-eclampsia | 16 (10.8%) | 6 (6.97%) | 22(9.4%) |
| Polyhydroaminos | 4 (2.7%) | 2(2.3%) | 6(2.6%) |
| Pre-term labour | 12(8.1%) | 8(9.3%) | 20(8.5%) |
| Abortion, IUFD& SB | 6(4%) | 10(11.6%) | 16(6.8%) |

**Table IV:** Frequency of fetal outcome in GDM and DM groups

| | GDM n= 148 | DM n=86 | P value | Total n = 234 |
|---|---|---|---|---|
| Macrosomia (>4000g) | 22 (14.9%) | 26 (30.2%) | 0.005* | 48(20.5%) |
| Hypoglycemia ( <40 mg/dl) | 0 | 2 (2.33%) | 0.13 | 2(0.85%) |
| Hyperbilirubinemia (>103μmol/L) | 16 (10.81%) | 8(9.3%) | 0.7 | 24(10.25%) |
| Hypocalcaemia (< 7 mg/dl) | 0 | 4(4.6%) | 0.009 | 4(1.71%) |
| Polycythemia (PCV> 65 %) | 4(2.7%) | 8(9.3%) | 0.03** | 12(5.1%) |
| Congenital malformation | 4(2.7%) | 4(4.6%) | 0.32 | 8(3.40%) |

*OR: 2.48( 95% CI=1.24-4.98),RR: 2.03( 95% CI=1.23-3.36) **OR:3.69( 95% CI=1.00-15.12), RR: 3.44( 95% CI=1.07-11.09)

**Table V:** Frequency of maternal outcome compared with other international studies

| | Our study n= 234 | Jensen *et al* * n= 143 | Huddle **n= 354 | P value | Collective studies *** |
|---|---|---|---|---|---|
| Caesarean Section | 108(46.15%) | 46(32%) | 178(50.3%) | 0.0011 | 32-45% |
| Preterm Labour | 20(8.5%) | 15(10.5%) | - | 0.5 | 14-33% |
| Pre-eclampsia | 20(8.5%) | 28(19.6%) | - | 0.001 | 10-40% |
| Abortions | 16(6.8%) | 2(1.3%) | 23(6.5%) | 0.050 | 3.8-13.5% |

*Jensen DM, *et al*, (Denmark) Diabetic Medicine 2000; 17:281-286
** Huddle KR (South Africa). Diabetes International 1999; 9(3): 53-55
***Up to Date 10. 1. 2002

**Table VI:** Frequency of fetal outcome of diabetic mothers compared to other international studies

| | Our study n= 234 | Jensen *et al** n= 143 | Hod *et al* ** n=878 | P value | Collective studies *** |
|---|---|---|---|---|---|
| Macrosomia | 48(20.5%) | 20(14.0 %) | 157(17.9%) | 0.27 | 9-28% |
| Hyperbilirubinemia | 24(10.25%) | 15(10.5%) | 145(16.5%) | 0.01 | 11-29% |
| Hypoglycemia | 2(0.85%) | 34(24%) | 45(5.1%) | 0.0000 | 5-25% |
| Hypocalcaemia | 4(1.71%) | - | 48(5.5%) | 0.01 | 4% |
| Polycythemia | 12(5.1%) | - | 117(13.3%) | 0.0005 | 5-33% |
| Congenital malformation | 8(3.4%) | 34(24%) | 26(3.0%) | 0.00000 | 1.7-9.4% |

*Jensen DM, *et al* (Denmark) Diabetic Medicine2000; 17:281-286
**Huddle KR, (South Africa) Diabetes International 1999; 9(3): 53-55
***Up to Date 10.1. 2002

Frequency of abortion was more among GDM women as shown in Table I. The FBG and HbA1c were less in GDM group compared with DM group as presented in Table II. Table III demonstrates that the percentage of caesarian births, pre-eclampsia, and polyhydroaminos were more among GDM groups, pre-term labour and abortion percentage was more in DM groups. Diabetes mellitus group witnessed higher percentage for macrosomia, hypoglycemia, hypocalcaemia, polycythemia and congenital malformation as illustrated in Table IV. Table V and VI show that the results of this study had similar attitudes compared to other research.

## Discussion

The results showed that Caesarean Section (CS) were more frequent in GDM group than in DM group (47.3% vs. 44.2%) (Table III). Percent of CS in both groups was 46.15% which is statistically significant P value (P=0.0011) compared with international studies (Table V). The frequency of pre-term delivery tend to be higher in DM group than GDM group (9.3% vs. 8.1%) (Table III), percent of preterm labor in both groups was 8.5% which is not statistically significant when compared to international studies (P value = 0.5). The abortion was more in DM group than GDM group (11.6 % vs.4%) and this due to uncontrolled BS in type 1DM, type 2 DM before planning for pregnancy, percent of abortion in both groups was (6.8%), which is statistically significant (P value=0.050) compared with international studies (Table V). Pre-eclampsia was defined as blood pressure -140/90mmHg and proteinuria of +2 on a urine protein test strip (equal to 1.0 g/l). Pre-eclampsia more frequent in GDM group than in DM group (10.8% vs 6.97%) (Table III) which is statistically significant when compared to international studies (P value =0.001) (Table V).

Our study confirms that poor metabolic control before and during pregnancy is associated with prenatal mortality, intra uterine fetal death, still birth and congenital malformations. We found an increased risk of macrosomia, despite earlier delivery in women with type 1 diabetes. One fifth of the diabetic women delivered macrosomic infants (birth weight >4000 g). Macrosomia were (20.5% vs. 9-28%) in our study compared with collective studies which is not statistically significant P value (P=0.27) (Table VI). the outcomes were predated by inadequate maternal self-care (home monitoring of blood glucose) and professional care (preconceptional guidance). Women with adverse pregnancy outcome seemed to have slightly more in DM group than GDM group, hypocalcaemia (< 7mg/dl, normal value 8.2-10.2 mg/dl), polycythemia (PCV > 65%, normal value < 55%) were more in DM group than GDM group, which is statistically significant (P value = 0.0005) compared with international studies (Table VI). Hypocalcaemia were 1.71% compared with collective studies 4% which is statistically Significant (P value=.01) (Table VI). Hypoglycemia (<40 mg/dl) were less in our group than international group 0.85% vs5-25% (Table VI), data suggest that glycemic control need closed observation and good control. Hyperbilirubinemia similar to international studies which are statistically significant (Table VI), hypoglycemia, hypocalcaemia polycythemia and congenital malformation were more in DM group than GDM group. When compared to international studies: our results were similar to these studies in regard to caesarean section, pre-term labour and pre-eclampsia. Abortion rates were higher in our group than the European rates but

approaching the rates from South Africa. As for fetal outcomes; results of our study were nearly similar to other international rates in regard to macrosomia and congenital malformations. Hypocalcaemia and polycythemia were lower than other international rates.

## Conclusion

Diabetes mellitus in pregnancy is associated with higher rates of adverse maternal and fetal outcomes than GDM, indicating that DM (type 1, type 2) in pregnancy is a serious condition. Strict glycemic control is of paramount importance in reducing these adverse outcomes. Our data suggest that glycemic control, self-care, and education of the patient still need to be improved significantly and that adequate control using daily glucose monitoring in all patients.

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