Original Article

The Relationship between Insulin Demand and Feto-maternal Outcome in Women with Diabetes Mellitus and GDM

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Nurun Naher[1*], Fariha Tabassum Faria[2]

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Sheikh Sayera Khatun Medical College (SSKMC), Gopalganj, Bangladesh

*Corresponding Author

ABSTRACT

Introduction: *Diabetes mellitus is an important disorder in pregnancy which places. Mother and fetus at risk during current pregnancy and also has serious implications for their long term well-being. Pre conceptional councelling was implanted in pregnancy with diabetics mellitus.* ***Methods & Materials:*** *From January 2006 to December 2008, this prospective study was carried out at the Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine, and Metabolic Disorders (BIRDEM), Dhaka. Over 150 people with diabetes were recruited for the study. Pre-gestational diabetes mellitus (PGDM) - group A, and gestational diabetes mellitus (GDM) - group B were the two groups of women into whom they were split.* ***Results:*** *In group A, insulin requirement was 30-75 IU in 30 (50%), <30 IU in 17 (28%) and >75 IU in 13 (22%) women, and in group B was <30 IU in 36 (60%), 30-75 IU in 16 (27%) and >75 IU in 8(13%) women. In both groups, hypoglycemia was high among babies born to mothers on insulin <30 IU and >75 IU, and hyperbilirubinemia was high among babies born to mothers on insulin dose 30-75 IU and >75 IU and <30 IU. In group A, RDS was high among babies born to mothers on insulin dose <30 IU (69.2%), in group B insulin dose 30-75 IU.* ***Conclusion:*** *In diabetes pregnancies, proper blood sugar management can lower the risk of congenital defects, as well as the morbidity and mortality of both the mother and the fetus.*

Keywords: *Gestational Diabetes Mellitus, Maternal, neonatal, blood sugar level*

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1. *Registrar, Department of Obstetrics & Gynaecology, BIRDEM General Hospital, Dhaka, Bangladesh*
2. *Student, Department of Obstetrics & Gynaecology, Mymensingh Medical College (MMC), Mymensingh, Bangladesh*

INTRODUCTION

Feto maternal outcomes in pregnancies complicated by diabetes or gestational diabetes mellitus (GDM) are closely linked to the delicate balance of insulin regulation. During pregnancy, the body undergoes dynamic changes, including insulin sensitivity alterations and increased glucose demands by both the mother and the developing fetus.

In a study, 290 women at high risk for GDM expressed maternal and fetal outcomes according to early or standard screening and GDM diagnosis time. The objective of that study was to evaluate whether early screening (16-18 weeks) and treatment of GDM may improve maternal and fetal outcomes[1]. As only limited and confusing evidence about serum placental growth factor (PlGF) level in GDM exists in the known literature, that research aimed to evaluate the association of maternal serum PlGF level with GDM status. None of the variables, including maternal age, BMI, insulin, and HOMA-IR, showed significant correlations in GDM and control groups[2].

Another study showed the results of 40 years at the Perinatal Diabetes Research Centre at São Paulo State University (UNESP), Brazil, on the maternal MGH environment and placental markers. They also described the unidirectional relationship between MGH and excessive fetal growth, supplying moderator analysis[3]. Gestational diabetes is diagnosed by screening all pregnant women during pregnancy because GDM generally has few or no symptoms. In 2020, Kalaivani conducted a study with 150 patients on the perinatal outcome of gestational diabetes mellitus expectant mothers at a tertiary hospital[4].

Another research in the same year investigated whether pre-pregnancy smoking is a risk factor for insulin-requiring GDM in Korean women[5]. Insulin-requiring GDM was defined as no claims for diabetes mellitus, a fasting blood glucose level of < 126 mg/dL before pregnancy, and initiation of insulin treatment during pregnancy. The relationship among the distribution of pathological values at the Oral Glucose Tolerance Test (OGTT), metabolic risk factors and pregnancy outcomes in women with GDM has not been identified[5].

Researcher Parrettini compared metabolic and therapeutic parameters, maternal-fetal outcomes and post-partum OGTTs with respect to the number and distribution of altered values of diagnostic OGTT in pregnancy[6]. India is considered the world capital of diabetes, and proper care and management of the same are society's demands. A prospective observational study focused on pregnancy outcomes in pregestational and gestational diabetic women where it was revealed that excessive insulin resistance or the inability to increase insulin production accordingly disrupts the physiological modulation of pregnancy-mediated glucose metabolism and may cause maternal GDM[7]. Treatment for gestational diabetes mellitus and maternal and neonatal pregnancy data were prospectively collected on outcomes. There are several influential works to establish a prospective GDM registry system in Japan[8, 9].

METHODS & MATERIALS

From January 2006 to December 2008, this prospective study was carried out at the Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine, and Metabolic Disorders (BIRDEM), Dhaka. Over 150 people with diabetes were recruited for the study. Pre-gestational dia-

betes mellitus (PGDM), gestational diabetes mellitus (GDM) and 75 Non-DM patients were the three groups of women.

The inclusion criteria included pre-gestational diabetes women who were already taking insulin, as well as gestational diabetic women who were pregnant and needed it during the last trimester. This study excluded participants with diabetes mellitus worsened by other medical conditions as well as those with retinopathy or nephropathy. The patients with diabetes were treated with subcutaneous insulin therapy and dietary control to keep fasting blood glucose levels below 105 mg/dl and post-prandial glucose levels below 140 mg/dl. Each research subject's pertinent information was entered into a questionnaire.

The computer program SPSS was used to examine the data. The permission was obtained prior to the study population's recruitment. The Bangladesh College of Physicians and Surgeons (BCPS) provided ethical clearance. GDM and NIDDM are comparable pathologically. Its primary characteristic is insulin resistance, which is most likely brought on by pregnancy's anti-insulin hormone. The leading cause of lipolysis and insulin resistance is the human placental hormone (HIPL). In the third trimester, it also changes how mothers metabolize carbohydrates. Pregnancy raises levels of prolactin and cortisol. Cortisol reduces glucose use and increases the body's natural synthesis of glucose and glycogen. The fetus's pathophysiologic response to elevated maternal glucose levels is a function of both the elevation and the length of time.

RESULTS

There were total 150 patients into three groups for instance, Group A: PGDM (n=75), Group B: GDM (n=75) and Group C: Non-diabetic (*n*=75).

Table I: Age distribution of the study subjects

Age group (years)	Group A (*n*=60)		Group B (*n*=60)		Group C (*n*=60)		*p*-value
	N	%	N	%	N	%	
≤25	10	16.7	9	15	12	20	<0.05*
20-30	14	23.33	30	50	29	48	
31-35	27	66.67	15	25	14	24	
≥35	9	33.33	6	10	5	8	

*Chi-square test, *=Significant*

Table I shows that in group A, most of the women belonged to age group 31-35 years (66.67%), in group B and C, age group 20-30 years (50 and 48%). So, the groups were not comparable as regarding age. Besides, most of the women of all three groups (A, B and C) presented at term gestation (≥37 weeks), 80, 74 and 88 percent, respectively.

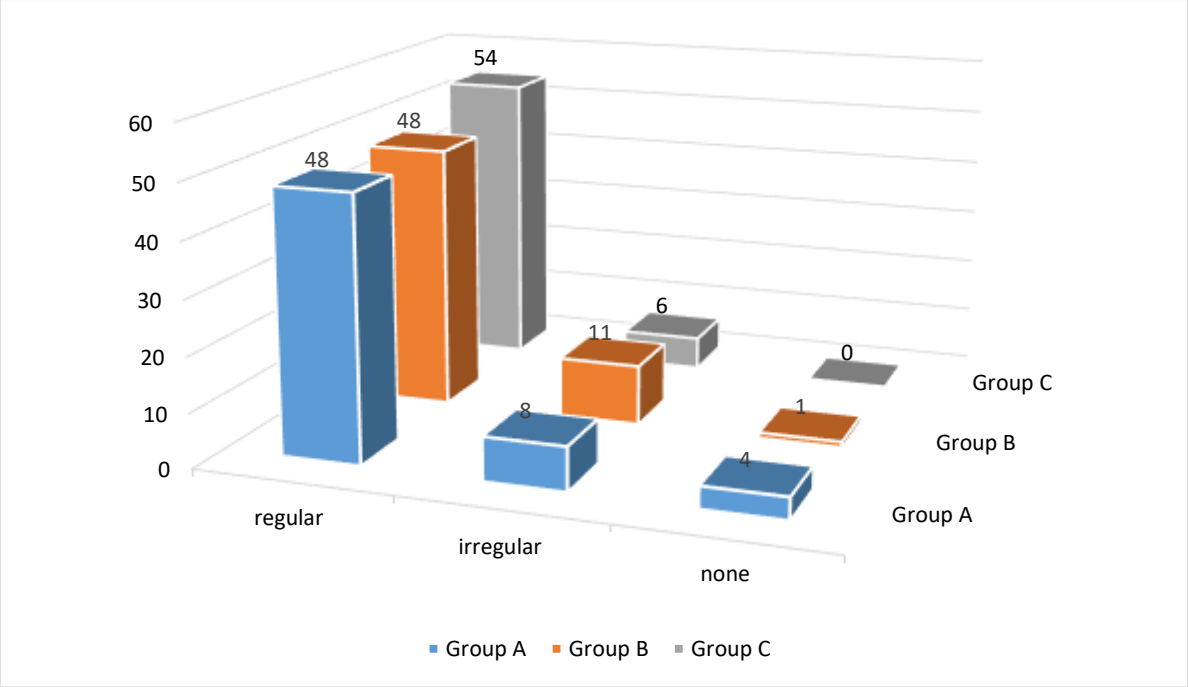

Figure 1: Status of Antenatal checkup of the study subjects (n=180)

Figure 1 shows that most of women of all three groups (A, B and C) were on regular antenatal care (ANC) (48, 48, and 54%), followed by irregular (8, 11 and 6%) and none (4, 1 and 0%).

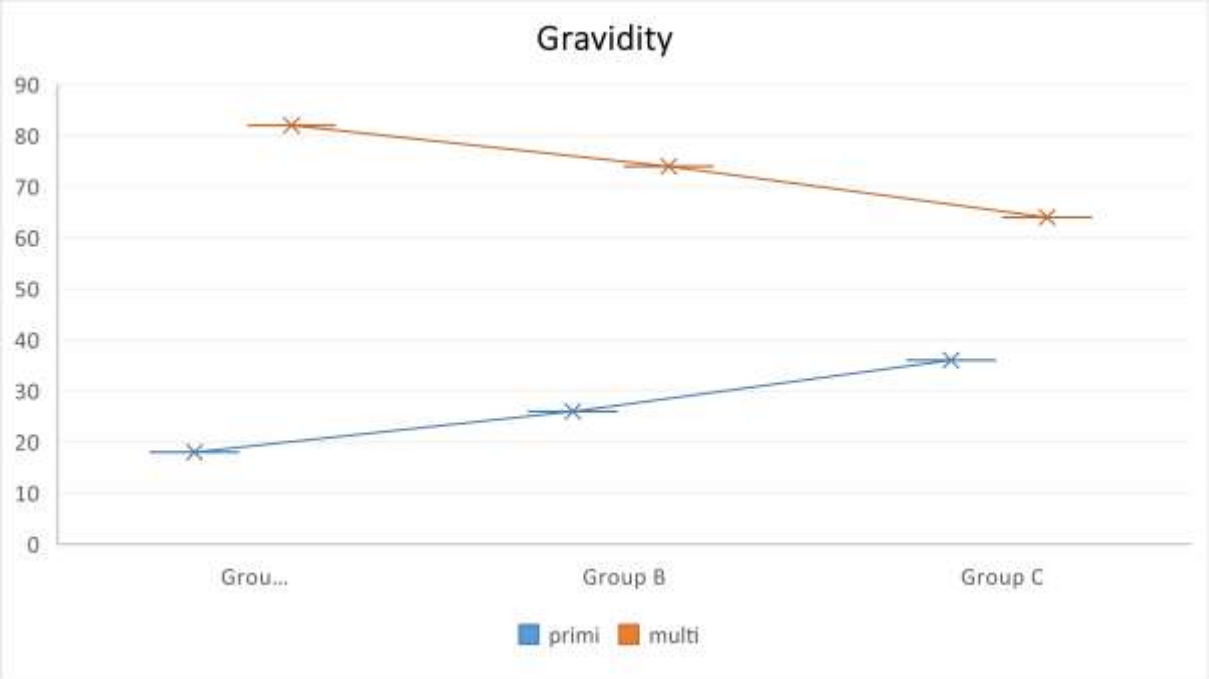

Figure 2: Gravidity of the study population (n=180)

Figure 2 shows that maximum number of women of all three groups (A, B and C) belonged to multigravida group (82, 74 and 64%). Primigravida was 18 percent in group A, 26 percent in group B and 36 percent in group C.

Table II: Comparison of mean systolic blood pressure of the patients

SBP (mmHg)	Group A (*n*=60)	Group B (*n*=60)	Group C (*n*=60)
Mean±SD	116.00±13.25	112.60±13.97	107.60±14.51
Range	90-160	90-150	90-150
Groups	-	***p*-value**	***p*-value**
A vs B and C	-	>0.10	<0.01**
B vs C	-	-	>0.05^{ns}

*ANOVA test (multiple comparison), Ns = Not significant, **= Significant*

Table II shows comparison of mean systolic blood pressure (SBP) of the study subjects between groups. Mean (±SD) SBP of group A, B and C women were 116.00±13.25, 112.60±13.97 and 107.60±14.51 (range 90-160, 90-150 and 90-150) mmHg, respectively. Comparison of mean SBP between group A and B, and group B and C were not significant, however, between group A and C was significant (p<0.01).

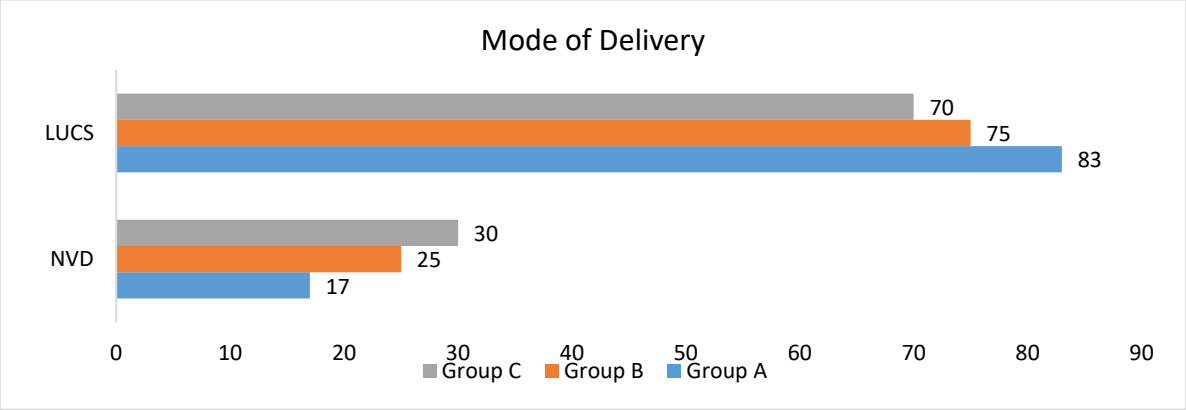

Figure 3: Mode of delivery of the study subjects

Figure 3 shows that most of the women of all three groups (A, B and C) were delivered by lower uterine Cesarean section (LUCS) 83, 75 and 70%), and the rest were normal vaginal delivery (NVD) (17, 25 and 17%).

Table III: Maternal complications of the study subjects

Complications	Group A (n=60)		Group B (n=60)		Group C (n=60)		*p*-value
	n	**%**	***n***	**%**	***n***	**%**	
PPH	15	25	12	23	10	16	>0.10^{ns}
Wound infection	5	10	3	5	0	0	
UTI	3	5	9	15	4	7	
None	36	60	33	57	46	77	

Chi-square test, ns = Not significant

Table-III shows that most common complication was PPH (25% in group A, 23% in group B and 16% in group C)). In this series, there was no maternal death.

Table IV: Neonatal complications of the study subjects

Complications	Group A (n=60)		Group B (n=60)		Group C (n=60)		*p*-value
	n	%	*n*	%	*n*	%	
Present	57	95	59	98	25	42	<0.001**
Absent	3	5	1	2	35	58	
	(*n*=47)		(*n*=49)		(*n*=20)		
RDS	28	59.6	29	59.2	7	35	-
Hypoglycemia	13	27.7	9	18.4	0		
Hyperbilirubinemia	45	95.7	36	73.5	17	85	
Hypocalcaemia	0		2	4.1	0		

*NOTE: Some of babies had more than one complication, Chi-square test, **Significant*

Table-IV shows that 60 percent of group C, 6 percent of group A and 2 percent of group B babies had no complication at birth. Complication was maximum in group B babies (98%), followed by group ^ (95%) and group C (42%). Hyperbilirubinemia was the most common complication in all three groups (A, B and C) and next common complication was RDS.

Table V: Requirement of insulin in PGDM and GDM patients

Insulin (IU)	Group A (*n*=60)		Group B (*n*=60)		*p*-value
	n	%	*n*	%	
<30	17	28	36	60	<0.01**
30-75	30	50	16	27	
>75	13	22	8	13	

*Chi-square test/Unpaired Students' test, **Significant*

Table-V shows that in group A, insulin requirement was 30-75 IU in 30 (50%), <30 IU in 17 (28%) and >75 IU in 13 (22%) women, and in group B was <30 IU in 36 (60%), 30-75 IU in 16 (27%) and >75 IU in 8(13%) women.

Table VI: Effect of insulin dose on neonatal complication

Fetal complication	**<30 IU**		**30-75 IU**		**>75 IU**		***p*-value**
	n	%	*n*	%	*n*	%	
Group A	**(*n*=14)**		**(*n*=27)**		**(*n*=9)**		
Present	13	92.9	25	92.6	9	100	>0.50^{ns}
Absent	1	7.1	2	7.4	0		
Group B	**(*n*=31)**		**(*n*=15)**		**(*n*=4)**		
Present	31	100	15	100	3	75	<0.01**
Absent	0		0		1	25	

*Chi-square test, ns = Not significant, **Significant*

Table VI shows effect of insulin dose on neonatal complications. In both the groups (A and B), fetal complication was present irrespective of insulin dose. In group A and B, respectively, 92.9 and 100.0 percent (insulin dose <30 IU), 92.6 and 00 percent (insulin dose 30-75 IU, and 100 and 75 percent (insulin dose>75 IU).

Table VII: Effect of insulin dose on neonatal complication

Fetal complications	**<30 IU**		**30-75 IU**		**>75 IU**	
	n	%	*n*	%	*n*	%
Group A	(*n*=13)		(*n*=25)		(*n*=9)	
Group B	(*n*=31)		(*n*=15)		(*n*=3)	
RDS						
Group A	9	69.2	14	56	5	55.6
Group B	16	51.6	11	73.3	2	66.7
Hypoglycemia						
Group A	5	38.5	6	24	2	22.2
Group B	5	16.1	3	20	1	33.3
Hyperbilirubinemia						
Group A	11	84.6	25	100	9	100
Group B	25	80.6	10	66.7	1	33.3
Hypocalcaemia						
Group A	0	0	0	0	0	0
Group B	1	3.2	1	6.7	0	0

Table VII displays how the type of newborn problems is affected by insulin dosage. RDS was found to be high in group A babies whose mothers took less than 30 IU of insulin (69.2%) and in group B babies whose mothers took between 30 and 75 IU

of insulin (73.3%). None of the babies in group A had hypocalcaemia, and in group B, it was high among babies born to mothers on insulin dose 30-75 IU (6.7%), while hypoglycemia was high among babies born to mothers on insulin dose <30 IU (38.5%) and >75 IU (33.3%). Hyperbilirubinemia was high among babies born to mothers on insulin dose 30-75 and>75 IU (100% each) and <30 IU (80.6%).

Table VIII: Relationship of insulin dose on neonatal admission to NNCU

Admission to NNCU	<30 IU		30-75 IU		>75 IU		*p*-value
	n	**%**	***n***	**%**	***n***	**%**	
Group A	**(*n*=13)**		**(*n*=25)**		**(*n*=9)**		
Yes	0		5	20	1	11.1	>0.10
No	13	100	20	80	8	88.9	
Group B	**(n=31)**		**(n=15)**		**(n=3)**		
Yes	5	16.1	1	6.7	1	33.3	>0.10
No	26	83.9	14	93.3	2	66.7	

Chi-square test, ns=Not significant

Admission of babies to NNCU was very low irrespective of the dose of insulin by mothers of both group A and B.

DISCUSSION

In the United States, 5% of pregnancies result in an unfavorable perinatal outcome due to GDM[10]. The subject's age ranged from 20 to 38 years old. The greatest percentage of women in each of the three groups (A, B, and C) in this study belonged to the multigravida group (82, 74, and 64%). In group A, 18% of the primigravidas, 26% in group B, and 36% in group C. GDM has lower pregnancy-related morbidity and death than diabetes that is already established. Nonetheless, GDM is far worse than non-diabetic women if untreated.

If diabetes is managed throughout pregnancy, the outcome is normal and likely to be similar to that of a normal pregnancy [11]. In the study group, there was one neonatal death. Our 60 cases of non-diabetic patients as control group did not have any maternal or perinatal mortality, with the exception that hyperbilirubinemia was the most common. A congenital abnormality was not present. Unless it manifests at a time when nearly all fetal organogenesis has been finished, gestational diabetes mellitus is typically not linked to a significant prevalence of congenital abnormalities. Uncontrolled or undetected GDM in the early stages of pregnancy may lead to congenital abnormalities, according to research by Hawthorns G et al. that showed a malformation rate of 9.8% in GDM and 2.2% in the background population [12].

With the exception of hyperbilirubinemia and RDS, the patient with well-controlled DM and GDM did not have perinatal death or morbidity. This study has similarities to that of Jovanovich et al., wherein the mother's normal glycaemic levels were maintained for the majority of the pregnancy, leading to a near-complete disappearance of newborn morbidity[11]. In the

research group, there was not a single maternal death.

PPH was the most frequent maternal complication, occurring in 24% of groups A, B, and C. In all three groups, there was a greater incidence of LUCS. Group A had the highest LUCS (84%), followed by groups B and C (76% and 72%, respectively. According to a University of California study, GDM patients had a higher rate of cesarean sections (37% vs. 15%; p=0.01) than control patients[13]. However, if antenatal fetal surveillance is well-established, diabetes in pregnant women is well-controlled, and the pregnancy is straightforward, the pregnancy can be extended until spontaneous labor begins.

The benefit is that more vaginal births will take place, which is better than abdominal births. According to the study's findings, well-managed GDM and DM patients can have fetal outcomes that are similar to those of pregnant women without diabetes. A higher degree of glycemic control has been linked to better results[14]. This study emphasizes early booking screening because the first half of pregnancy can be used to diagnose gestational diabetes, particularly in high-risk individuals. It can be repeated between 24 and 28 weeks of gestation if the results are negative. This could lead to better perinatal outcomes by allowing for the development of intervention methods and offering the benefit of early diagnosis[14].

Although stringent management of maternal hyperglycemia and a high level of patient adherence are necessary for a successful decrease in GDM complications[15]. In this study, 54% of PGDM patients required between 30 and 75 IU of insulin, whereas 62% of GDM patients required less than 30 IU. Among the women who needed <30IU, the incidence of PPH was 50 and 22.6% in group A, 3.2% in wound infection, and 12.9% in UTI. Women who needed 30-75 IU of insulin had an incidence of PPH of 11.1 and 20%, wound infection of 7.4 and 0%, and urinary tract infection of 3.7 and 13.3%. Women using more than 75 IU of insulin had a 22.2% and 25% incidence of PPH, an 11.1 and 0% incidence of wound infection, and a 0% incidence of UTI.

In both groups, hypoglycemia was high among babies born to mothers on insulin <30 IU and >75 IU, and hyperbilirubinemia was high among babies born to mothers on insulin dose 30-75 IU and >75 IU and <30 IU. In group A, RDS was high among babies born to mothers on insulin dose <30 IU (69.2%), in group B insulin dose 30-75 IU. All of our GDM patients were recommended to obtain blood sugar tests at six weeks and again throughout their subsequent pregnancy when they were discharged. Women were directed to a diabetes clinic for appropriate blood sugar management if a postnatal visit revealed they were diabetic. Individuals who have a normal glucose tolerance ought to understand how important it is to maintain an optimal body mass index through diet and exercise[16].

Conclusion:

Proper antenatal checkup could identify gestational diabetes mellitus (GDM) and allow for an earlier initiation of treatment to manage blood sugar levels and address associated problems. Thus, in diabetes pregnancies, proper blood sugar management may lower the risk of congenital defects, as well as the morbidity and mortality of both the mother and the fetus. When obstetricians, pediatricians, endocrinologists, and neonatologists work together to manage diabetes, the best outcomes can be

achieved by keeping blood sugar levels as close to normal as feasible.

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