

# Gestational Diabetes Mellitus: Impact of Maternal Blood Sugar Level and BMI on Foetal Birth Weight

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## Abstract

Gestational diabetes mellitus (GDM) is defined as glucose intolerance of variable degrees with an onset, or first recognized, during pregnancy. About 15–45% of babies born to diabetic mothers can have macrosomia. This prospective case control study was conducted in the department of Obstetrics and Gynaecology of Gauhati medical college and hospital, Guwahati, Assam during the period of 2013–2015. A total of 160 patients were included in the study. 100 patients without any glucose abnormality were taken as control and 60 patients with gestational diabetes mellitus were included in the study as cases. In this study it was found that mean birth weight in GDM cases is more than normoglycemic control. The overweight and obesity group (BMI>25) have maximum birth weight. In this study it was found that the fasting blood glucose level is maximum in mothers with baby birth weight >3.5 kg.

**Keywords:** *Gestational diabetes mellitus, overweight, obesity, mean birth weight, body mass index.*

## Introduction

Gestational diabetes mellitus (GDM) is defined as glucose intolerance of variable degrees with an onset, or first recognized, during pregnancy. About 15–45% of babies born to diabetic mothers can have macrosomia, which is a 3-fold higher rate when compared to normoglycemic controls. Macrosomia is typically defined as a birth weight above the 90th percentile for gestational age or >4,000g.<sup>[1]</sup> Maternal obesity is associated with gestational diabetes mellitus (GDM) and adverse pregnancy outcomes.<sup>[2–5]</sup> When obese women were compared to normal-weight women, the newborns of obese women had more than double the risk of macrosomia compared to those of women with normal weight.<sup>[6]</sup> Most studies addressing the effects of maternal BMI on pregnancy outcomes include women with GDM.<sup>[7,8]</sup> In gravidas who are diabetic and in those who are not, there is a significant relation among increased maternal glucose levels, greater fetal growth, and higher infant weight at birth.<sup>[9–14]</sup> Maternal hyperglycemia leads to excess fetal insulin, itself a growth hormone for the fetus. Thus, offspring of mothers with gestational diabetes mellitus (GDM) have higher birth weights.<sup>[15]</sup> A study has shown that maternal obesity is a stronger predictor of a large-for-gestational-age infant than maternal hyperglycemia.<sup>[16]</sup> In the HAPO study the investigators found that the frequency of macrosomia in GDM was increased by 50% compared to non-GDM in both the nonobese and obese groups. Obesity was associated with a 2-fold higher frequency of macrosomia whether in the non-GDM or GDM group. Macrosomia in GDM only was present in 26%, in GDM

plus obesity in 33% and in obesity only in 41% women. Women who did not have GDM but who were obese had a 13.6% increased risk of macrosomia (defined as a child weighing 4,000 g or more at birth) than nonobese women.<sup>[17]</sup>

## Aims and objectives

The objective of this study were to examine association of birth weight with maternal blood glucose level and body mass index (BMI) in gestational diabetes mellitus cases and to determine the extent to which the effect of GDM is explained by its influence on birth weight or by maternal adiposity.

## Methods and materials

This was a prospective case control study conducted in the department of Obstetrics and Gynaecology of Gauhati medical college and hospital, Guwahati, Assam during the period of 2013–2015. A total of 160 patients were included in the study. 100 patients without any glucose abnormality were taken as control and 60 patients with gestational diabetes mellitus were included in the study as cases.

Eligibility criteria included patients attending antenatal OPD or admitted in the ward at term pregnancy.

**Exclusion criteria** - cases with insufficient information - where last menstrual period was not known, cases with severe anaemia, cases with twin pregnancy, cases with chronic hypertension,

chronic renal disease, cases having proteinuria before 20 weeks of gestation, cases diagnosed diabetes before pregnancy, cases where 5% dextrose drips were used and cases of prolonged labour were excluded. BMI was measured at the 1st visit in antenatal period.

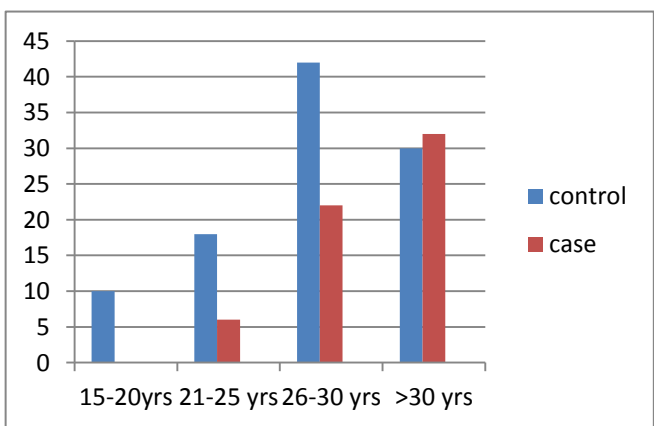
**Results and observations**

**Table 1: Distribution of patients**

Serial no	Group	No. Of cases n=160	Percentage
1	Control	100	62.50
2	Cases	60	37.50

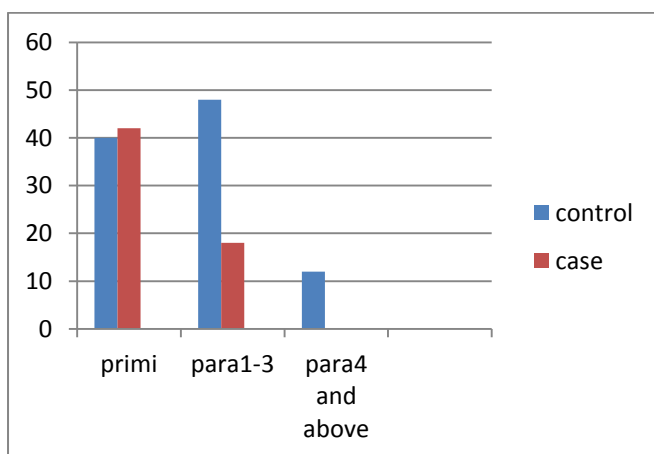
**Table 2: Age distribution**

Age group	Control	Cases
15-20 years	10	0
21-25 years	18	06
26-30 years	42	22
>30 years	30	32



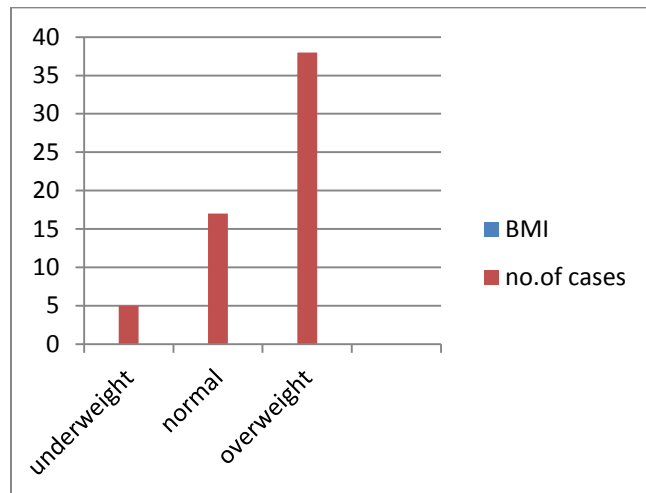
**Table 3: Distribution of parity among control and cases**

Parity	Control	Cases
Primi	40	42
Para 1-3	48	18
Para 4 and above	12	0
Total	100	60



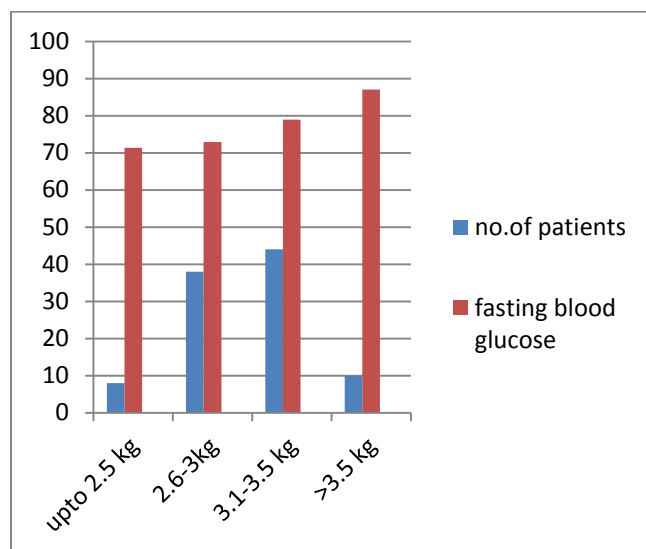
**Table4: distribution of cases depending on BMI**

category	BMI (kg/m <sup>2</sup> )	No of cases (N=60)	
Underweight	<18.5	05	
Normal	18.5-24.9	18	21
Overweight and obese	>25	17	34



**Table 5: Relation of maternal fasting blood glucose level with foetal birth weight in control group**

Birth weight in kg	No. Of patients	Mean maternal fasting blood glucose (mg%)
Upto 2.5kg	8	71.3
2.6-3 kg	38	72.9
3.1-3.5 kg	44	78.9
>3.5 kg	10	87



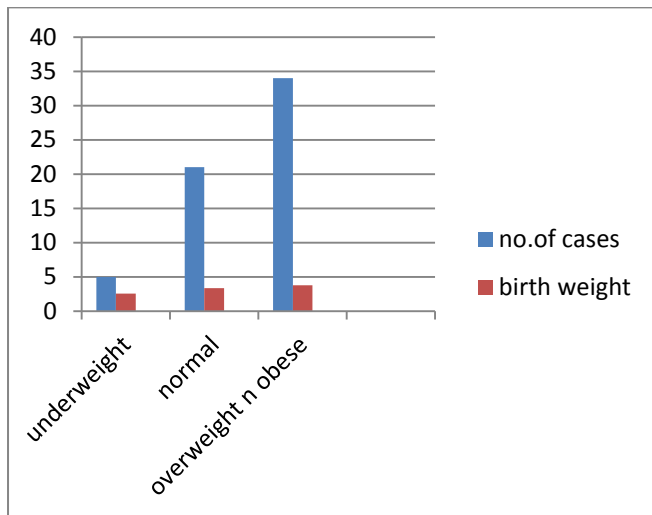
**Table 6: Relation of maternal fasting blood glucose level and foetal birth weight in gestational diabetic cases**

Foetal birth weight	No. of cases	Maternal fasting blood glucose level (mg%)	
Upto 2.5 kg	05	101	
2.6-3 kg	12	104	
3.1-3.5 kg	20	115	
>3.5 kg	23	122	

In the table it is seen that babies birth weight >3.5 kg have maximum fasting blood glucose levels.

**Table7: Relation of foetal birth weight to BMI**

BMI(kg/m <sup>2</sup> )	No. of cases (N=60)	Mean foetal birth weight (kg)
Underweight (<18.5)	05	2.55
Normal (18.5-24.9)	21	3.35
Overweight and obese (>25)	34	3.75



Overweight and obese women have babies with maximum birth weight.

**Table 8: Relation of mean maternal fasting blood glucose level and mean birth weight in normal and gestational diabetic women**

Group	Number	Maternal fasting glucose (mg%)	Mean birth weight(kg)
Control	100	83.52	3.11
Cases	60	112.4	3.51

P<0.05

There is significant difference in maternal fasting blood glucose and birth weight between control group and GDM group.

## Discussion

### 1. Relation of birth weight in control and GDM cases:

Following studies shows that mean birth weight in GDM cases is more than normoglycemic control .The difference is statistically significant.

A)

Group	Goldberg J.D. et al (1986) <sup>18</sup> N=58	Present study
	Baby birth weight mean(gm)	Baby birth weight mean(gm)
1.control(normoglycemic)	3231_+561	3110
2.gestational diabetes	3597_+721 P<0.05	3511 P<0.05

B)

Group	Mutangala Muloye Guy <sup>20</sup> (2017)	Present study
	Baby birth weight mean(gm)	Baby birth weight mean(gm)
1.Non GDM(control)	4156_+165	3110
2.Gestational diabetes	4182_+177 P=.001	3511 P<0.05

Jeanette wahlberg et al<sup>[20]</sup> in their study also found that GDM women had higher mean infant birth weight compared with controls(3682gm VS 3541gm .P<0.001).

### 2. Relation of BMI and foetal birth weight:

In our study it was found that the overweight and obesity group (BMI>25) have maximum birth weight.

Michael Conall Denney et al<sup>[19]</sup> (2012) concluded that birthweight correlated with maternal BMI was higher in infants born to overweight mothers( mean difference 0.9 kg) and obese mothers when compared with offspring of women with normal BMI (P<0.001). 22% infants born to obese mothers and 16% born to overweight mothers were large for gestational age compared with 12% born to mothers with normal BMI.

Liu Jian et al<sup>[24]</sup> in their study concluded that High BMI measured at GDM screening was the most important determinant for risk of macrosomia.

Martin kate E,M Rosalie et al<sup>[25]</sup> in their study on maternal BMI and GDM on pregnancy outcome, found that Raised maternal BMI is a risk factor for high infant birth weight and incidence of birth weight >90% (RR 1.38; 95% CI 1.07 to 1.77; p = 0.01) was significantly increased in women who were obese, independent of GDM.

### 3) Relation of maternal blood glucose with birth weight

In our study it was found that the fasting blood glucose level is maximum in mothers with baby birth weight >3.5 kg.

OdedLangerMDRogerMazzePhD<sup>[22]</sup> in their study found that the severity of glucose intolerance (hyperglycemia) was found to be associated with both maternal and neonatal morbidity in terms of infant size and cesarean section rate. By use of hierarchical cluster analysis to identify three groups on the basis of control levels (low <87 mg/dl, mid 87 to 105 mg/dl, high >105 mg/dl) we were able to show a positive outcome in the low group with reduced rates of large-for-gestational-age (2%) and macrosomic (0%) infants. Furthermore, they showed that as mean blood glucose levels and instability in glycemic control increased from group to group, incidence of large-for-gestational-age and macrosomic infants increased.

Jeanette et al<sup>[21]</sup> in their study found that birth weight positively correlated with fasting blood glucose level at GDM diagnosis(P<0.001).

Seabra Gisele et al<sup>[23]</sup> in their study found that higher fasting glucose levels were found in the second semester for women whose infants had macrosomia than for women whose newborns were normal weight (86.2 mg/dL and 78.8 mg/dL; post hoc = 0.003).

## Conclusion

In GDM the birth weight is significantly more than normal mothers. Increased BMI is a risk factor for large for gestational age infant. As the BMI increases there is increase in birth weight. Increased fasting blood glucose level is another risk factor for increased birth weight.

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