

## Obstetrical outcome in gestational diabetes mellitus: a retrospective study

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### ABSTRACT

**Background:** Gestational diabetes mellitus (GDM) is associated with adverse maternal and fetal outcomes. Majority of the maternal complications associated with GDM have been decreasing nowadays, however the relative risk of development of perinatal complications remain higher in women with hyper glycaemia.

**Methods:** This retrospective study was conducted among 286 delivered pregnant women. The pregnant women were diagnosed as GDM by DIPSI diagnostic criterion. The study was performed to find the association of various risk factors with GDM occurrence and to assess the obstetrical outcome in the GDM and normoglycaemic women.

**Results:** Out of the 286 women, the proportion of women affected with GDM was 20.6%. The onset of GDM was more common among women between 25-30year (62.7%). GDM onset is increased when they had previous history of GDM and family history of diabetes. The obstetric complications were less common among GDM women (23.72%). GDM women had increased rate of caesarean delivery (69.5%) and induction of labour (42.4%). The neonatal complications were more common among GDM neonates (57.62%). The proportion of occurrence of congenital anomalies and macrosomia (>3.5kg) was similar among both groups.

**Conclusions:** Risk factors associated with GDM onset such as previous history of GDM and family history of diabetes are significant risk factors. Advanced age, increasing parity and occurrence of abortions were not associated with GDM onset. With good glycaemic control the obstetrical complications and macrosomia are preventable. Rate of Induction of labour, caesarean delivery and neonatal morbidity remains higher among GDM women.

**Keywords:** DIPSI, Gestational diabetes mellitus, Macrosomia, Meal nutritional therapy

### INTRODUCTION

GDM has been defined as any degree of glucose intolerance with onset or first recognition during pregnancy.<sup>1</sup> Among the medical disorders which affect the pregnancy, Diabetes is one of the most common medical complications of pregnancy. It complicates two to five percent of pregnancies, of which 90% is contributed by Gestational Diabetes Mellitus (GDM).<sup>2</sup>

The prevalence of GDM varies, widely based on the diagnostic criteria used and the ethnic group studied.<sup>3</sup> Among ethnic groups in South Asian countries, Indian

women have the highest frequency of GDM.<sup>4</sup> It has been reported that prevalence of GDM is almost 11-fold higher in Indian women when compared to the Caucasian population.<sup>5</sup> GDM development is associated with the occurrence of impaired glucose tolerance (IGT) within a given population. A study by ICMR-INDIab estimated the prevalence of IGT between 8.3-14.6%.<sup>6</sup> It has been reported that because of high prevalence of IGT among Indian population, there is a proportionate increase in the occurrence of GDM.<sup>7,8</sup>

Glucose intolerance is associated with adverse maternal and fetal outcomes. It has been observed that women with

history of GDM and their offspring are at risk of developing diabetes in future.<sup>9,10</sup> Therefore there is a definite need of universal screening for GDM for an early detection which helps in proper monitoring and treatment of the disease so as to prevent the complications associated with it.

The conventional methods so far used to diagnose GDM are as per country specific guidelines. DIPSI (Diabetes in Pregnancy Study group of India)-a modified WHO criteria was designed as per the Indian standards. It is simple, convenient and can be used as a universal screening test irrespective of meal time but having low sensitivity and is affected by diurnal variation.<sup>11-15</sup>

Recently a study by Srinivasan et al concluded that DIPSI criterion can be applied in low resource countries as it is easy and cost effective.<sup>16</sup> Majority of obstetrical complications associated with GDM have been decreasing since 1980's due to increased awareness and appropriate multidisiplinary antenatal care however the relative risk of development of perinatal complications remains 3 fold higher.<sup>15</sup> A study by Jadhav et al in 2017 observed that decreased incidence of maternal complications like preeclampsia and preterm birth in GDM women but observed increased incidence of macrosomia despite well glycaemic control.<sup>17</sup> The present study has been done to assess the maternal and fetal outcome in women diagnosed as GDM.

## METHODS

This retrospective study was conducted in the ESIC Medical College and PGIMSR, Chennai for a period of 6 months from January 2016 to June 2016. Primary objective was to know the proportion of GDM occurrence among pregnant women delivered during the study period. Secondary objective was to find the association of risk factors with GDM occurrence and to assess the obstetrical and neonatal outcome among GDM and normoglycaemic women

### Inclusion criteria

- All the pregnant women delivered in the institute during study period were included.

### Exclusion criteria

- Pregnant women with preexisting Type 1 and Type 2 DM were excluded from the study.

Being a retrospective study, the details regarding maternal demographic characters, obstetrical and neonatal outcome were recorded from the medical records. All pregnant women were diagnosed as GDM by DIPSI diagnostic criterion. Pregnant women were given 75g anhydrous glucose in 250-300 ml water irrespective of last meal status. Plasma glucose estimation from venous blood sample was measured after 2 hours and

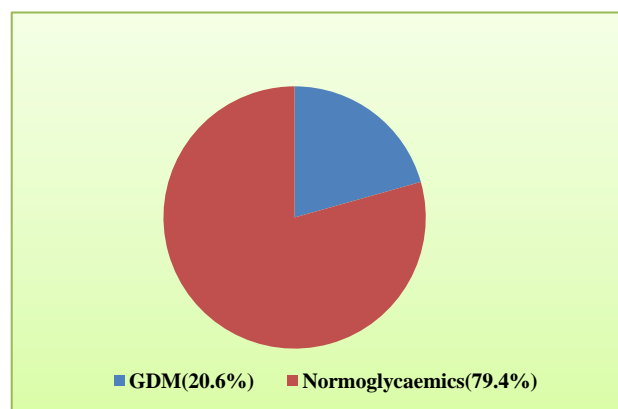
plasma glucose values of  $\geq 140$ mg/dl was considered diagnostic of GDM.<sup>18</sup> After the diagnosis was made, initial advice regarding Medical Nutrition Therapy (MNT) was given for 2weeks. Insulin therapy was started when the FBS value reached  $\geq 90$ mg/dl and 2-hour PPPG value  $\geq 120$ mg/dl. Pregnant women were carefully monitored throughout the pregnancy and followed up till delivery. At each visit all pregnant women were monitored for the early detection of obstetrical complications by means of clinical examination, biochemical and radiological investigations. GDM women on MNT and medical therapy having well controlled sugars were planned for termination of pregnancy at 40 completed weeks while GDM women with high dose of insulin and uncontrollable sugars were planned for termination of pregnancy depending on the clinical condition. Induction of labour was performed with cerviprime and oxytocin. During labour pregnant women were carefully monitored and active management of labour done. Caesarean section was performed for obstetrical indications. Routine postnatal sugar monitoring was done.

### Statistical analysis

Categorical data were presented as numbers and percentages while, continuous data were expressed as mean $\pm$ standard deviation (SD). An association between various attributes and GDM, Pearson Chi square test has been used. The Statistical significance was considered at  $p < 0.05$ . The analyses were performed using SPSS statistical software (version 21.0). The graphics were provided by Microsoft excel.

## RESULTS

There were 301 deliveries during study period. 6 pregnant women had type 2 diabetics and were excluded. 9 case records had incomplete data. Totally 286 pregnant women were included for the study. Among them 59(20.6%) were diagnosed as GDM according to DIPSI criteria and 227 (79.4%) were normoglycaemics. It is depicted in Figure 1.



**Figure 1: Proportion of GDM and normoglycaemics in the study population.**

GDM onset is associated with various factors such as age, parity, BMI, previous history of GDM and family history of diabetes. In the present study all above factors were studied, however due to unavailability of BMI details, its association in development of GDM was not analysed. Among 286 women, majority of them the women were aged between 25-30years accounting to 163 (57%) women. Among 44 women (15.4%) who were ≥31years, 11(25%) women had GDM, while 33(75%) women were normoglycaemic throughout the pregnancy. In our study the onset of GDM was seen more common among women between 25-30year age group (62.7%) compared to 18.6% women who were ≥31 years (p= 0.321) (Table 1).

**Table 1: Association of Age with GDM occurrence.**

Age (years)	GDM n-59	Non GDM n-227	Total n-286
19-24	11	68	79
	13.9%	86.1%	100%
	18.6%*	30.0%*	27.6%*
25-30	37	126	163
	22.7%	77.3%	100%
	62.7%*	55.5%*	57.0%*
≥31	11	33	44
	25%	75%	100%
	18.6%*	14.5%*	15.4%*
Total	59 (100%)*	227 (100%)*	286 (100%)*

\*column percentages

Among 59 GDM women, 17 (28.8%) had previous history of one or more abortions. The occurrence of one or more abortions among normoglycaemic women was 24.2%. It implies that history of one or more abortions was not associated with the occurrence of GDM. (p=0.470) (Table 2).

**Table 2: Association of abortion with GDM occurrence.**

Abortion	GDM n-59	Non GDM n-227	Total n-286
Yes	17	55	72
	23.6%	76.4%	100.0%
	28.8%*	24.2%*	25.2%*
No	42	172	214
	19.6%	80.4%	100.0%
	71.2%*	75.8%*	74.8%*
Total	59(100%)*	227(100%)*	286*

\*column percentages

In the present study, 139(48.6%) were primigravida and 147 (51.4%) were multigravida women. Occurrence of GDM among primigravida and multigravida women was 22.3% and 19.0% respectively. The occurrence of GDM among primigravida and multigravida was not statistically significant. (p= 0.497). This is illustrated in the Table 3. In the present study, 33 (11.5%) women had previous history of GDM. Among them, 23 (69.7%)

women developed recurrent GDM in the present pregnancy while 10 (30.3%) women did not develop GDM in spite they had previous history of GDM.

**Table 3: Association of parity with GDM occurrence.**

Parity	GDM n-59	Non GDM n-227	Total n-286
Primi	31	108	139
	22.3%	77.7%	100.0%
	52.5%*	47.6%*	48.6%*
Multi (one or more)	28	119	147
	19.0%	81.0%	100.0%
	47.5%*	52.4%*	51.4%*
Total	59 (100%)*	227 (100%)*	286 (100%)*

\*column percentages

This implies that rate of recurrent GDM increases in women with previous history of GDM (p=.000). This is illustrated Table 4.

**Table 4: Association of previous history with GDM occurrence.**

Past history	GDM n-59	Non GDM n-227	Total n-286
Yes	23	10	33
	69.7%	30.3%	100.0%
	39.0%*	4.4%*	11.5%*
No	36	217	253
	14.2%	85.8%	100.0%
	61.0%	95.6%	88.5%
Total	59 (100%)*	227(100%)*	286 (100%)*

\*column percentages

Among 59 GDM women, 34 (57.6%) had family history of diabetes. while the same was 53 (23.3%) in non GDM women. This implies that occurrence of GDM was associated with a family history of diabetes and this was significant (p=0.00). This is illustrated in Table 5. Among the GDM women, Insulin therapy was required in 26 (44.1%) women while the remaining 33 (55.9%) required meal nutrition therapy along with life style modification.

**Table 5: Association of family history with GDM occurrence.**

Family history	GDM N-59	Non GDM N-227	Total N-286
Yes	34	53	87
	39.1%	60.9%	100.0%
	57.6%*	23.3%*	30.4%*
No	25	174	199
	12.6%	87.4%	100.0%
	42.4%	76.7%	69.6%*
Total	59 (100%)*	227 (100%)*	286 (100%)*

\*column percentages

In the present study medical complications were observed in 64 (22.37%) women. Most common complication was Hypothyroidism found in 31 (10.83%) women followed by Anaemia in 24(8.39%) women and others constituted to affect 7 (2.44%) women. Among the other complications, it was found that 1 (1.7%) women had Atrial septal defect in GDM category and 6 (2.64%) women were affected (Epilepsy in 4, Bronchial asthma in one and Protein S deficiency in one) in the non GDM category.

The medical complications affected 16 (27.11%) of the GDM and 48 (21.14%) of the non GDM women. However increased occurrence of medical complications among GDM women was not statistically significant in the present study. (p=0.702). This is shown in Table 6.

**Table 6: Association of medical complications with GDM.**

	GDM n-59 (%)	NON GDM n-227 (%)	Total n-286 (%)
Anemia	7 (11.9)	17 (7.48)	24 (8.39)
Hypothyroidism	7 (11.9)	24 (10.57)	31 (10.83)
Chronic hypertension	1 (1.7)	1 (0.44)	2 (0.69)
Others	1 (1.7)	6 (2.64)	7 (2.44)
Total complications	16 (27.11)	48 (21.14)	64 (22.37)

In the present study, 78 (27.27%) women had one or the other pregnancy specific complications. PROM was the most common complication found in 32 (11.18%) women followed by Oligohydramnios in 28 (9.8%) women while 11 (3.84%) and 4 (1.4%) women had Preeclampsia and polyhydramnios respectively. Other complications namely placenta previa, hydrocephalus and intrauterine death was noticed in 3 (1.04%) women, who were of non GDM category.

The occurrence of obstetric complications were more commonly noticed among normoglycaemic women 64 (28.19%) whereas GDM women 14 (23.72%) had decreased occurrence of pregnancy complications. (p=0.789). This is illustrated Table 7.

**Table 7: Obstetric complications associated with GDM.**

	GDM n-59 (%)	NON GDM n-227 (%)	Total n-286 (%)
PROM	6 (10.16)	26 (11.45)	32 (11.18)
Oligo-hydramnios	4 (6.77)	24 (10.57)	28 (9.8)
Preeclampsia	3 (5.08)	8 (3.52)	11 (3.84)
Polyhydramnios	1 (1.7)	3 (1.32)	4 (1.4)
Others	0	3 (1.32)	3 (1.04)
Total	14 (23.72)	64 (28.19)	78 (27.27)

Among 59 GDM women, 25 (42.4%) required induction of labor while 9 (15.3%) had spontaneous onset of labour. In normoglycemic women, 79 (34.8%) required induction of labour and 71 (31.3%) had spontaneous labour. The association of need for labour induction, occurrence of spontaneous labour and direct caesarean section in GDM women showed statistically just significant (p= 050) (Table 8).

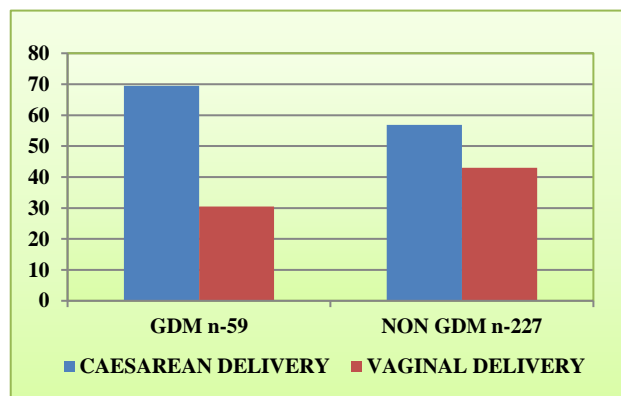
**Table 8: Mode of onset of labour.**

Mode of onset of labour	GDM n-59 (%)	NON GDM n-227 (%)	Total n-286 (%)
Spontaneous labour	9	71	80
	11.3	88.8%	100.0
	15.3*	31.3%*	28.0*
Induced	25	79	104
	24.0	76.0%	100.0
	42.4*	34.8%*	36.4*
Direct LSCS	25	77	102
	24.5	75.5%	100.0
	42.4*	33.9%*	35.7*
Total	59	227	286
	(100)*	(100)*	(100)*

\*column percentages

In the present study, over all caesarean section rate stood up to 59.4%. The rate of caesarean section and vaginal delivery in GDM women were was 69.5% and 30.5% respectively whereas the rate of caesarean section and vaginal delivery in Non GDM women were 56.8% and 43% respectively.

In the present study GDM women had increased occurrence of caesarean section up to 69.5%. It was statistically significant. (p=0 .042) (Figure 2).



**Figure 2: Mode of delivery in the study population.**

As already mentioned, in the present study 170 (59.4%) women required caesarean section. The higher rate of caesarean section was due to post caesarean pregnancy with doubtful scar in 73 (42.94%) women followed by fetal distress in 24 (14.11%) women.



The proportion of women requiring caesarean section due to failed induction was 8 (13.55%) in GDM women when compared to 9 (3.96%) in non GDM women (Table 9). In the present study 13 (4.54%) women had one or another maternal morbidity. PPH was most common complication affecting 6 (2.09%) women followed by wound infection in 5 (1.74%) women.

**Table 9: Indication for caesarean section.**

Indication for caesarean section	GDM N-59	Non GDM N-227 (%)	Total N-286
Failed induction	8 (13.5)	9 (3.96)	17
Fetal distress	4	20	24 (14.11)
CPD	2	19	21
Post caesarean pregnancy	19 (32.2)	54 (23.78)	73 (42.94)
Meconium stained liquor	3	9	12
Breech presentation	2	10	12
Others	3	8	11
Total	41 (69.5)	129 (56.8)	170 (59.4)

Febrile morbidity was observed in 2 (3.38%) of GDM women. 8.47% of GDM women had maternal morbidity compared to 3.52% of normoglycaemic women. However, it was not statistically significant (p=0.136) (Table 10).

**Table 10: Maternal morbidity in the study population.**

	GDM n-59	NON GDM n-227	Total n-286
PPH	2 (3.38)	4 (1.76)	6 (2.09)
Wound infection	1 (1.69)	4 (1.76)	5 (1.74)
Maternal fever	2 (3.38)	0	2 (0.69)
Total	5 (8.47)	8 (3.52)	13 (4.54)

In the present study, majority of neonate 130 (45.5%) weighed between 2.51-3kg followed by 85(29.7%) neonate who weighed between 3.01-3.50 kg. The proportion of neonate weighing more than 3.5kg was 6.6%.

The occurrence rate of macrosomia (>3.5kg) was 8.5% among GDM women corresponding figure for normoglycaemics was 6.2%. The occurrence of macrosomia among GDM women was not statistically significant (p=0.883). This is illustrated in Table 11.

In the present study overall need for NICU admission was 43%. Most common neonatal complication was RDS found in 45 (15.73%) neonate followed by hyperbilirubinemia in 35 (12.23%) neonate. Occurrence of congenital anomalies among GDM and non GDM

women was 3.38% and 3.52% respectively. The neonatal complications which required NICU care was more common among GDM neonates accounting to 57.62%. compared to non GDM neonates of about 38.76% (p=0.004). This is illustrated in Table 12.

**Table 11: Distribution of neonatal weight.**

	GDM n-59	Non GDM n-227	Total n-286
<2kg	2	4	6
	33.3%	66.7%	100.0%
	3.4%*	1.8%*	2.1%*
2.01-2.50kg	9***	37	46
	19.6%	80.4%	100.0%
	15.3%*	16.3%*	16.1%*
2.51-3kg	25**	105	130
	19.2%	80.8%	100.0%
	42.4%*	46.3%*	45.5%*
3.01-3.50kg	18	67	85
	21.2%	78.8%	100.0%
	30.5%*	29.5%*	29.7%*
>3.5kg	5	14	19
	26.3%	73.7%	100.0%
	8.5%*	6.2%*	6.6%*
Total	59 (100)	227 (100)	286 (100)

\*column percentages,\*\*\* twins weighing 2 and 2.2 kg \*\* twins weighing 2.9 and 2.95 kg

**Table 12: Occurrence of neonatal complications.**

	GDM n-59	NON GDM n-227	Total n-286
Hyperbilirubinemia	11 (18.64)	24 (10.57)	35 (12.23)
RDS	9 (15.25)	36 (15.85)	45 (15.73)
SGA/IUGR	5 (8.47)	15 (6.6)	20 (7)
HIE	2 (3.38)	2 (0.88)	4 (1.39)
Hypoglycemia	4 (6.77)	1 (0.44)	5 (1.74)
Sepsis	1 (1.69)	2 (0.88)	3 (1.04)
Congenital anomalies	2 (3.38)	8 (3.52)	10 (3.5)
Total	34 (57.62)	88 (38.76)	122 (42.65)

## DISCUSSION

In the study among 286 women, the proportion of women diagnosed with GDM was 20.6%. Seshiah et al in their community based study in 2008 reported the prevalence of GDM of about 17.8% women in urban, 13.8% in semi urban and 9.9% in rural areas.<sup>19</sup> The recent guidelines issued by the State Health Society and Directorate of Public Health and Preventive Medicine estimates the incidence of GDM to increase by 20%.<sup>20</sup> In our study mean age in study population was 26.951±3.5744. The proportion of women affected with GDM was more common in the age group of 25-30 years (62.7%). Similar findings were found by recent researchers, they observed majority of GDM affected women were aged between 26-

30 years.<sup>21,22</sup> In present study the occurrence of GDM among women  $\geq 31$  years was 18.6%. A study by Seshiah et al reported age more than 25 years is a risk factor for GDM.<sup>19</sup> The occurrence of one or more abortions among GDM and normoglycaemics women was 28.8% and 24.2% respectively. History of one or more abortions is not associated with the occurrence of GDM in present study ( $p=0.470$ ). However, a study by Saxena et al reported previous history of abortions is a risk factor for GDM occurrence.<sup>23</sup>

In the present study 48.6% were primigravida and 51.4% were multigravida. Occurrence of GDM among primigravida and multigravida women was 22.3% and 19.0% respectively. Seshiah et al reported GDM occurrence among multigravida was 25.8%.<sup>13</sup> Rajput et al. shows that higher parity would have a higher rate of GDM occurrence.<sup>24</sup>

In the present study, 69.7% women developed recurrent GDM. Above findings are comparable to 50% being reported by Seshiah et al.<sup>18</sup> Suggests previous history of GDM is a risk factor for GDM occurrence.

In the present study, 57.6% women of GDM had family history of Diabetes. This is similar to the findings obtained by Joy et al, they observed 64.86% had family history, however a study done by Bhat et al and Seshiah et al reported GDM occurrence of about 37.3% and 32.3% respectively for women who had family history of GDM.<sup>19,25,26</sup>

In the present study medical complications most commonly reported was anemia and hypothyroidism. Overall it affected 27.11% of GDM women and 21.14% of non GDM women. Saxena et al reported increased occurrence of hypothyroidism in women with hyperglycaemia.<sup>23</sup> Similarly a study by Kadiyala et al reported occurrence of hypothyroidism was associated with hyperglycaemia.<sup>27</sup>

In the present study occurrence of obstetric complications like PROM, oligohydramnios, preeclampsia and polyhydramnios were more common among normoglycaemic women (28.19%) whereas GDM women has had decreased occurrence of obstetric complications (23.72%). It was comparable to findings reported by Jadhav et al.<sup>17</sup> This may be due to early diagnosis and prompt multidisciplinary management of GDM women with lifestyle modifications and accurate glycemic control by medical therapy.

Among GDM women, rate of induction of labour was 42.4%. In normoglycaemic women 34.8% required induction of labour. A study by Sathiamma et al. observed need for induction of labour for about 37.2% among GDM women.<sup>28</sup> The rate of caesarean section and vaginal delivery in GDM women was 69.5% and 30.5% respectively whereas among non GDM women 56.8% underwent caesarean section and 43% had vaginal

delivery. This It implies that there is increased occurrence of caesarean section in GDM women. , comparable to findings reported by Saxena et al. They reported that 71.4% of hyperglycaemic women required caesarean section.<sup>23</sup>

Occurrences of maternal complications like post-partum haemorrhage, fever and wound infection was 8.47% in GDM women when compared to 3.52% in normoglycaemic women. However, it was not statistically significant.

In the present study there was no neonatal death. The occurrence of neonatal complications which required NICU care was more common among GDM neonates accounting to 57.62% compared to non GDM neonates of about 38.76%. In the present study .Neonatal complications were more common among GDM women. Similar results were obtained by Saxena et al.<sup>23</sup> Jadhav et al reported 33.75% of neonatal complications.<sup>17</sup>

The occurrence of congenital anomalies among GDM women was 3.38%. In normoglycaemics women it was 3.52%. The proportion of occurrence of congenital anomalies between GDM and normoglycaemics women was same. Similar observations has been observed by Jadhav et al.<sup>17</sup>

In the present study, majority of neonate (45.5%) were weighing between 2.51-3kg followed by 29.7% neonate who were weighing between 3.01-3.50kg.

The proportion of neonate weighing more than 3.5kg among GDM was 8.5%. It was comparable to results obtained by Wahi et al.<sup>29</sup> Sathiamma et al observed macrosomia in about 2.9% of neonates delivered by GDM mother.<sup>28</sup>

## CONCLUSION

Indian population have inherent tendency to develop diabetes and in turn GDM. DIPSI- modified WHO criteria designed as per Indian standards, which is an easy, cost effective and recommended by recent researchers has been used for GDM screening in our study population.

Risk factors associated with GDM occurrence such as previous history of GDM and family history of diabetes remains the significant risk factors. Advanced age, increasing parity and occurrence of one or more abortions was not associated with GDM onset. GDM women had associated increased medical complications (27.11%) however with good glycaemic control the proportion of women affected with obstetrical complications were less (23.72%). The occurrence of macrosomia and congenital anomalies among both groups was similar. Rate of Induction of labour (42.4%), caesarean delivery (69.5%) and neonatal morbidity (57.62%) remains higher among GDM women.

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