

# Glycemic control and its associated factors among women with gestational diabetes mellitus in a tertiary care Centre, Puducherry, South India

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## ABSTRACT

**Background:** Worldwide, one in ten pregnancies is related with diabetes; 87.6% of which are gestational diabetes mellitus (GDM). Maternal hyperglycaemia affects the successful progression of pregnancy. **Objectives:** To determine the proportion and the factors associated with poor glycaemic control among women with gestational diabetes. **Methods:** This hospital-based cross-sectional study was conducted in a tertiary care hospital, Puducherry, South India from September to October 2019. Pregnant women diagnosed as GDM and on treatment for at least one month were approached consecutively for the study. A fasting blood sugar (FBS)  $\geq 92$  mg/dl and postprandial blood sugar (PPBS) 1 hour  $\geq 180$  mg/dl or PPBS 2 hour  $\geq 153$  mg/dl were considered as poor glycaemic control. **Results:** A total of 301 women with GDM were included and the mean (SD) age was 27 (5) years. Of total, 29 (10%) reported GDM during their previous pregnancy and 95 (32%) got diagnosed before reaching the tertiary care hospital. Lifestyle modifications (77%) were the most common mode of management for GDM. Of total, 116 (38.5%; 95% CI 33%-44.3%) had poor glycaemic control. Multigravida women (46.9%) and those on pharmacological treatment for GDM had poor glycaemic control. **Conclusion:** One-third of women with GDM at a tertiary care centre had poor glycaemic control. Therefore, a novel approach to improve awareness about GDM control both among pregnant women and the medical fraternity is needed.

**Keywords:** Gestational diabetes Mellitus, FBS, PPBS, poor glycaemic control, prevalence

## Introduction

Globally about 223 million women (20-79 years) are estimated to be living with diabetes of which one third are in the reproductive age group.<sup>[1]</sup> Diabetes mellitus (DM) is one of the most usual complications during pregnancy.<sup>[2]</sup> Around one in six births worldwide are affected by some form of hyperglycaemia.<sup>[1]</sup> Any

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Received: 17-07-2020

Revised: 17-09-2020

Accepted: 24-11-2020

Published: 30-01-2021

degree of glucose intolerance with onset or recognising during pregnancy is defined as gestational diabetes mellitus (GDM).<sup>[2]</sup> The prevalence of hyperglycaemia in pregnancy ranges from 10% to 53.5% depending on the geographical region<sup>[3-5]</sup> with the highest being reported in South East Asia region.<sup>[6]</sup> Majority (84%) of the hyperglycaemia in pregnancy is accounted for by GDM<sup>[1]</sup> and most were reported in low or middle-income countries, where there is limited access to ante-natal care.<sup>[7]</sup> The prevalence of DM is increasing in India and a similar trend is being observed in GDM as well.<sup>[8]</sup> There is an exceptionally high estimated prevalence (27.5%) in India when compared to other Asian countries like Sri Lanka (9.9%) and Bangladesh (9.8%).<sup>[9]</sup>

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**How to cite this article:** Meena G, Venkatachalam J, Chinnakali P, Olickal JJ, Kumar KV, Subramanian S, *et al.* Glycemic control and its associated factors among women with gestational diabetes mellitus in a tertiary care Centre, Puducherry, South India. J Family Med Prim Care 2021;10:491-5.

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#### Quick Response Code:



Website:  
www.jfmpc.com

DOI:  
10.4103/jfmpc.jfmpc\_1465\_20

Glycemic control is important in pregnant women since even minor changes in blood glucose levels can have adverse effects on the mother and child.<sup>[10]</sup> Globally, GDM is one of the major reasons for mortality and morbidity of both the mother and new-born. Age of the mother and a family history of diabetes are widely considered as the risk factors associated with GDM.<sup>[11]</sup> The risk of developing subsequent type 2 DM (T2DM) and cardiovascular diseases are significantly higher among women with a history of GDM. The prevalence of poor glycemic control among women with GDM under medical care is not much explored. Although glycemic control can be achieved through diet modification and physical activity, around 30-40% of the pregnant women required medical intervention.<sup>[12]</sup> A study from USA reported that 22% of the pregnant women had poor glycemic control and hypertension and history of preterm deliveries were associated with it.<sup>[13]</sup> Early identification of pregnant women with poor glycemic control can help to prevent and minimize foetal and maternal morbidity.<sup>[14]</sup> Glycemic control can prevent or reduce the risk of pre-eclampsia, macrosomia and shoulder dystocia.<sup>[15]</sup>

Women with GDM need more intensive care than other diabetes patients and studies on their glycemic control across the country is limited. So in this study, we aimed to assess the prevalence of poor glycaemic control among women with GDM and the factors associated with it.

## Methods

### Study design, population, and setting

This hospital-based cross-sectional analytical study was conducted in the department of Obstetrics and Gynaecology (OB&G) at a tertiary care center, Puducherry, South India during September and October 2019. The average number of deliveries conducted per year is over 15000. Screening for GDM is offered to all pregnant women and laboratory investigations are provided free of cost to all mothers. This tertiary care center follows the criteria proposed by International Association of Diabetes in Pregnancy Study Group (IADPSG) for diagnosis of GDM. As per IADPSG criteria Oral glucose tolerance test (OGTT) was done by using 75 g of glucose (fasting) at first visit to the hospital.

### Study participants

Pregnant women diagnosed as GDM and on treatment for at least one month were included. Women with a diagnosis of diabetes before pregnancy (overt diabetes) were excluded.

### Sample size and sampling technique

Using OpenEpi version 3.01, assuming the expected proportion with poor glycemic control among GDM mothers as 21.8%,<sup>[13]</sup> absolute precision of 5%, the sample size was 262. Considering the non-response rate as 15%, we need 308 participants for this study. Consecutive eligible mothers were included.

## Study procedure

Information on socio-demographic, obstetrics and treatment characteristics, type of management (drug/lifestyle modifications), duration of drug treatment, and hospitalization during this pregnancy were collected using a semi-structured questionnaire. Details about glycaemic control were extracted from individual case records. All participants were diagnosed as GDM using the IADPSG criteria. A fasting plasma glucose (FPG)  $\geq 92$  mg/dl, or 1-hour plasma glucose  $\geq 180$  mg/dl or 2-hour plasma glucose  $\geq 153$  mg/dl considered as poor glycemic control. Those mothers without reports on blood glucose in the last two months, we advised FBG/PPBG measurements and collected the reports from hospital management and information system (HMIS). Ethical clearance was obtained from the Institutional Ethics Committee (JIP/IEC/2019/0309, Date of approval of ethics is 29/07/2019) of Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry, India.

## Statistical analysis

Data entry was done with EpiData Manager Version 4.2 and was STATA version 14 (StataCorp. Texas, United States) was used for analysis. Continuous variables like age, fasting blood sugar (FBS), postprandial blood sugar (PPBS) 1 hour and PPBS 2-hour, duration of drug treatment for GDM, period of gestation (POG) at the time of diagnosis of GDM were summarized as mean (SD). Women with poor glycemic control were summarized as percentages with 95% confidence interval (CI). Association of socio-demographic and clinical parameters with poor glycemic control was assessed using Chi-square test and unadjusted prevalence ratio with 95% CI were calculated as measures of association. A *P* value less than 0.05 was considered statistically significant.

## Results

A total of 301 women were included and the mean (standard deviation) age was 28 (4.5) years. Sociodemographic and obstetric characteristics are summarized in Table 1. Of total, 120 women (40%) were graduates, one third ( $n = 102$ ) had a family history of diabetes, 57 (19%) had a family history of hypertension, and about half ( $n = 154$ ) were primigravida. Multigravida mothers with history of abortions and GDM in their previous pregnancy was 15% ( $n = 47$ ) and 19% ( $n = 28$ ) respectively. The mean (SD) gestational age at the time of diagnosis of GDM was 26.3 (6.2) weeks. Of total, 23% were insulin or metformin and the rest 77% were advised diet modification.

Of total, 116 women had poor glycemic control (38.5%; 95%CI 33.0-44.3). Table 2 describes the association of socio-demographic and obstetric characteristics with poor glycemic control. Prevalence of poor glycemic control was higher in women aged more than 30 years (PR 1.31 95% CI; 0.91-1.85), without formal education (PR 1.70 (95% CI; 0.83-3.44), employed (PR 1.17 95% CI; 0.74-1.83), multi

gravida (PR 1.53 95% CI; 1.14-2.06), with family history of hypertension (PR 1.05 95% CI; 0.74-1.5) and with any other comorbidities (PR1.01 95% CI; 0.73-1.41).

**Table 1: Socio-demographic and obstetric characteristics of women with gestational diabetes mellitus attending a tertiary care centre, Puducherry 2019 (n=301)**

Variable	n	%
Age (in years)		
18-25	130	43.2
26-30	115	38.2
>30	56	18.6
Education		
No formal education	12	04.0
Class 1-10	80	26.6
Higher secondary	51	16.9
Graduate	120	39.9
Post-graduation and above	38	12.6
Occupation		
Homemaker	274	91.0
Employed	27	09.0
Gravida		
Primi	154	51.2
Multi	147	48.8
Family h/o diabetes	102	33.9
Family h/o hypertension	57	18.9
Other comorbidities**	72	23.9
History of GDM in previous pregnancy	28	19.1

\*Other comorbidities-seizure disorder, systemic lupus erythematosus, Hbsag positive, thyroid disease, chronic hypertension

## Discussion

The present study assessed the level of glycemic control among mothers with GDM at a public tertiary care centre in South India and also examined factors associated with poor glycemic control. We found more than one third of mothers had poor glycemic control and multigravida mothers had higher level of poor glycemic control.

There is limited evidence of glycemic control among GDM mothers in India, though studies are available for glycemic control in general population. To our knowledge, this is one of the first estimates from Indian population. A study conducted in Saudi Arabia<sup>[7]</sup> reported a similar prevalence (46.9%) using HbA1c for assessing glycemic control. Our findings were much higher than the results reported by Scifres *et al.* from Pittsburgh, United States (21.8%).<sup>[13]</sup> The possible reason for this difference could be due to a differences in knowledge of GDM and behaviour of mothers, quality of diabetes care and definitions used to quantify glycemic control. Our study used a lower cut off for target glucose value might be the reason for high prevalence of uncontrolled GDM. This could be a better strategy to decrease GDM related complications.<sup>[12]</sup> The effect of glycemic control on foetal growth abnormalities, adverse maternal outcomes and increased chances for future type 2 DM encourages further investigation on poor glycemic control during pregnancy.<sup>[11]</sup>

In the present study, women aged more than 30 years had higher prevalence of poor glycemic control compared to younger age

**Table 2: Association of socio-demographic and obstetrics characteristics with poor glycemic control among women with GDM attending a tertiary care Centre, Puducherry, 2019 (n=301)**

Variable	n	Poor Glycemic control n (%)	Crude PR (95% CI)	P
Total	301	116 (38.5)		
Age groups (years)				
18-25	130	48 (36.9)	1	-
26-30	115	41 (35.6)	0.96 (0.69-1.34)	0.837
>30	56	27 (48.2)	1.31 (0.91-1.85)	0.138
Education				
No formal education	12	06 (50.0)	1.70 (0.83-3.44)	0.14
Class 1-10	80	36 (45.0)	1.53 (0.93-2.49)	0.089
Higher secondary	51	15 (29.4)	1	-
Graduation	120	48 (40.0)	1.36 (0.84-2.19)	0.208
Post-graduation and above	38	11 (29.0)	0.98 (0.51-1.89)	0.962
Occupation				
Homemaker	274	104 (38.0)	1	-
Employed	27	12 (44.4)	1.17 (0.74-1.83)	0.49
Gravida				
Primi	154	47 (30.5)	1	-
Multi	147	69 (46.9)	1.53 (1.14-2.06)	0.004
Family h/o diabetes	102	38 (37.3)	0.95 (0.70-1.29)	0.745
Family h/o hypertension	57	23 (40.4)	1.05 (0.74-1.5)	0.752
Other comorbidities*	72	28 (38.9)	1.01 (0.73-1.41)	0.944
H/o GDM in previous pregnancy (n=147)	28	11 (39.3)	0.81 (0.49-1.32)	0.394

\*Other comorbidities-seizure disorder, systemic lupus erythematosus, hbsag positive, thyroid disease, chronic hypertension; PR-prevalence ratio

groups. This finding was similar to the study by Buhary *et al.*<sup>[17]</sup> Advancing age is a major risk factor for GDM and greater average age among the pregnant women who are carriers of the metabolic disturbance leading to poor glycemic control.<sup>[16]</sup> Our study found that multigravida had 1.5 times higher risk for poor glycemic control compared to primigravida. These results being similar to the study conducted at Pittsburgh.<sup>[13]</sup> Multigravida women were more obese compared to primigravida women and GDM is more common in overweight and obese women than normal-weight women. Similarly, multigravida pregnancy has more chances of being a late pregnancy than the primi.<sup>[17]</sup>

In our setting, lifestyle modification was most common mode of first-line management for mothers. But it is important to achieve the target levels of glycemic control with the use of insulin or metformin.<sup>[18]</sup> Also, those mothers who are aged over 30 years, having a family history of hypertension, and/or being multigravida need to be followed-up more frequently to achieve the glycemic targets. Primary health care personnel need to be trained in management of GDM especially in diet counselling and follow up so that GDM mothers can make frequent follow visits to primary health facilities which will be closer to their home. In pregnant women with a history of uncontrolled GDM, primary care center should test their glycemic status six weeks after delivery to rule out diabetes and pre-diabetes. Also breastfeeding should be encouraged for at least 3 months to reduce the risk of diabetes.<sup>[19]</sup> India's guidelines regarding management of GDM recommends the above strategy (GDM guidelines, India).<sup>[20]</sup>

As this was a hospital-based study from a single tertiary care setting, which is expected to receive high-risk cases, findings cannot be generalized to primary care settings. We did not have information on adherence to diet modifications which could have explained high levels of poor glycemic control. We defined glycemic control based on fasting and postprandial blood glucose levels; HbA1c measurements would have been better. However, the study was conducted in real world setting and reflects the realities in managing GDM in public tertiary referral hospital.

## Conclusion

More than one third of women with GDM at a tertiary care centre had poor glycaemic control. Multi gravida and women with a family history of hypertension were associated with poor glycemic control. Insulin therapy along with lifestyle modification needs to be emphasized. It is necessary to improve awareness about GDM and its control measures among medical fraternity, patients and their family members. As majority of the pregnant women as seeking antenatal care from primary care canters, this study highlights the importance of primary care physicians to screen pregnant women for GDM and to check their control status at regular intervals. It is also important to suggest life style modifications and other control measures to tackle at GDM at primary care level.

## Acknowledgements

We extend our gratitude to the clinical and non-clinical staffs of Department of Obstetrics and Gynaecology, JIPMER, for providing assistance for conducting the study.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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