

# Does Two Hour Post 75-Gram Sugar Test Levels for Diagnosis of Gestational Diabetes Correlate with Type of Intervention Required? An Audit from Tertiary Care Center of India

NAMRATA KUMAR<sup>1</sup>, VINITA DAS<sup>2</sup>, ANJOO AGARWAL<sup>3</sup>, AMITA PANDEY<sup>4</sup>, SMRITI AGRAWAL<sup>5</sup>

## ABSTRACT

**Introduction:** Gestational diabetes mellitus is carbohydrate intolerance of variable severity with onset or first recognition during pregnancy.

**Aim:** This study was planned to correlate the relation of 2 hours post 75-gram glucose test done irrespective of meals with type of intervention required and fetomaternal outcome.

**Materials and Methods:** This was a retrospective observational study conducted over a period of one year. All women registering in antenatal outpatient department in the university and who were diagnosed with gestational diabetes were enrolled in the study. Total number of women registered was 1922. Out of them, 211 had sugar level more than or equal to 140 mg/dL while 14 were having type 2 diabetes known prior to pregnancy. Data was analysed using Statistical Package for Social Sciences (SPSS) version 15.0. Frequency

distribution, percentages and students t-test was used for statistical analysis.

**Results:** Occurrence of GDM came out to be 10.9% in our antenatal population. With increasing sugar levels, insulin requirement increases. Three fourth of the women with Diabetes In Pregnancy Study group of India (DIPSI) sugar test levels between 140-160 mg/dL were well controlled with medical nutrition therapy itself. Our study showed that more than half of the women on MNT alone could be easily carried beyond 37 weeks. However, the number perhaps reduced significantly in patients who required insulin in addition to MNT. Intrauterine demise, preterm births and FGR are more common compared to foetal malformation and macrosomia in our population.

**Conclusion:** Timely diagnosis and intervention is of great help in improving both short and long term health benefits in mother and baby. Medical nutrition therapy is an easy intervention with definite benefits.

**Keywords:** Diabetes, DIPSI, Gestational diabetes, Pregnancy

## INTRODUCTION

Diabetes in pregnancy is a problem of global concern. Gestational Diabetes Mellitus (GDM) is classically defined as glucose intolerance of variable severity which is recognised for the first time during pregnancy [1]. According to the criteria laid by International Association of Diabetes and Pregnancy Groups, GDM affects 9-25% of all pregnancies [2]. African American, Asian, Hispanic women are at higher risk for GDM compared with white women [3]. In a random survey performed in various cities in India in 2002-2003, an overall GDM prevalence of 16.55% was observed which is much higher than the west [4].

Glucose intolerance is an umbrella term for several metabolic conditions which result from blood glucose higher than normal. Most recently, International Federation of Gynaecology and Obstetrics, FIGO [5], has clarified that Diabetes in pregnancy would be considered if gestational intolerance occurs in first trimester and value of oral glucose tolerance test is  $\geq 200$  mg/dL. Various world bodies have their recommendation to diagnose and pick gestational diabetes [6].

The prevalence of disease varies between different geographical areas and so does the constraints in test in term of cost effective and hence country specific detection model is specifically laid stress upon. Diabetes in pregnancy study group of India, DIPSI test, has been considered as best accepted testing method in Indian perspective [7]. This test classifies GDM in sugar range between 140-199 mg/dL, 2 hours after 75 gm sugar irrespective of meals.

GDM is first treated with Medical Nutrition Therapy (MNT) and later insulin or Oral Hypoglycaemic Agent (OHA) can be added if sugars are not controlled with diet therapy itself. While, values above 200 mg/dL fall within the definition of overt diabetes clearly requiring insulin with or without oral hypoglycaemic agents in addition to medical nutrition therapy. The last group of sugar values between 120-139 mg/dL are defined as gestational glucose intolerance and as such no intervention is stated by any of the available guidelines.

Target glucose levels in gestational diabetes is Fasting blood sugar  $<95$  mg/dL and postprandial blood sugar  $<120$  mg/dL. When this target is not achieved through nutrition and exercise, then insulin is added. Gestational diabetes has been diagnosed by different criteria, laid by different world bodies. In Indian context considering the DIPSI criteria none of the study available in literature has correlated the test levels with type of intervention required. Therefore, the present study was conducted with an aim to correlate the relation of 2 hours post 75-gram glucose test done irrespective of meals with type of intervention required and fetomaternal outcome.

## MATERIALS AND METHODS

This was a retrospective observational study conducted over a period of one year from January 2016 to January 2017. All women registering in antenatal outpatient department in the university and who were diagnosed with gestational diabetes were enrolled in the study. All procedures followed were in accordance with the ethical standards of the responsible.

Institutional Committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. Informed consent was obtained from all patients for being included in the study. All the antenatal women attending antenatal outpatient department underwent blood sugar testing by giving 75g oral glucose and measuring plasma glucose 2 hour after ingestion irrespective of last meal at their first visit. Pre-weighed 75g glucose sample was dissolved in 300ml water and women were instructed to drink in 5 min. A plasma standardized glucometer was used to evaluate blood glucose 2 hour after the oral glucose load. If vomiting occurs within 30 min of oral glucose intake, test was repeated next day. If vomiting occurs after 30 min the test was continued.

If 2 hour plasma glucose level >140 mg/dL, women was labelled as GDM and Medical Nutrition Therapy (MNT) was started by dedicated dietician. Maternal nutrition plan in women with GDM consisted of 50-60% calories from carbohydrate, 25-30% from fat, 10-20% from protein. Saturated fat intake was less than 10% of the total calories and dietary cholesterol was less than 300mg/d. There were three major meals with three small snacks in between. Weight gain targets of women with GDM were based on pre-pregnancy body mass index.

MNT was given to the pregnant women for a period of 2 weeks and then fasting and 2 hour postprandial blood sugar levels were assessed. However, if the women are diagnosed with GDM in third trimester, MNT was continued for only 3-7 days and then fasting and 2 hour postprandial blood sugar levels were assessed.

If 2 hour postprandial glucose was  $\leq$  120 mg/dL, then MNT was continued and repeat blood sugar (fasting and 2 hour postprandial) was done fortnightly till 28 weeks and then weekly thereafter. If 2 hour postprandial plasma glucose came to be more than 120 mg/dL, intervention in form of adding insulin along with MNT was done.

## STATISTICAL ANALYSIS

Data was analysed using Statistical Package for Social Sciences (SPSS) version 15.0. Frequency distribution, percentages and students t-test was used for statistical analysis.

## RESULTS

Total number of women registered over one year was 1922. Out of them, 211 had DIPSI test sugar level more than or equal to 140 mg/dL while 14 were having type 2 diabetes known prior to pregnancy. Two women had termination of pregnancy in first trimester due to missed abortion. We analysed data of 209 women who were diagnosed as Gestational diabetes. Hence, occurrence of GDM came out to be 10.9% in our antenatal population. Age of the women ranged from 19 to 42 years.

Hyperglycaemia in pregnancy frequently presents with some or the other evidences of bad obstetrical outcome. Out of 209 women with GDM in present pregnancy, 8% had bad obstetric history in form of preterm and term foetal demise with no living babies, 9% had previous abortions without any living baby.

We analysed at what gestation we are encountering development of gestational diabetes and in that context, it was found that 27 % of women were diagnosed in first trimester while 43% of the women were diagnosed after 28 weeks.

Of those who were diagnosed after 28 weeks, it was investigated that how many actually had a normal DIPSI test before and how many actually presented in the hospital after 28 weeks since these were the women who could have been diagnosed earlier, shown in [Table/Fig-1]. We found that more than half of the women (n=59, 65.5%) presented to the hospital at a gestational age of more than 28 weeks.

[Table/Fig-1] shows time of first ANC registration of women diagnosed with GDM after 28 weeks (n=90).

Gestational age	Number (n= 90)	Percentage
6 – 10 wks	9	10 %
11- 14 wks	6	6.6%
15 – 17 weeks	4	4.4%
18- 20 wks	0	0
21- 27 wks	6	6.6%
28 – 32 wks	35	38.8%
33- 34 wks	11	12.2%
34 – 37 wks	13	14.4%

**[Table/Fig-1]:** Shows time of first ANC registration of women diagnosed with GDM after 28 weeks (n = 90).

DIPSI sugar level mg/dL	Number (n= 209)	MNT alone (n= 134)	MNT + INSULIN (n = 75)	P
140-160	108 (51.6%)	86 (79.6%)	22 (20.3%)	<0.001*
160 – 180	41 (19.6%)	23 (56%)	18 (43.9%)	0.267
180 – 200	29 (13.8%)	14 (48.2%)	15 (51.7%)	0.130
> 200	31 (14.8%)	11 (35%)	20 (64.5%)	0.001

**[Table/Fig-2]:** DIPSI blood sugar level at the time of diagnosis and intervention required (n= 209).

\*Statistically significant difference. Majority of women having sugar level 140-160 mg/dL were managed with MNT alone while those with level more than 200 mg /dL were requiring insulin along with MNT.

POG at delivery	MNT alone (n= 53)	MNT+ INSULIN (n= 30)	p-value
Less than 28 wks	1 (2%)	1 (3.7%)	0.336
28 – 31 wks	3 (6%)	1(3.7%)	0.828
32 – 33 wks 6d	2 (3.7%)	4 (13.1%)	0.767
34 – 37 wks	14 (26%)	19 (63%)	0.004
More than 37 wks	33 (62%)	5 (16.6%)	0.002

**[Table/Fig-3]:** shows relationship of type of therapy for hyperglycaemia and Period of gestation at time of delivery (n=83).

DIPSI blood sugar values were correlated with the type of intervention required as shown in [Table/Fig-2]. With increasing sugar levels, insulin requirement increases. Majority (79%) of the women with DIPSI sugar levels between 140-160 mg/dL were well controlled with medical nutrition therapy itself. DIPSI sugar levels correlated well with method of disease control indeed.

When to deliver patients with gestational diabetes has always been a concern for obstetricians. Traditionally, these women were not allowed to continue pregnancy beyond 37 weeks. Our study showed that more than half of the women on MNT alone could be easily carried beyond 37 weeks as shown in [Table/Fig-3]. However, the number perhaps reduced significantly in patients who required insulin in addition to MNT.

If we look upon the fetomaternal complication documented in our study, we had a follow up data for 83 women who were treated for hyperglycaemia in pregnancy. There were very few still births (9%) and neonatal death (1.2%). The incidence of foetal malformation was also not significant (2.4%) one being an open neural tube defect and other being tracheoesophageal fistula. Foetal macrosomia was also relatively less seen in our population while foetal growth restriction was much more commoner (7.2% versus 25.3%).

## DISCUSSION

Pregnancy induces changes in maternal metabolism to accommodate, nurture and keep pace with the growth of the foetus in the womb from conception until full term birth. This is achieved by complex interactions of the fetoplacental-maternal unit, through secretion of hormones and metabolic mediators that create insulin resistance and modify maternal carbohydrate, lipid, and amino acid metabolism to ensure adequate nutrient supply to the foetus [5].

Insulin resistance continues to increase as pregnancy advances and is well established by the 24th week. As long as the maternal pancreas continues to increase insulin production and secretion, hyperglycaemia is prevented. When this capacity is overwhelmed by rising insulin resistance, maternal hyperglycaemia ensues. Maternal insulin production capacity is thus put under immense stress during pregnancy. This explains why women with pre-existing insulin resistance (e.g., overweight, obese, excessive weight gain during pregnancy, polycystic ovarian syndrome) or those with lower ability to produce insulin (e.g., short stature, stunted) are more prone to GDM [5].

If blood sugar levels are not optimally control, GDM has several maternal and foetal complications. Maternal complications include pre-eclampsia, preterm labour, polyhydramnios, premature rupture of membrane, post-partum haemorrhage, caesarean section, uterine atony, infection etc. Foetal complications include congenital malformations, macrosomia, stillbirth, shoulder dystocia. Neonatal adverse effects include- hyperbilirubinaemia, Respiratory Distress Syndrome (RDS), hypoglycaemia, seizures, sepsis.

The prevalence of gestational diabetes following DIPSI criteria came out as 10% in our study population. Not all Indian studies have shown high rates, like study by Junnare KK et al., showed a much lower prevalence of GDM that is 6.52% and they labelled it due to lesser sensitivity of the test [8]. Another study by Viswanathan Mohan et al., also emphasised that the DIPSI non-fasting OGTT criteria cannot be recommended for diagnosis of GDM due to its low sensitivity [9]. They concluded that as a single-step diagnostic test for GDM, the fasting OGTT is mandatory and second-best option is two-step procedure using the 50-g glucose challenge test as an initial screening test, followed by the diagnostic fasting OGTT. This quaint finding in reported studies is further addressed and is now well validated and recommended test in government of India guidelines [10]. We report a relatively less prevalence considering the fact that hospital-based studies are not good prevalent studies.

Our study showed that around 8% of women had bad obstetrics history without any live baby. Around 27% of women were diagnosed with gestational diabetes in first trimester which is actually a very high number and this emphasises why Indian women should be screened at very first visit and not delayed till 24 weeks unlike Caucasian women. Out of those who were diagnosed after 28 weeks, 70% were the women who actually presented late in pregnancy emphasising that a good number could have been diagnosed earlier. A good correlation was seen between DIPSI test levels and type of therapy. Majority of women having sugar level 140-160 mg/dL were managed with MNT alone compared to insulin in addition of MNT while those with level more than 200 mg / dL were requiring insulin as a must. This difference was statistically significant.

Gestational diabetes which is well controlled does not mandate an early delivery, and we realized that majority of the patients who were controlled with MNT alone could be taken beyond 37 weeks compared to those with insulin in addition to MNT (62% versus 14.8%) and this was statistically significant.

There was no significant difference in mode of delivery LSCS versus vaginal delivery in between the type of intervention be it only MNT or MNT with insulin. Fifty two percent women controlled on MNT alone required caesarean delivery while 66.6% of those who were controlled on MNT with insulin required caesarean section.

Recent study by Wei YM et al., divided group of women between those diagnosed as diabetic before pregnancy and those diagnosed as GDM in pregnancy and classified the later into two subgroups of diagnosis before 24 weeks and after 24 weeks [11]. The percentage of insulin requirement was significantly higher in group diagnosed prior to pregnancy as compared to those diagnosed in pregnancy (90.8% versus 53.8%). Also, pre-gestational diabetics had higher rates of caesarean section compared to gestational diabetics

( $p < 0.01$ ). There was no significant difference in preterm birth rate, caesarean delivery rate, macrosomia percentage, preeclampsia rate, percentage of neonatal admission required between the two subgroups of GDM.

The follow up data in our study also showed that there were very few still births and neonatal death. The incidence of foetal malformation was also not significant.

Most talked foetal complication of maternal diabetes, that is, macrosomia was also relatively less seen in our population while foetal growth restriction was much commoner. This is an area which needs an insight, for why do we have more FGR's not being explained by vasculopathy or thrombophilia. New concepts are now coming into limelight. The concept of thin fat babies in South Asian women was studied by Hema Venketravan et al., and they found that increased anterior abdominal wall thickness leading to a 'thin but fat' phenotype signifying a disproportionate increase in adiposity despite smaller or similar lean body mass can be seen in the fetuses of mothers with GDM, even at 20 weeks, thus pre-dating the biochemical diagnosis of GDM [12].

There were no maternal deaths and surgical site infection was found in 7.2%. Study by Bartakova et al., evaluated 364 women with GDM with risk factors like obesity, hypertension, polycystic ovary syndrome, thrombophilia, anaemia, smoking and allergy [13]. These were the women who were having a significantly more number of labour inductions, cesarean sections and instrumental deliveries. The new-borns of this subgroup had significantly more common worse perinatal outcomes in form of low apgar scores and macrosomia. It is well proven that the potential complications do exist in women with both gestational and pre-gestational diabetics especially with Asian ethnicity. Rashida FB et al., in a study upon pregnant women in Bangladesh found that neonatal complications were significantly higher in both pre-gestational (74 %) and gestational diabetics (58%) when compared with non-diabetic controls (24%) [14]. Our data suggests that by timely diagnosis, good control and fetomaternal vigilance, gestational diabetes can have a fairly comparable outcome with non-diabetic controls.

A universal testing at first visit to ensure early diagnosis and management can very well prevent complications associated with GDM.

## LIMITATION

A potential limitation of our study is that the comorbid factors were not evaluated. Also, the sample size was limited.

## CONCLUSION

Timely diagnosis and intervention is of great help in improving both short and long-term health benefits of mother and baby. Medical nutrition therapy is an easy intervention with definite benefits. Insulin is a gold standard second step after MNT. Oral hypoglycaemic agents use in pregnancy is an upcoming tool to replace insulin or sometimes lessen insulin doses in resource constraints situations. Range of blood sugar levels in DIPSI test correlate well with the type of intervention required and also with period of gestation to which pregnancy can be continued. Intrauterine demise, preterm births and FGR are more common compared to fetal malformation and macrosomia in our population. GDM can be controlled by Dietary and lifestyle modification alone or with insulin added to it. When target glucose levels (Fasting blood sugar  $< 95$  mg/dL, 2 -hours postprandial blood sugar  $< 120$  mg/dL) cannot be consistently achieved through nutrition & exercise, insulin is added. Long term consequences include type 2 diabetes in future and that is why prevention right at onset of first threat in form of GGI can be rightly said as a golden opportunity and a ray of hope to prevent the global diabetic burden.

## ACKNOWLEDGEMENTS

We thank the entire patient group for their cooperation.

## REFERENCES

- [1] American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes Care*. 2009;32(1):S62-S67.
- [2] Sacks DA, Hadden R, Maresh M, Deerochanawong C, Dyer AR, Metzger BE, et al. HAPO study cooperative research group: Frequency of gestational diabetes mellitus at collaborating centers based on IADPSG consensus panel recommended criteria. *Diabetes Care*. 2012;35:526-28.
- [3] Ferrara A. Increasing prevalence of gestational diabetes mellitus: a public health perspective. *Diabetes Care*. 2007;30(2):S141-46.
- [4] Seshiah V, Balaji V, Balaji MS, Paneerselvam A, Arthi T, Thamizharasi M, et al. Gestational diabetes mellitus manifests in all trimesters of pregnancy. *Diabetes Research and Clinical Practice*. 2007;77(3):482-84.
- [5] Hod M, Kapur A, Sacks DA, Hadar E, Agarwal M, Di Renzo GC, et al. The International Federation of Gynecology and Obstetrics (FIGO) Initiative on gestational diabetes mellitus: A pragmatic guide for diagnosis, management, and care. *International Journal of Gynecology and Obstetrics*. 2015;131:173-211.
- [6] International Association of Diabetes and Pregnancy Study Groups Consensus Panel. International Association of Diabetes and Pregnancy Study Groups recommendations on the diagnosis and classification of hyperglycaemia in pregnancy. *Diabetes Care*. 2010;33(3):676-82.
- [7] Seshiah V, Balaji V, Shah SN, Joshi S, Das AK, Sahay BK, et al. Diagnosis of gestational diabetes mellitus in the community. *J Assoc Physicians India*. 2012;60:15-17.
- [8] Junnare KK, Adhau SR, Hegde MV, Naphade PR. Screening of gestational diabetes mellitus in antenatal women using DIPSI guidelines. *Int J Res Med Sci*. 2016;4:446-49.
- [9] Mohan V, Mahalakshmi MM, Bhavadharini B, Maheswari K, Kalaiyarasi G, Anjana RM, et al. Comparison of screening for gestational diabetes mellitus by oral glucose tolerance tests done in the non-fasting (random) and fasting states. *Acta Diabetol*. 2014;51:1007-13.
- [10] Association of Physicians of India. Diagnosis and management of GDM: Indian guidelines, chap. 55. *Medicine update*. vol. 13. 2013.
- [11] Wei YM, Yang HX. Characteristics of pregestational diabetes mellitus diagnosed during pregnancy and the effects on pregnancy outcomes. *Zhonghua Fu Chan Ke Za Zhi*. 2017;52(4):227-32.
- [12] Venkataraman H, Ram U, Craik S, Arangunasekaran A, Seshadri S, Saravanan P, et al. Increased fetal adiposity prior to diagnosis of gestational diabetes in South Asians: more evidence for the 'thin-fat' baby. *Diabetologia*. 2017;60:399-405.
- [13] Bartakova V, Tapalova V, Wagnerova K, Janku P, Belobradkova J, Kankova K, et al. Pregnancy outcomes in women with gestational diabetes: specific subgroups might require increased attention. *Ceska Gynekol*. 2017;82(1):1623.
- [14] Rashid FB, Khatoon H, Hasnat MA, Amin R, Azad AK. Perinatal complications in diabetes mellitus with pregnancy: comparison between Gestational Diabetes Mellitus (GDM) and Diabetes Mellitus Prior to Pregnancy. *Mymensingh Med J*. 2017;26(1):12430.

### PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Obstetrics and Gynecology, King George's Medical University, Lucknow, Uttar Pradesh, India.
2. Professor and Head, Department of Obstetrics and Gynecology, King George's Medical University, Lucknow, Uttar Pradesh, India.
3. Professor, Department of Obstetrics and Gynecology, King George's Medical University, Lucknow, Uttar Pradesh, India.
4. Professor, Department of Obstetrics and Gynecology, King George's Medical University, Lucknow, Uttar Pradesh, India.
5. Associate Professor, Department of Obstetrics and Gynecology, King George's Medical University, Lucknow, Uttar Pradesh, India.

### NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Namrata Kumar

Department of Obstetrics and Gynecology, King Georges Medical University, Lucknow, Uttar Pradesh, India.

E-mail : dr.nmrata@gmail.com

Date of Submission: **Jan 09, 2018**

Date of Peer Review: **Mar 10, 2018**

Date of Acceptance: **Apr 05, 2018**

Date of Publishing: **Jun 01, 2018**

FINANCIAL OR OTHER COMPETING INTERESTS: None.