

## Glycated hemoglobin in early pregnancy as a predictor of gestational diabetes mellitus

Sujithra. D.<sup>1</sup>, Sukanya Mukherjee<sup>2,\*</sup>, Sudha S<sup>3</sup>

<sup>1</sup>Senior Resident, Dept. of Obstetrics and Gynecology, Chennai Medical College Hospital & Research Centre, Tamil Nadu,

<sup>2</sup>Assistant Professor, Dept. of Obstetrics and Gynecology, DM Wayanad Institute of Medical Sciences, Wayanad, Kerala,

<sup>3</sup>Professor, Dept. of Obstetrics and Gynecology, Amrita School of Medicine, Amrita Institute of Medical Sciences, Kochi, Kerala, India

**\*Corresponding Author:**

Email: drsukanya.peace@gmail.com

Received: 6<sup>th</sup> April, 2018

Accepted: 10<sup>th</sup> April, 2018

### Abstract

**Introduction:** The prevalence of Gestational diabetes mellitus (GDM) is high in Asian subcontinent. As per current guidelines, the routine screening for GDM is at 24 to 28 weeks of gestation. 30 to 50% of GDM cases may remain undiagnosed until such period of screening. This study aims to investigate HbA1C levels at as early as 12 weeks of pregnancy as a predictor of GDM.

**Materials and Methods:** This prospective study included 100 patients enrolled at their first antenatal visit, or before 12 weeks of gestational age, who attended OPD. At the time of enrolment for HbA1c and routine antenatal investigations were done. A 75 gm GTT was done at 22 to 26 weeks of gestation. HbA1c cutoff was taken as  $\geq 5.7$  &  $\leq 6.4$  and patients having value  $\geq 5.7$  were taken as abnormal. Subjects with HbA1c  $\geq 6.5$ , overt diabetes, hemoglobinopathies, anaemia, chronic renal diseases and multiple pregnancies were excluded from the study.

**Results:** It is found that women  $>28$  years had higher levels of hbA1C in comparison to patients  $<28$  years of age. There was a good statistical agreement between HbA1c & GTT with a p value of 0.581. Sensitivity of HbA1c was 70.4% and specificity 93.2%.

**Conclusion:** The study concludes that women with higher HbA1c ( $\geq 5.7$ ) were more likely to develop GDM than those women with lower HbA1c ( $\leq 5.7$ ). HbA1c can be done routinely in early pregnancy (1<sup>st</sup> trimester). Women with higher HbA1c ( $\geq 5.7$ ) can benefit from early interventions early in pregnancy thereby prevent GDM and adverse perinatal and pregnancy outcomes.

**Keywords:** Early pregnancy, Glycated hemoglobin, GDM, Maternal age.

### Introduction

Diabetes mellitus is a major metabolic disorder affecting millions worldwide. The prevalence of Gestational diabetes mellitus (GDM) is high in Asian subcontinent.<sup>1</sup> The incidence of GDM in India, Chennai was  $<1\%$ <sup>1</sup> and  $3.8\%$ <sup>2</sup> in Kashmir. The mothers with GDM and their neonates may suffer adverse effects such as preeclampsia and macrosomia respectively and also associated with high rates of caesarean sections.<sup>3</sup> As per current guidelines, the routine screening for GDM is at 24 to 28 weeks of gestation which may be unfortunate, for 30 to 50% of GDM cases may remain undiagnosed until such period of screening, the time by which the adverse effects might already have taken course.<sup>4</sup> Early detection of GDM and treatment can reduce the risks of complication in both the mothers and their babies.<sup>5-8</sup> HbA1c, is recently included as a diagnostic tool for diabetes in non-pregnant general population, but not yet recommended for the diagnosis of GDM by any current guidelines. This study aims to investigate HbA1C levels at as early as 12 weeks of pregnancy as a predictor of GDM.

### Materials and Methods

The work embodied in this prospective study included 100 patients enrolled at their first antenatal visit, or before 12 weeks of gestational age, who attended OPD. Patients with overt diabetes, hemoglobinopathies,

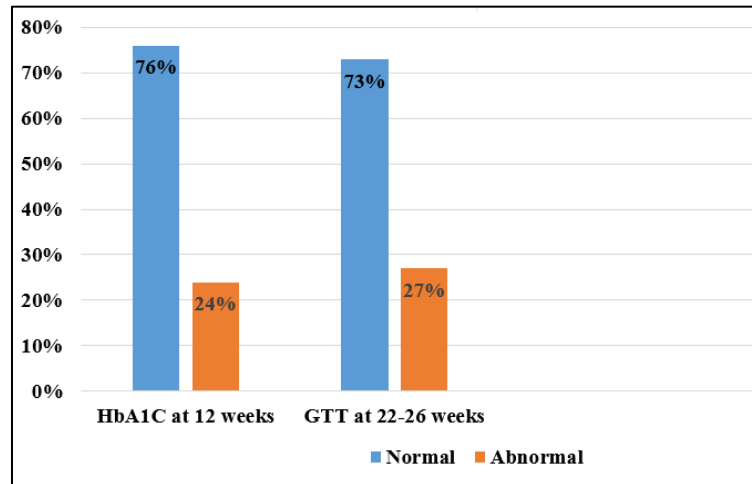
anaemia (hb  $<10\%$ ), chronic renal diseases, and multiple pregnancies were excluded from the study. Blood was collected at the time of enrolment for HbA1c and routine antenatal investigations. Subjects with HbA1c  $\geq 6.5$  were excluded from the study. Gestational age was confirmed with 1<sup>st</sup> trimester ultrasound and singleton pregnancies were included in the study. NT scan was done at 11–13 weeks, and anomaly scan before 20 weeks of gestation. All included in the study were then subjected to a 75 gm GTT at 22 to 26 weeks of gestation and values were interpreted using IADPSG 2010/WHO2013 criteria. HbA1c cut-off was taken as  $\geq 5.7$  &  $\leq 6.4$  and patients having value  $\geq 5.7$  were taken as abnormal.<sup>7</sup> The study duration was 2 years (September 2014 to August 2016). HbA1c was measured using HPLC method.

### Results

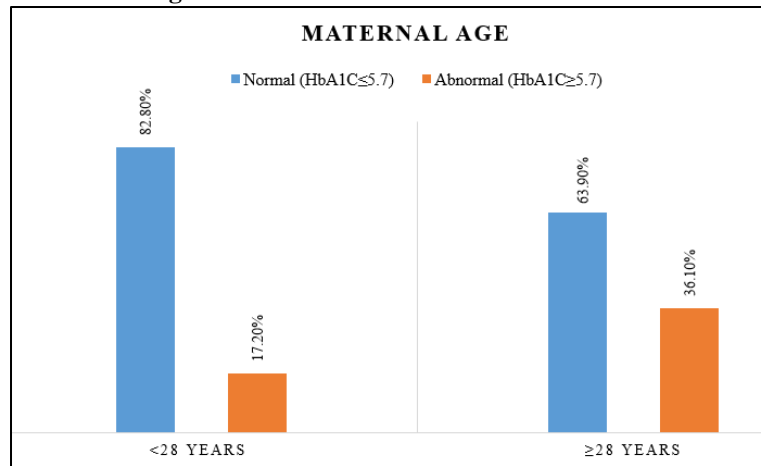
The average gestational age in this study was  $7 \pm 0.85$  weeks.

Mean age of patients was  $27.6 \pm 4.67$ , mean weight gain was  $14.12 \pm 2.99$ .

**Graph 1: Frequency distribution of HbA1C and GTT**



**Graph 2: Association of maternal age with HbA1C**

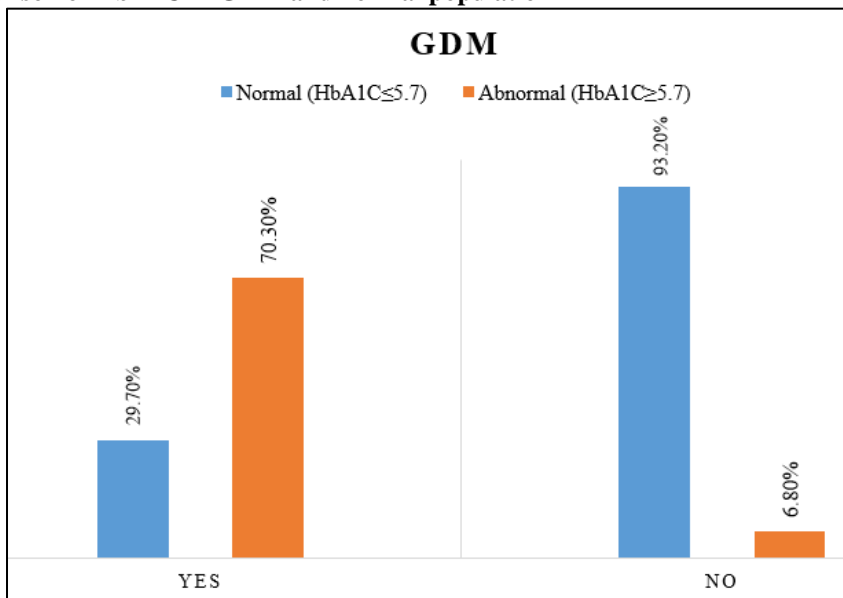


**Table 1: Frequency distribution of HbA1C in GDM and non GDM group**

HbA1C	GDM				P Value
	Yes		No		
	n = 27	%	n = 73	%	
Abnormal (≥5.7)	19	70.3	5	6.8	0.581
Normal (≤5.7)	8	29.7	68	93.2	

**Table 2: HbA1C in GDM**

Sensitivity	70.4%
Specificity	93.2%
Predictive value positive	79.2%
Predictive value negative	89.5%
Accuracy	87%

**Graph 3: Comparison of HbA1C in GDM and normal population**

In all 100 patients there was no abortions or abnormalities observed. Other factors like mode of delivery, parity and maternal weight gain showed no comparable association.

### Discussion

It is well documented in various studies that, in a normal, early pregnancy (between 6 to 10 weeks) there is a fall in fasting blood glucose.<sup>5,6,9</sup> This remains so for the remaining part of pregnancy. Hence, the newly formed erythrocytes during this phase are exposed to lower glucose concentration in comparison to those of non-pregnant women. Consecutively the glycosylation is also less.

In all the 100 antenatal patients HbA1c was taken before 12 weeks of gestation and the diagnosis of GDM was done using GTT (modified IADPSG 2010) at 22–26 weeks. The objective of this study was to find out if early pregnancy HbA1c (between  $\geq 5.7$  &  $\leq 6.4$ ) can be a predictor for GDM. The standard cut-off for HbA1c was taken as  $\geq 5.7$  in reference to earlier studies.<sup>10-12</sup> The sensitivity and specificity in various studies with respect to HbA1C cut off for diagnosis of GDM<sup>10-12</sup> shows, the lesser the HbA1C value, the better the specificity but sensitivity will decrease.

In this study the average maternal age taken was 28 years. It is found that women  $>28$  years had higher levels of hba1C in comparison to patients  $<28$  years of age. Therefore increasing maternal age is found to be a risk factor for high HbA1C levels and development of GDM.

In this study, there is a good statistical agreement between HbA1c & GTT with a p value of 0.581. Sensitivity of HbA1c is 70.4% and Specificity being 93.2%. These results imply that women with higher

HbA1c ( $\geq 5.7$ ) were more likely to develop GDM than those women with lower HbA1C ( $\leq 5.7$ ).

In all 100 patients there was no abortions or abnormalities observed. Other factors like mode of delivery, parity and maternal weight gain showed no comparable association which could be due to smaller sample size.

This study concludes that increasing maternal age is associated with increased levels of HbA1C in pregnancy ( $\geq 5.7$ ) and development of GDM. Also HbA1C can be used as a reliable tool for predicting GDM in as early as 12 weeks of gestation.

### Conclusion

HbA1c can be done routinely in early pregnancy (1<sup>st</sup> trimester). Women with higher HbA1c ( $\geq 5.7$ ) can benefit from early interventions like appropriate diet and lifestyle modification early in pregnancy thereby prevent GDM and adverse perinatal and pregnancy outcomes.

### References

1. Ramachandran A, Snehalatha C, Shyamala P, Vijay V, Viswanathan M. Prevalence of diabetes in pregnant women – a study from southern India. *Diabetes Research and clinical practice*. 1994 Aug 1;25(1):71-74.
2. Zargar AH, Sheikh MI, Masoodi SR, Laway BA, Wani AI, Bhat MH, Dar FA. Prevalence of gestational diabetes mellitus in Kashmiri women from the Indian subcontinent. *Diabetes research and clinical practice*. 2004 Nov 30;66(2):139-145.
3. Suhonen L, Hiilesmaa V, Teramo K. Glycaemic control during early pregnancy and fetal malformations in women with type I diabetes mellitus. *Diabetologia*. 2000 Jan 1;43(1):79-82.
4. HAPO study cooperative Research group. Hyperglycemia and adverse pregnancy outcomes. *N Engl J Med*. 2008 may 8;2008(358):1991-2002.

5. Bartha JL, Martinez – Del – Fresno P, Comino-Delgado R. Gestational diabetes mellitus diagnosed during early pregnancy. *American journal of obstetrics and gynecology*. 2000 Feb 29;182(2):346-350.
6. Hawkins JS, LO JY, Casey BM, McIntire DD, Leveno KJ. Diet-treated gestational diabetes mellitus: comparison of early vs routine diagnosis. *American journal of obstetrics and gynecology*. 2008 Mar 31;198(3):287 –el.
7. Cowie CC, Rust KF, Ford ES, Eberhardt MS, Byrd-Holt DD, LiC, Williams DE, Gregg EW, Bainbridge KE, Saydah SH, Geiss LS. Full accounting of diabetes and pre-diabetes in the US population in 1988-1994 and 2005-2006. *Diabetes care*. 2009 Feb 1;32(2):287-294.
8. Pettitt DJ, Knowler WC, Baird HR, Bennett PH. Gestational Diabetes: infant and maternal complications of pregnancy in relation to third – trimester glucose tolerance in the prima Indians. *Diabetes care*. 1980 May 1;3(3):458-464.
9. Mills JL, Jovanovic L, Knopp R, Aarons J, Conley M, Park E, Lee YJ, Holmes L, Simpson JL, Metzger B. Physiological reduction in fasting plasma glucose concentration in the first trimester of normal pregnancy: the diabetes in early pregnancy study. *Metabolism*. 1998 Sep 30;47(9):1140-4.
10. Lind T, Cheyne GA. Effect of normal pregnancy upon the glycosylated haemoglobins. *BJOG: An International Journal of Obstetrics & Gynaecology*. 1979 Mar 1;86(3):210-3.
11. Nielson LR, Ekborn P, Damm P, Glumer C, Frandsen MM, Jensen DM, Matheisen ER. HbA1c levels are significantly lower in early and late pregnancy. *Diabetes care*. 2004 may 1;27(5):1200-1.
12. Aldasouqi S, Solomon D, Bokhari S, Khan P, Muneera S, Gossain V. Glycohaemoglobin A1c: a promising screening tool in gestational diabetes mellitus. *International journal of diabetes in developing countries*. 2008 Oct 1;28(4):121.

**How to cite this article:** Sujithra D., Mukherjee S, Sudha S. Glycated hemoglobin in early pregnancy as a predictor of gestational diabetes mellitus. *Ind J Obstet Gynecol Res*. 2018;5(3):327-330.