

Level of glycosylated haemoglobin in the first trimester in cases of gestational diabetes mellitus

Gautam P,¹ Saha R,² Maharjan S,³ Bhusal S⁴

¹Pratigyan Gautam, Lecturer; ²Rachana Saha, Professor; ³Sujata Maharjan, Resident, Department of Obstetrics and Gynaecology, Kathmandu Medical College Teaching Hospital, Sinamangal, Kathmandu, Nepal; ⁴Surendra Bhusal, Assistant Professor, Department of Anaesthesia and Intensive Care, National Academy of Medical Sciences, Mahabouddha, Kathmandu, Nepal.

Abstract

Background: Glycosylated haemoglobin (HbA1c) level during early pregnancy has been proposed as a predictor of gestational diabetes mellitus (GDM).

Objectives: To determine the mean value of first trimester's glycosylated haemoglobin (HbA1c) in gestational diabetes mellitus cases.

Methods: An analytical cross-sectional study was conducted among GDM cases at the Obstetrics and Gynaecology Department of Kathmandu Medical College after ethical clearance. Purposive sampling was done to enrol 102 cases that presented over a period of August 2020 to January 2021. First trimester HbA1c levels were recorded. The HbA1c values were grouped into two taking 5.7% as a cut-off which is an established threshold for prediabetes in a normal population.

Results: The mean age of participants was 28.74 ± 4.1 years and mean body mass index was 29.13 ± 2.73 kg/m². Mean value of HbA1c was $5.52 \pm 0.44\%$. Mean value of fasting blood glucose and postprandial glucose after oral glucose tolerance test (OGTT) was 102.25 ± 7.36 mg/dl and 167.55 ± 10.91 mg/dl respectively. Out of total participants, only 40 (39.21%) had HbA1c value more than 5.7% while 62 (60.78%) had HbA1c value less than 5.7%. There was weak positive correlation between HbA1c and Fasting Blood Glucose (Pearson's correlation coefficient $r = 0.13$). Similarly, correlation between HbA1c and blood sugar after OGTT ($r = 0.17$) was also insignificant.

Conclusion: This study concluded that the HbA1c value of first trimester is not very different than normal population. Hence, diabetic range of HbA1c value in first trimester is useful in diagnosing overt diabetes.

Key words: Fasting blood glucose; Gestational diabetes mellitus; Glycosylated haemoglobin; Oral glucose tolerance test; Postprandial.

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Address for correspondence

Dr. Pratigyan Gautam
Lecturer, Department of Obstetrics and Gynaecology,
Kathmandu Medical College Teaching Hospital,
Sinamangal, Kathmandu, Nepal.
E-mail: gpratigyan@hotmail.com

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INTRODUCTION

Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance with onset or first recognition during pregnancy.¹ It has been reported that GDM affects 1–14% of all pregnancies, and that its incidence has been steadily rising.² The incidence of gestational diabetes mellitus was 1.58% in Kathmandu Medical College Teaching Hospital in the year 2014.³ The GDM cases are at risk of developing a number of serious obstetric as well as long-term metabolic morbidity to women and their newborns.^{4,5} Usually, screening for GDM is done at 24 to 28 weeks of pregnancy. Early detection of GDM and treatment can reduce the risks of complication in both the mothers and their babies. Glycosylated haemoglobin (HbA1c) is an index of mean plasma glucose over the previous three months.⁵ At present, HbA1c measurement is not part of routine antenatal care, but a first-trimester HbA1c concentration $\geq 6.5\%$ is useful for diagnosis of overt diabetes. Some of

the studies have shown that first trimester's HbA1c level between 5.5% and 6.5% was associated with an increased risk of GDM.^{1,6} Hence, the main aim of this study was to determine the mean value of first trimester's HbA1c in GDM cases.

METHODOLOGY

This was an analytical cross-sectional study conducted at the Department of Obstetrics and Gynaecology, Kathmandu Medical College, Teaching Hospital over the six months period (August 2020 to January 2021). Prior permission for the study and ethical clearance were taken from the Institutional Review Committee of Kathmandu Medical College (Ref. 2207202003). For Sample size calculation, confidence coefficient of 0.95 was decided. Standard Deviation (SD) of 0.36 was taken with reference to the study by Khalafallah et al.⁴ Sample size required was 102 gestational diabetes mellitus cases. Pregnant ladies whose HbA1c level from the first trimester was available were included. At the study site, HbA1c is routinely done during first trimester. Patients diagnosed as overt diabetes mellitus, anaemia (Hb <10 gm/dl), chronic liver disease, and renal insufficiency were excluded from the study. Study group was selected from the pregnant ladies having antenatal checkup at Kathmandu Medical College. During 24-28 weeks of pregnancy, fasting blood sugar (FBS) and oral glucose tolerance test (OGTT) was done and GDM was diagnosed based on either FBS or blood glucose after OGTT.

According to National Institute for Health and Care Excellence (NICE) guideline (2015),⁷ Diabetes in pregnancy: management from preconception to the postnatal period article, the patients were categorised

as GDM cases on the basis of FBS and two hours OGTT value. The GDM cases were diagnosed if one of the values was deranged: i) Fasting plasma glucose: ≥ 101 mg/dl (5.6 mmol/L); and ii) 2.2 hours plasma glucose: ≥ 140 mg/dl (7.8 mmol/L) following 75 gm oral glucose load. In total, 102 pregnant ladies diagnosed with GDM were included for the study. For patient diagnosed as GDM, first trimester's HbA1c level was recorded. The HbA1c values were grouped into two taking 5.7% as a cut-off which is an established threshold for prediabetes in a normal population.

RESULTS

Among 102 GDM cases, mean age was 28.74 ± 4.1 years and mean body mass index (BMI) was 29.13 ± 2.73 kg/m². In present study, 52 (50.9%) of cases were primigravida followed by 42 (41.17%) were gravida 2, 7 (6.8%) were gravida 3 and 1 (0.98%) were gravida 4. Mean value of first trimester's HbA1c was $5.52 \pm 0.44\%$. In pregnant mother, who were classified as GDM based on FBS, the mean FBS value was 102.25 ± 7.36 mg/dl. While for those who were classified as GDM based on blood sugar after two hours of OGTT, the mean value of postprandial blood sugar was 167.55 ± 10.91 mg/dl. Out of total participants, only 40 (39.21%) had HbA1c value more than 5.7% while 62 (60.78%) patients had HbA1c value less than 5.7%. Hence the significant number of GDM cases had their first trimester's HbA1c value less than the prediabetic cutoff of 5.7% (Figure 1). There was weak positive correlation between HbA1c and FBS (Pearson's correlation coefficient, $r = 0.13$; Figure 2). Similarly, correlation between HbA1c and blood sugar after OGTT ($r = 0.17$) was also insignificant (Figure 3).

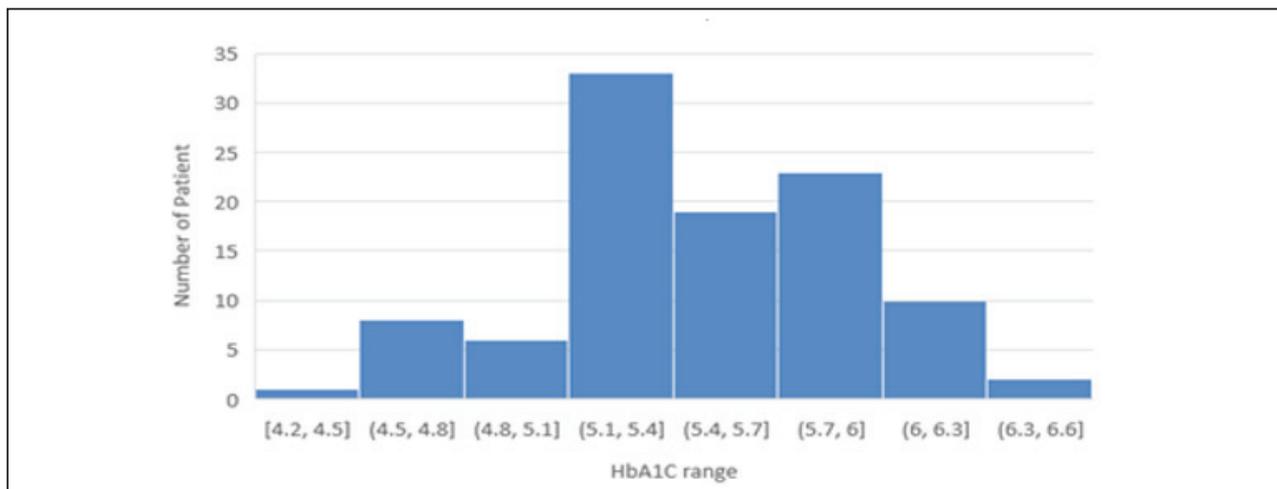


Figure 1: Frequency distribution of HbA1c

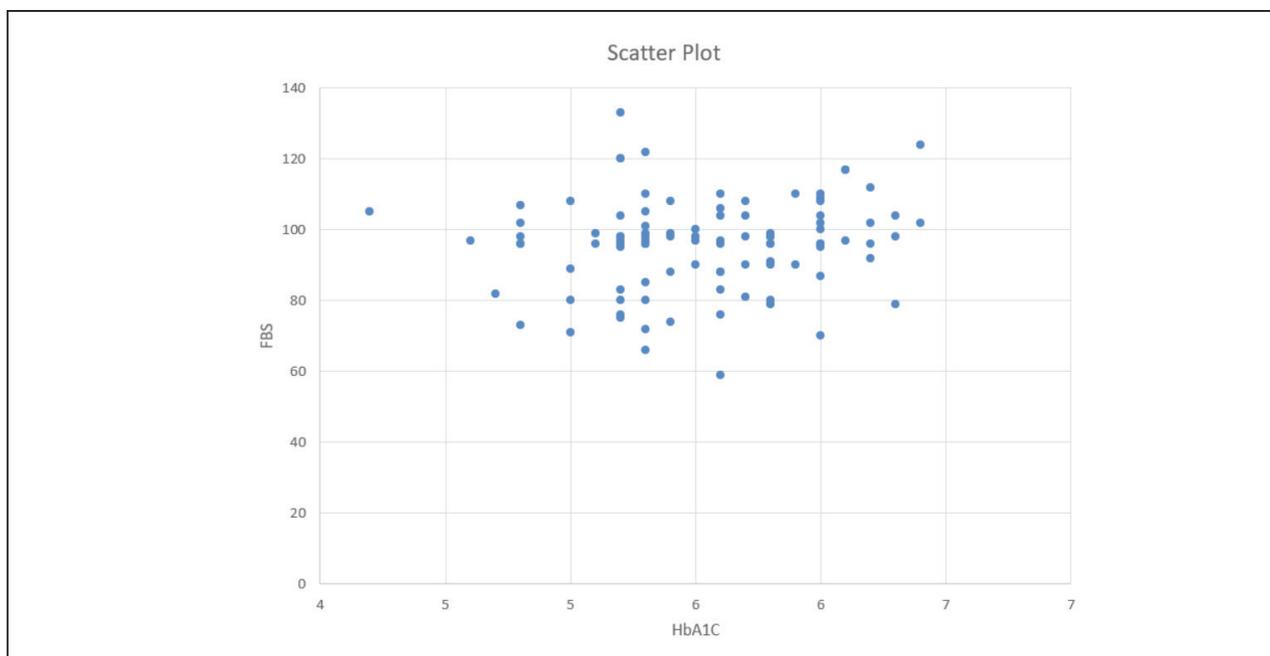


Figure 2: Scatter plot of glycosylated haemoglobin and fasting blood sugar

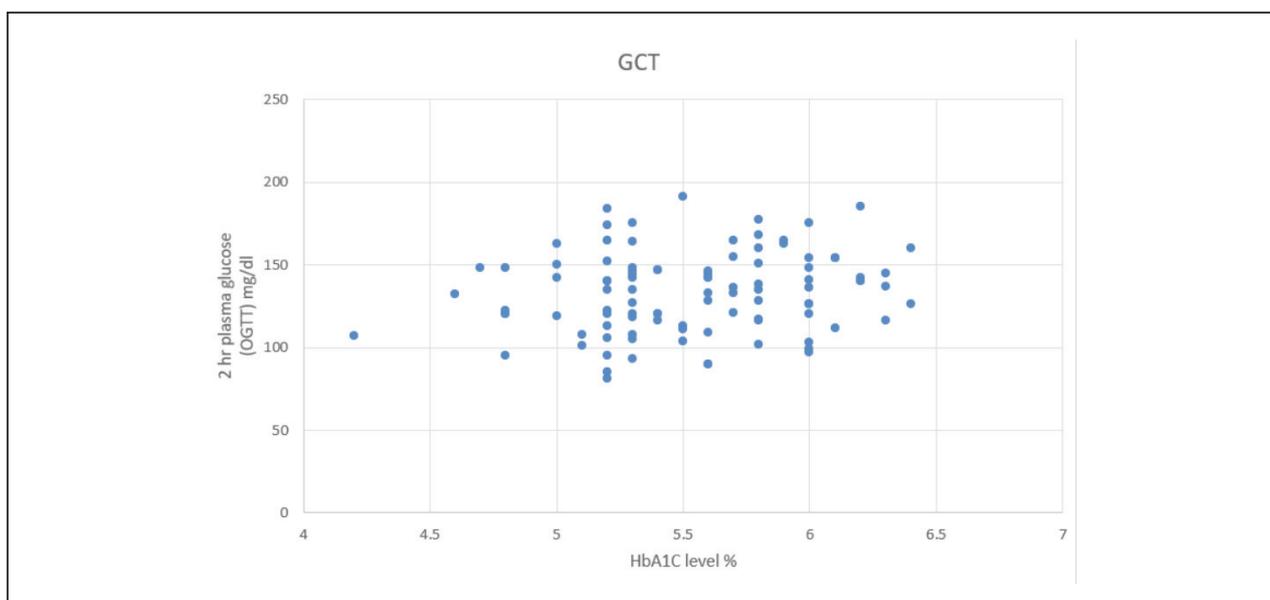


Figure 3: Scatter plot of glycosylated haemoglobin and postprandial after oral glucose tolerance test

DISCUSSION

Globally, the prevalence of GDM is rising and there is wide variation in the prevalence due to ethnic heterogeneity among different population and also because of the different screening and diagnostic criteria being used. The OGTT is a cumbersome test that is time consuming and often poorly tolerated by pregnant ladies and sometimes it may delay the diagnosis and possibility of early treatment for the high-risk women. The testing of

HbA1c, has been 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 is because HbA1c is influenced by different factors such as anaemia, less haemoglobin glycosylation in the first trimester, increased red cell turnover, physiological hydraemia in pregnancy, slower intestinal passage, and nutritional changes. The HbA1c is an uncomplicated test, less time consuming

does not require any specific patient preparation and is considered straightforward compared with the OGTT. Therefore, HbA1c (>6.5%) can be employed for diagnosis of overt diabetes during the first trimester. Also, some authors have proposed that HbA1c in prediabetic range (5.7-6.5%) is predictive of future GDM.⁸ The standard cut-off value of HbA1c for prediabetes was taken as ≥ 5.7 in reference to earlier studies.⁶ Mean level of HbA1c was found to be $5.52 \pm 0.44\%$ which is close to normal population (5.42 ± 0.01). Versantvoort et al. studied HbA1c levels in healthy pregnant women and concluded that the cut off levels of HbA1c in first trimester for GDM cases was 5.4% and it is not different than this study.⁹ This shows that, HbA1c value during first trimester done in healthy and GDM cases is not different. Arbib et al. study showed that the mean HbA1c concentration (%) for all samples collected up to 12 weeks of gestation was $5.43 \pm 0.42\%$, which is similar to current study.⁵ Various studies has shown that during first trimester (six weeks to eight weeks), there is fall in fasting blood sugar level and that ultimately leads to erythrocytes exposed to low level of sugar.¹⁰⁻¹² Hence, leading to low glycosylated haemoglobin, which may explain the reason behind similar glycosylated haemoglobin at first trimester between GDM and healthy pregnant ladies. Study done by Amylid et al. concluded that women at risk for GDM have higher first-trimester HbA1c levels and values $\geq 6.0\%$ (42 mmol/mol) are predictive of GDM, which is different than current study.¹³

This study was done at single hospital and HbA1c values were obtained by standard laboratory methods. The main limitation of present study is that we have no information on HbA1c values of non-gestational diabetes mellitus cases. Moreover, sample size of present study was small, which leads to a low prevalence of adverse outcome; therefore, subgroup analyses are of limited value.

CONCLUSION

The glycosylated haemoglobin values in the first trimester in gestational diabetes mellitus cases of this study were not very different than normal population. Hence, glycosylated haemoglobin value during first trimester is not necessarily within prediabetic range in gestational diabetes mellitus cases. However, the diabetic range of glycosylated haemoglobin value in first trimester is useful in diagnosing overt diabetes.

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REFERENCES

- Balaji V, Madhuri BS, Ashalatha S, Sheela S, Seshia V. A1C in gestational diabetes mellitus in Asian Indian women. *Diabetes Care*. 2007 Jul;30(7):1865-7. [[PubMed](#) | [Full Text](#) | [DOI](#)]
- Dubey D, Kunwar S, Gupta U. Mid-trimester glycosylated haemoglobin levels (HbA1c) and its correlation with oral glucose tolerance test (World Health Organization 1999). *J Obstet Gynaecol Res*. 2019 Apr;45(4):817-23. [[PubMed](#) | [Full Text](#) | [DOI](#)]
- Bajracharya A, Saha R, Shakya A. Pregnancy outcome in gestational diabetes mellitus. *J Kathmandu Med Coll*. 2014 Jul-Sep;3(3):107-12. [[Full Text](#) | [DOI](#)]
- Khalafallah A, Phuah E, Al-Barazan AM, Nikakis I, Radford A, Clarkson W, et al. Glycosylated haemoglobin for screening and diagnosis of gestational diabetes mellitus. *BMJ Open*. 2016 Apr;6(4):e011059. [[PubMed](#) | [Full Text](#) | [DOI](#)]
- Arbib N, Shmueli A, Salman L, Krispin E, Toledano Y, Hadar E. First trimester glycosylated haemoglobin as a predictor of gestational diabetes mellitus. *Int J Gynaecol Obstet*. 2019 May;145(2):158-63. [[PubMed](#) | [Full Text](#) | [DOI](#)]
- Sujithra D, Mukherjee S, Sudha S. Glycated haemoglobin in early pregnancy as a predictor of gestational diabetes mellitus. *Ind J Obstet Gynecol Res*. 2018;5(3):327-30. [[Full Text](#) | [DOI](#)]
- National Institute for Health and Care Excellence. Diabetes in pregnancy: Management of diabetes and its complications from preconception to the postnatal period. NG3, Feb 2015. [[Full Text](#)]
- Seo JY, Hwang SS, Kim JH, Lee YA, Lee SY, Shin CH, et al. Distribution of glycated haemoglobin and its determinants in Korean youth and young adults: A nationwide population-based study. *Sci Rep*. 2018 Jan 31;8(1):1962. [[PubMed](#) | [Full Text](#) | [DOI](#)]
- Versantvoort ARE, Roosmalen J, Radder JK. Course of HbA1c in non-diabetic pregnancy related to birth weight. *Neth J Med*. 2013 Jan;71:22-5. [[PubMed](#) | [Full Text](#)]

10. Bartha JL, Martinez-Del-Fresno P, Comino-Delgado R. Gestational diabetes mellitus diagnosed during early pregnancy. *Am J Obstet Gynecol.* 2000 Feb;182(2):346-50. [[PubMed](#) | [Full Text](#) | [DOI](#)]
11. Hawkins JS, Lo JY, Casey BM, McIntire DD, Leveno KJ. Diet-treated gestational diabetes mellitus: Comparison of early vs routine diagnosis. *Am J Obstet Gynecol.* 2008 Mar 31;198(3):287.e1-6. [[PubMed](#) | [Full Text](#) | [DOI](#)]
12. Mills JL, Jovanovic L, Knopp R, Aarons J, Conley M, Park E, et al. 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. [[PubMed](#) | [Full Text](#) | [DOI](#)]
13. Amylidi S, Mosimann B, Stettler C, Fiedler GM, Surbek D, Raio L. First-trimester glycosylated haemoglobin in women at high risk for gestational diabetes. *Acta Obstet Gynecol Scand.* 2016; 95:93-7. [[PubMed](#) | [Full Text](#) | [DOI](#)]