

Screening of hemoglobin A1c in gestational diabetes among women attending metabolic clinic at a tertiary care hospital in Uttar Pradesh



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ABSTRACT

Background: Gestational diabetes mellitus (GDM) is a common medical condition that complicates pregnancies. Gestational diabetes mellitus (GDM) is a diabetic metabolic disorder that occurs in 4% of all pregnant women and 14% of ethnic groups with more prevalence of type II diabetes. It can be defined as increased or abnormal insulin resistance, decreased insulin sensitivity or glucose intolerance with first diagnosis during pregnancy.

Aims and Objectives: The purpose of this study was to evaluate the diagnostic screening value of the HbA1c, prevalence of GDM and associated risk factors. **Materials and Methods:** The study was conducted at the metabolic clinic; in the department of Biochemistry located at SIMS, Hapur. A semi-structured pretested questionnaire was used for data collection. Following the DIPSI guidelines, patients with plasma glucose values > 140 mg/dl were labeled as GDM. Statistical methods used were OR (CI95%), percentage, Chi square. **Results:** Out of 500, 6.72% had GDM. Among all GDM patients, 64.71% had age more than 30 years, 70.59% had BMI more than 25, 41.18% had gravida more than 3 and p-value was significant with regard to age and BMI. P value was found to be significant for risk factors namely positive family history of Diabetes Mellitus, history of big baby and presence of more than one risk factor. **Conclusion:** GDM is associated with high BMI, early pregnancy loss, family history of DM and previous history of big baby and there could be more than one risk factor. Thus universal screening followed by close monitoring of the pregnant women for early detection of GDM may help improving maternal and fetal outcomes.

Key words: Diabetes Mellitus; GDM; BMI; Gravida

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INTRODUCTION

The definition of GDM is not consistent across governing bodies which can make diagnosing GDM challenging. American College of Obstetricians and Gynecologists (ACOG) defines GDM as carbohydrate intolerance that begins during pregnancy.¹ The American Diabetes Association (ADA) defines diabetes as “diabetes mellitus that is first diagnosed in the second or third trimester of pregnancy that is not clearly either preexisting type 1 or type 2 diabetes”.² The ADA adopted this definition as a result of the increased prevalence of undiagnosed type 2

diabetes.² The World Health Organization (WHO) defines GDM as hyperglycemia during pregnancy without prior history of diabetes.³ The International Association of Diabetes and Pregnancy Study Groups (IADPSG) was the first to recommend that diabetes mellitus (DM) recognized during the first trimester of pregnancy be diagnosed as overt DM rather than as GDM. This is secondary to the increased prevalence of type 2 DM in women of child bearing age. Glucose intolerance in patients with DM in the first trimester likely precedes pregnancy and therefore is medically managed as pre-gestational.⁴ Prevalence of gestational diabetes mellitus (GDM) is known to vary

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widely depending on the region of the country, dietary habits, and socio-economic status. This study was undertaken to assess HbA1c in GDM in women attending metabolic clinic at a tertiary care hospital in SIMS, Hapur, Uttar Pradesh. This study enrolled women, with their estimated gestational age between 24th and 28th week. After informing, women who consented to participate were given a standardized 2-h 75 g oral glucose tolerance test (OGTT). A proforma containing general information on demographic characteristics, socio-economic status, family history of diabetes and/or hypertension and past history of GDM was filled up. American Diabetes Association (ADA) criteria for 75 g 2-h OGTT was used for diagnosing GDM. Prevalence of diabetes is increasing globally, particularly in the developing world; China and India being major countries contributing to increasing burden. International Association of Diabetes and Pregnancy Study Groups recommends the use of fasting plasma glucose, Hemoglobin A1c (HbA1c) or random glucose measurement for women at their first prenatal visit to screen for overt DM and GDM. The recommended thresholds for over DM are a fasting plasma glucose greater than or equal to 7.0 mmol/L (126 mg/dL), a HbA1c greater than or equal to 6.5% and or a random glucose greater than or equal to 11.1 mmol (200mg/dL). IADPSG recommends that GDM be diagnosed at the first prenatal visit if the fasting plasma glucose is greater than or equal to 5.1 mmol/L (92 mg/dL) and less than 7.0 mmol/L (126 mg/dL). If the test is negative, IADPSG recommends a 75 grams 2-hour oral glucose challenge test (OGCT) at 24 to 28 weeks gestation. Overt DM is diagnosed if the fasting plasma glucose is greater than or equal to 7.0 mmol/L (126 mg/dL). GDM is diagnosed if fasting plasma glucose is greater than or equal to 5.1 mmol (92 mg/dL), 1-hour plasma glucose greater than or equal to 10 mmol (180 mg/dL), or a 2 hour plasma glucose of 8.5 mmol/L (153 mg/dL).⁴ In contrast, ACOG supports the two step method for the screening of GDM whereby a screening 1 hour 50 g OGCT is performed. American College of Obstetricians and Gynecologists states the commonly used plasma glucose cutoffs at 1 hour vary between 130 mg/dL - 140 mg/dL. If the 1-hour screening OGCT is positive per institutional cutoff, ACOG recommends a 3-hour 100 gram OGCT to confirm the diagnosis of GDM. Plasma glucose is measured fasting prior to the test, 1 hour post consumption, 2 hours post consumption and 3 hours post consumption. ACOG supports two cutoff recommendations: one from the National Diabetes Data Group (NDDG) and Carpenter and Coustan. Due to minimal evidence suggesting one cutoff is more beneficial than the other, ACOG does not recommend one more than the other. Carpenter and Coustan support using the following cutoffs: fasting ≥ 5.3 mmol/L (95mg/dL), 1 hour ≥ 10 mmol/L

(180 mg/dL), 2 hour ≥ 8.6 mmol/L (155 mg/dL), 3 hour ≥ 7.8 mmol/L (140 mg/dL). NGGD supports using the following cutoffs: fasting ≥ 5.8 mmol/L (105mg/dL), 1 hour ≥ 10.6 mmol/L (190 mg/dL), 2 hour ≥ 9.2 mmol/L (165 mg/dL), 3 hour ≥ 8.0 mmol/L (145 mg/dL). Two abnormal values are needed during the 3-hour OGCT to diagnose GDM. India is projected to have the highest cases of people with diabetes in the world, by 2030. The rise in prevalence is attributed to ageing population, urbanization, rising obesity, unhealthy diets and physical inactivity, in addition to the genetic predisposition of South Asians to diabetes. Gestational Diabetes Mellitus (GDM) is defined as any degree of glucose intolerance with the onset or first recognition during pregnancy with or without remission after the end of pregnancy. GDM is associated with higher incidence of maternal diabetes mellitus later in life.² Poor glycemic control during pregnancy is associated with high morbidities and mortalities among mothers and infants.^{3,4} Therefore, appropriate diagnosis and management of GDM will improve maternal and fetal outcome. There are several studies which have investigated the relationship between the presence of GDM and HbA1c. Wahl et al found higher prevalence of GDM with regard to higher education, higher BMI. The findings of the present study are in agreement with the findings of Wahi et al, with regard to high prevalence associated with BMI ≥ 25 . Wide geographical variation has been observed in prevalence of GDM in by some authors^{5,6,7} in different parts of India. However, some studies have found that HbA1c could be used as a screening test to limit the number of women who need to undergo OGCTs According to a nationwide survey in India in 2002, prevalence of GDM was estimated to be 16.55 percent.⁸ Uttar Pradesh is the largest state in India, with population of 230 million, 4.5million pregnancies every year and has high maternal & Infant Mortality Rate.^{9,10} There has been conflicting evidence relating to the association of elevated HbA1c and adverse pregnancy outcomes. The present study was carried out with the following aims and objectives.

AIMS AND OBJECTIVES

1. The purpose of this study was to evaluate the diagnostic screening value of the HbA1c
2. To find out the prevalence of GDM among the study population
3. To study the associated risk factors.

MATERIALS AND METHODS

This cross sectional study was conducted at the metabolic clinic in the department of Biochemistry, SIMS. The study was approved by the Institutional Ethics Committee.

Inclusion criteria

Women with estimated duration of pregnancy between 24 to 28 weeks of gestation, attending the metabolic outdoor clinic.

Exclusion criteria

Women having gestation period less than 24 weeks or more than 28 weeks of gestation, women with history of Diabetes Mellitus prior to the onset of pregnancy, multiple pregnancy and major chronic diseases including cancer were excluded.

All the women were informed about the nature of the study and those who gave the consent were included in the study. Using semi-structured pretested questionnaire, data was collected which included socio-demographic and personal information such as height, weight, family history of Diabetes Mellitus, history of pregnancy loss. The sample size for the present study was calculated considering the findings of national wide survey. Assuming the permissible error of 20 percent at level of significance of 95%, a total of 500 women were required. The participants were given 75 grams of oral glucose irrespective of the meals and their plasma glucose was estimated at 2 hours. Patients with plasma glucose values >140 mg/dl were labeled as GDM and the rest as non-GDM group. All the women were investigated for risk factors namely family history of Diabetes, history of big baby (Birth weight more than 3.5 kg) and presence of more than one risk factor.

STATISTICAL ANALYSIS

Results were expressed using SPSS (version 20.0). Odd's ratio CI at 95% was calculated using cross table analysis among GDM & NGDM groups. Chi square test was applied and p value <0.05 were considered significant.

RESULTS

A total of 500 cases were included in the study. The findings of socio-demographic profile of the cases showed that there were 388 (76.88%) Hindus, 96(19.37%) Muslim and 18(3.75%) belonged to other religion respectively whereas 294 (58.50%) respondents were from village background. As regards, GDM, 34 (6.72%) respondents were diagnosed to have pregnancy with Gestational Diabetes Mellitus (GDM) of Type 2 variety; whereas 470 (93.28%) did not have Gestational Diabetes (Non GDM). Thus the prevalence of Diabetes Mellitus was 6.72 percent. All the respondents were examined with regard to age, Body Mass Index (BMI), Gravida and history of abortion.

Table 1 shows distribution of patients with regard to Odd's Ratio (OR), Chi value and significance based on p value for GDM, Non GDM group with variables namely age, BMI, and Gravida. OR and 95% CI were found to be significant with regard to age [2.08 (1.00-4.30)], BMI [2.24 (1.05-4.79)]. There were 290(56.92%) patients who did not have any history of abortion as against 220 (43.08%) patients who had one or more abortions. Average no. of abortions was 1.08.

Table 2 Shows distribution of patients with regard to risk factors from history namely history of early pregnancy loss, family history of DM, and history of big baby in previous pregnancy and presence of more than one risk factor. OR and 95% CI were found to be significant with regard to positive family history of DM [2.12 (1.01 to 4.41)], Positive History of big baby [3.71 (0.99 to 13.84)], presence of more than one risk factor [2.6 (1.01 to 6.68)]. The p value was significant for all the risk factors except history of early pregnancy loss.

Table 1: Distribution of patients with regard to Age, BMI and Gravida

Variable	GDM n=34 (100)*	Non GDM n=472 (100)*	OR	95%CI	Chi Sq. value	P value Significance
Age						
>28 Years	20 (64.70)	220 (46.82)	2.06	1.00-4.30	4.06	Significant at 0.05
BMI						
>26	24 (70.59)	244 (51.69)	2.24	1.05-4.79	4.45	Significant at 0.05

Table 2: Distribution of patients with regard to risk factors from history

Variable	GDM n=30 (100)*	Non GDM n=470 (100)*	OR	95%CI	Chi Sq. value	P value Significance
Positive history of early pregnancy loss	06	168	0.46	0.19 to 1.07	3.40	Not Significant at 0.05
Positive family history of DM	12	48	2.12	1.01 to 4.41	4.08	Significant at 0.05
Positive history of big baby	3	12	3.71	0.99 to 13.84	6.40	Significant at 0.05

DISCUSSION

The variation in the prevalence of GDM in India could be due to local, cultural context. In addition, other factors that could influence the variation of GDM prevalence could be technical issues such as sample drawn from urban or rural part, ethnicity, higher education, higher BMI, obesity and diagnostic methods used. Some studies have concluded that patients with elevated HbA1c measurements are at increased risk of adverse pregnancy outcomes.¹¹⁻¹⁵ Studies using HbA1c as a predictor of GDM during the mid second trimester show mixed results. Multiple studies have suggested stratification of patients based on HbA1c does not create adequate sensitivity and specificity for it to replace the OGCTs for diagnosis of all cases of GDM. A 2017 study of Taiwanese women concluded that there was an association between increased HbA1c and GDM, although it was not significant enough to replace OGCT as a diagnostic approach to GDM.¹⁵ High prevalence of GDM among Indian population could be due to trend towards older maternal age, decrease in physical activity and adoption of modern lifestyles, and increasing prevalence of obesity in urban area.¹⁵ In the present study in SIMS, Hapur, the prevalence of GDM was 6.72 percent. However, corresponding figure in a study in Gujarat, by Parikh Pallav et al¹² the prevalence was 13.79 percent. The variation could be due to the socio-geographical differences as documented in other studies. The GDM prevalence was found to be 3.8 % in Kashmir,¹³ 6.6% in Rajasthan,¹⁴ 13.9% in Haryana.¹⁵ In the present study, the association of age and diabetes was found to be statistically significant. However, Verma et al¹⁶ did not find it to be significant. It could be due to a different study design which was limited to rural population of Jammu. Significant association was found with regard to BMI in GDM. Similar observations were observed in studies conducted elsewhere in India.¹⁷ A study from 2014 contradicted this and showed that there was not a significant correlation between HbA1c levels and adverse pregnancy outcomes.¹⁸ Since BMI is a modifiable risk factor for prevention of maternal/fetal complications associated with gestational diabetes mellitus, advice on life-style modifications even during pre-pregnancy and pregnancy period would be highly beneficial. Association of family history of Diabetes Mellitus and history of early pregnancy loss among women with GDM was in agreement with the study undertaken by Saxena et al¹⁸ in a tertiary level hospital in north India. In the present study, there was no association of presence of GDM and history of early pregnancy loss. It could be due to the fact that pregnancy loss could be due to many other reasons such as accident, stress, infections. In the context of rising and varied prevalence of GDM in India, it is important to note the association of various risk factors while examining the pregnant women. Early diagnosis and timely treatment of

gestational diabetes not only improve the maternal and fetal outcome pregnancy but also will facilitate prevention of morbidities and mortalities of mothers and infants.

CONCLUSION

GDM is associated with high BMI, early pregnancy loss, family history of DM and previous history of big baby and there could be more than one risk factor. Thus universal screening followed by close monitoring of the pregnant women for early detection of GDM may help improving maternal and fetal outcomes.

LIMITATIONS OF THE STUDY

Since it was a cross sectional study, the other maternal/pregnancy outcome related risk factors such as vaginal candidiasis, abruption placenta, Intrauterine death, macrosomia, still birth etc. were not studied.

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Authors Contribution:

VS- Concept and design of study, manuscript preparation, data collection, statistically analyzed and interpreted, critical revision of the manuscript; **PK-** Collected data, statistically analyzed and interpreted, critical revision of the manuscript.

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