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Prevalence of Gestational Diabetes in Women Attending Ante-natal Clinic in West Bengal: A Hospital-based Cross-sectional Study from Eastern India

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Abstract

Background: *Prevalence of gestational diabetes mellitus (GDM) varies with different regions of the country, socioeconomic status, and diagnostic criteria. This study was done to obtain the prevalence rate of GDM and its associated risk factors, in women attending antenatal care (ANC) clinic in West Bengal.*

Methodology: *This is a hospital-based cross-sectional study. All women who met the inclusion criteria and gave informed consent were enrolled in the study. A patient information sheet containing general information on age, pre-pregnancy weight, socioeconomic status, education level, parity, and family history of diabetes was filled after interviewing the patient. Results of (2 hour -75g glucose)Glucose Challenge Test (GCT) was noted and DIPSI criteria was used for diagnosis.*

Results: *A total of 310 women participated in the study and GDM was diagnosed in 34.19% women. On bivariate analysis, risk factors found to be significantly associated with GDM were age, socioeconomic status, body mass index (BMI), family history of diabetes, and higher parity.*

Conclusions: *The prevalence of GDM was found to be 34.19% in an urban ANC clinic in West Bengal. The study obtains a prevalence rate of using DIPSI criteria in urban population and it also shows that family history of diabetes mellitus (DM), high BMI, higher parity, and high socioeconomic status are associated with higher risk of GDM. The study population being an urban one with trends towards high maternal age and higher socioeconomic status showed higher prevalence of risk factors and GDM than other studies. It brings to light how prevalence of GDM not only varies from region to region but also in different clinical settings owing to different patient populations. Further extensive prevalence studies*

in different study population using uniform criteria are required to obtain true prevalence rate of GDM in India.

Keywords: ***DIPSI, prevalence, GDM, urban, eastern India***

INTRODUCTION

Diabetes is one of the most prevalent diseases in the world and in recent years these prevalence rates are increasing. This is extremely relevant in the Indian scenario as the 6th edition of *The World Diabetes Atlas* estimated that over 65 million Indians are affected with diabetes mellitus in 2013; a 103% rise compared to their 2001 estimate of 32 million. Among these, there is a population of special importance, that is, women of child-bearing age, as hyperglycemia during pregnancy either due overt (pre-pregnancy) diabetes or gestational diabetes not only has a significant effect on maternal and fetal outcome but also has a far-reaching and long-term effect on the lives of both mother and child.

Gestational diabetes mellitus (GDM) is defined as "any degree of glucose intolerance with onset or first recognition during pregnancy." This definition is also applicable for conditions persisting after pregnancy and includes the possibility of unrecognized glucose intolerance existing before pregnancy.[1]

Prolonged postprandial hyperglycemia is a normal physiological mechanism in pregnant women in order to provide a steady supply of glucose to the fetus. There is also sustained post-prandial hyperinsulinemia achieved by peripheral insulin resistance.[2,3] However, in case these pregnancy-induced changes in glucose metabolism are exaggerated, gestational diabetes results.

Indians have a genetic predisposition toward diabetes mellitus and this also applies to gestational diabetes as it is seen that prevalence of gestational diabetes among pregnant women mirrors that of diabetes mellitus in the general population.[4,5] The higher incidence of gestational diabetes among Indian women has been noted in several studies and led to their classification as high risk ethnic group for gestational diabetes mellitus.[6]

Risk factors of GDM include advanced maternal age, obesity, family history of type 2 diabetes, and belonging to a high-risk ethnic group.[7] Some studies have shown association of GDM with urban habitat, higher socioeconomic status, educational level, parity, and weight gain during pregnancy.[8,9]

Prevalence of both diabetes mellitus and gestational diabetes are increasing in India,[10–12] which may be attributed to the epidemic of obesity, decreased physical activity, and other lifestyle changes. In India rates have been shown to vary from 3.8% in a study conducted in Kashmir to 35% in Punjab in a study in different settings using different criteria.[13,14]

It is seen that proper management of the condition minimizes adverse fetal outcomes[15] which include for gestational age (LGA) fetus with predisposition to shoulder dystocia and cesarean delivery, and neonatal hypoglycemia.[7,16]

Furthermore, gestational diabetes in a pregnant woman also indicates a high risk of developing type 2 diabetes after pregnancy[17] and so the importance for postpartum and regular testing of glucose levels must be impressed upon these patients during their antenatal care (ANC) clinic visits.

The exposure of the fetus to a hyperglycemic uterine environment induces hyperinsulinimea in the fetus, leading to an increase in fetal fat cells contributing higher incidence of metabolic syndrome in children born to mothers having diabetes during pregnancy.[18] This intergenerational effect perpetuates a cycle which leads to spiraling of cases of diabetes mellitus in the population.[19]

As members of this high-risk group, every pregnant Indian woman should ideally be screened for gestational diabetes as part of their ANC.[20] A survey of 250 Indian doctors involved in the care of pregnant patients by International Diabetes Federation revealed that 86% performed universal screening but at different points of time and with different criteria. Screening practices, diagnostic criteria, and management protocols lack uniformity in Indian clinical setting.[21] Different guidelines

have been prescribed by the American Diabetes Association(ADA),[21] International Association of Diabetes and Pregnancy Study Group (IADPSG),[22] World Health Organization (WHO),[23] and Diabetes in Pregnancy Study Group India (DIPSI).[20] Consensus to as which standard test to use to diagnose GDM is still in discussion. In low-resource, highly populated and high-risk setting of India the DIPSI criteria provides a cost effective and logistical screening test.[24,25] The DIPSI recommends universal screening by a single 75g-2 hours glucose challenge test in an Indian setting, due to the high pervasiveness of GDM in India and the test being effective in detecting GDM while being simple, economic, and feasible. The test is usually recommended at 24–28 weeks but recent studies have shown that it may be advantageous to screen in the first trimester itself as fetal beta cells recognize and respond to the maternal glycemic level as early as 16th week of gestation.[20] Women detected with GDM should be warned against excess weight gain during pregnancy and advised on an appropriate diet [medical nutrition therapy (MNT)] including calorie restricted diet for obese women and regular monitoring of glucose levels, preferably daily self monitoring, the values of which is to be used to assess the success of MNT and the need for insulin therapy.[26]

In the present study, women attending ANC clinic over a period of 2 months have been approached, and those who have met the inclusion criteria and have given consent are included in the study. Data is obtained from interviews, medical records, and anthropometric measurements. These include data on general medical history, the presence or absence of various risk factors, plasma glucose levels, height, etc. The prevalence of GDM and associated factors is calculated and risk analysis is done.

The model is used as a cross-sectional study. The model is cost effective as it collated and analyses routinely collected data to extract relevant information about the prevalence of gestational diabetes and risk factors.

Among existing studies of this nature in India, only few uses the DIPSI criteria although it was recommended in clinical practice in the Indian setting by various studies. Different criteria produce a wide variation in the prevalence rates, as baseline characteristics of populations differ greatly in different areas of India. Prevalence studies from several areas using uniform criteria and multi-center studies spanning different regions are required to achieve a true picture of GDM and its risk factors in India. These studies will help in clearer outlook in prevention, diagnoses, and management of GDM as well as policy making and keeping in mind the long-term and inter generational implications of GDM.

OBJECTIVE: To find out the prevalence of Gestational Diabetes Mellitus and its risk factors in a cross-section of pregnant women in West Bengal

MATERIALS AND METHODS

The study was conducted over the months of July and August 2015 at the ANC at KPC Medical College, Jadavpur, Kolkata, West Bengal, after obtaining clearance from the Institutional Ethics Committee. Women attending the ANC clinic are approached, the study explained to them, and those who give informed consent are included. Exclusion criteria are overt diabetes, multi-fetal pregnancies, or any chronic illness. Participants are interviewed to obtain the following information: family history of diabetes mellitus, parity, past history of GDM, education level, socioeconomic status (according Kuppuswamy socioeconomic status scale), and pre-pregnancy weight and these information were entered in a patient information sheet for each patient. The height of each patient is measured and BMI is calculated. Then, the results of the 75g-2 hour glucose challenge test which is prescribed universally to pregnant patients on first visit is noted from the patients' records. The test is taken after 3 days of unrestricted diet and an overnight fast. The patient is given 75g glucose powder dissolved in 200–250ml water taken over 10 min, venous blood sample is collected after 2 hours, and plasma glucose level is estimated using glucose oxidation and peroxidation (GOD-POD) method.

Patients with results of 140 mg/dl or above are diagnosed with gestational diabetes whereas those of 120mg/dl and above are classified as decreased

gestational glucose tolerance (DGGT).

The data is analyzed to find prevalence rates of GDM and its risk factors. Odds ratios were calculated using bivariate analysis. Chi-square test is done to test the difference between the two proportions. Statistical analysis was done by NCSS 2004 and PASS 2002 (NCSS LLC. Kaysville, Utah, USA)

RESULTS

The total sample size was 310 using DIPSI criteria and gestational diabetes was diagnosed in 34.19% of the sample. The baseline characteristics are given in Table 1 to 4. Only 21.29% of the women are below 25 years of age. Most of the women are aged between 25 and 29 years (41.29%). The mean age of those enrolled in the study is 28.39±4.54 years (Table1). The highest prevalence was among women 34–40 years old (52.63%) and the lowest was among the age group 19–24 years (27.27%).The age-wise prevalence is given in Table 5

About 69.23% of women with BMI above 25 had GDM compared to 34% in women with BMI below 25. Prevalence of GDM according to BMI classification is given in Table 6.

Sixty-eight percent of women with family history of diabetes were diagnosed with GDM compared to 19.44% of the women with no family history (P<0.001).

Table | 1 Baseline characteristics of study population

Age (in years)	Number of Subjects	Percentage (%)
20 to 24	66	21.29
25 to 29	128	41.29
30 to 34	78	25.16
35 to 39	38	12.26
BMI (in kgm2)		
18.5–24.9	67	43.51
25–29.9	72	46.75
>=30	15	9.74
Parity		
0	224	72.26
1	80	25.81
2	6	1.94
Family history of DM	94	30.32

BMI: body mass index; DM: diabetes mellitus.

About 36.84% of women belong to upper middle class and higher class and had GDM compared to 18% of women belong to lower middle class and lower (P<0.05).

Twenty-one percent of women who are graduates and or had higher degrees are found to have GDM compared to 28% of women without higher degrees, but this was found to be statistically insignificant.

The odds ratio were highest for family history of DM (8.84), followed by high BMI.[3] (Table 7).

Table 2 | Baseline characteristics of study population (Contd)

Education Level	Count	Percentage (%)
Illiterate	4	1.29
Primary school certificate	10	3.23
Middle school certificate	24	7.74
High school certificate	30	9.68
Intermediate or post high diploma	66	21.29
Graduate or post-graduate	164	52.90
Professional or Honors	12	3.87
Socioeconomic status	**Count**	**Percentage (%)**
Upper(I)	72	23.23
Upper middle (II)	116	37.42
Lower middle (III)	78	25.16
Upper lower (IV)	40	12.90
Lower (V)	4	1.29

Table 3 | Number and percentages of GDM cases and non-GDM cases as per DIPSI criteria

Plasma Glucose Level (gm/dl)	Count	Percentage (%)
>=140	106	34.19
<140	204	65.81

Table 4 | Mean and SD of age, BMI, and plasma glucose level of participants

Criteria	Mean	Standard Deviation	Highest and Lowest Value (Range)
Mean age of participants	28.38	4.53	20–39 (19)
Mean BMI of participants	25.52	3.55	18.5–37.5 (19)
Mean plasma glucose level	129.90	27.49	84–199 (115)

BMI: body mass index.

Table 5 | Prevalence of GDM in various age groups

Age Group (Years)	GDM Count (%)
19 to 24	18 (27.27)
24 to 29	38 (29.68)
29 to 34	30 (38.46)
34 to 39	20 (52.63

Table 6 | Prevalence of GDM in various BMI classification groups

BMI (kg/m^2)	GDM Count (%)
Normal weight 18.5–24.9	34 (25.37)
Overweight 25–29.9	58 (39.72)
Obese>=30	14 (46.6)
BMI: body mass index, GDM: gestational diabetes mellitus	

Table 7 | Odds ratio of risk factors associated with GDM (bivariate analysis)

	Number with GDM	% with GDM	Odds Ratio (OR)	95% CI for OR	P Value
Age>=30	50	16.12	1.77	(1.1, 2.86)	<0.05
BMI>=25	72	23.22	3	(1.87, 4.82)	<0.01
Parity>=1	40	12.90	2.08	(1.25, 3.47)	<0.01
SES> = upper middle class	8	2.5	2.63	(1.17, 5.87)	<0.05
Family history of DM	64	20.64	8.84	(5.1, 15.31)	<0.001
BMI: body mass index, GDM: gestational diabetes mellitus. SES=Socio Economic Status					

DISCUSSION

Prevalence of GDM is found to vary according to region of study and screening criteria used. In 2005-2006, Seshiah found the prevalence rates in Tamil Nadu to be 17.8% for women in urban, 13.8% for women in semi-urban, and 9.9% for women in rural areas. A study conducted among rural women in Jammu showed a prevalence of 6.7%.In a multicity survey conducted in 2002–2003 by the single step 75g glucose 2-hour OGTT and the prevalence of GDM was found to be 12% in Bangalore, 15% in Thiruvananthapuram, 16.2%in Chennai, 17.5% in Ludhiana, 18.8% in Erode, 21% in Aluva, and an overall prevalence of 16.55%. An increasing trend had been seen in the prevalence of gestational diabetes. For example, these studies in south India show an increase in prevalence from 1% in 1998 to 16.55% in 2004. This may be attributed to rise in obesity and higher maternal age.[12–14,27] Risk factors of GDM have been shown to include advanced age, family history of diabetes mellitus, high BMI, high socioeconomic status, higher education level, past history of GDM, and Acanthosis nigricans in various studies.

The DIPSI criteria have been found effective as well as simple by some studies but found low in sensitivity by others. Around 34.19% of women were found to have GDM which was higher compared to data from most other studies but is similar to the 35% prevalence found in Punjab using WHO 2013 criteria. The difference may be attributed to the baseline characteristics of the population as the mean age and BMI were higher than most other study populations owing to the urban setting. Most of the population had at least obtained a college degree (graduate) and belong to the upper two socioeconomic classes. Most of the women were found to have at least one risk factor (overweight, 25 or older, or having family history of diabetes) (286% or 92.26%) as compared to 39.68% risk in a rural hospital in West Bengal.

Risk of age greater than 25 is not found to be statistically significant but age greater than 30 is. GDM is found to be associated with family history of DM, high BMI, age >30, higher parity, and high socioeconomic status. In this study, GDM occurred slightly more in less educated women but statistical significance was not proven. A study carried out in Italy showed high levels of maternal education were found to be associated with reduced risks of GDM as compared to less educated women. The study shows that risk of GDM increases with age as also seen in previous studies. The study shows higher pre pregnancy BMI to be associated with increased risk of GDM. Higher socioeconomic status was observed to be associated with higher GDM prevalence which may be attributed to a trend towards higher maternal

age, less physical activity, or higher BMI. GDM was found to be less prevalent in primipara women than women with higher parity. Family history of diabetes mellitus showed a significant association with higher risk of GDM as has been seen in other studies.[27] Analytical studies in different study populations are required to truly delineate the risk factors and their degree of association.

CONCLUSION

The study obtains a prevalence rate of using DIPSI criteria in urban population and it also shows that family history of DM, high BMI, higher parity, and high socioeconomic status are associated with higher risk of GDM. The study population being an urban one with trends towards high maternal age and higher socioeconomic status showed higher prevalence of risk factors and GDM than other studies. It brings to light how prevalence of GDM not only varies from region to region but also in different clinical settings owing to different patient populations. Further extensive prevalence studies in different study population using uniform criteria are required to obtain true prevalence rate of GDM in India.

REFERENCES

1. American Diabetes Association. Diagnosis and classification of diabetes mellitus (Position Statement). Diabetes Care. 2009;32 (Suppl. 1): S62–S67.
2. Phelps RL, Metzger BE, Freinkel N. Carbohydrate metabolism in pregnancy. XVII. Diurnal profiles of plasma glucose, insulin, free fatty acids, triglycerides, cholesterol, and individual amino acids in late normal pregnancy. Am J Obstet Gynecol. 1981;140(7):730–6.
3. Butte NF. Carbohydrate and lipid metabolism in pregnancy: Normal compared with gestational diabetes mellitus. Am J Clin Nutr. 2000 May; 71 (5 Suppl):1256S–S1261.
4. Radha V, Mohan V. Genetic predisposition to type 2 diabetes among Asian Indians. Indian J Med Res. 2007;125(3):259–74.
5. King H. Epidemiology of glucose intolerance and gestational diabetes in women of childbearing age. Diabetes Care. 1998;21(Suppl 2):B9–13.
6. Beischer NA, Oats JN, Henry OA, et al. Incidence and severity of gestational diabetes mellitus according to country of birth in women living in Australia. Diabetes. 1991;40 (Suppl 2):35–8.
7. HAPO Study Cooperative Research Group. The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study. Intl J Gynaecol Obstet. 2002;78:69–77.
8. Arora GP, Thaman RG, Prasad RB, et al. Prevalence and risk factors of gestational diabetes in Punjab, North India: Results from a population screening program. Eur J Endocrinol. 2015 Aug;173(2):257–67.
9 Rajput R, Yadav Y, Nanda S, Rajput M. Prevalence of gestational diabetes mellitus and associated risk factors at a tertiary care hospital in Haryana. Indian J Med Res. 2013 Apr;137(4):728–33.
10. Anjana RM, Pradeepa R, Deepa M, et al. Prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural India: Phase I results of the Indian Council of Medical Research-India DIA Betes (ICMR-INDIAB) study. Diabetologia. 2011;54:3022–7.
11. Mohan V, Deepa M, Deepa R, et al. Secular trends in the prevalence of diabetes and impaired glucose tolerance in urban South India: The Chennai Urban Rural Epidemiology Study (CURES-17). Diabetologia. 2006; 49:1175–8.
12. Seshiah V, Balaji V, Balaji MS, et al. Prevalence of gestational diabetes mellitus in South India (Tamil Nadu): A community based study. J Assoc Physicians India. 2008;56:329–33.
13. Zargar AH, Sheikh MI, Bashir MI, et al. Prevalence of gestational diabetes mellitus in Kashmiri women from the Indian subcontinent. Diabetes Res Clin Pract. 2004; 66:139–45.
14. Arora GP, Thaman RG, Prasad RB, et al. Prevalence and risk factors of gestational diabetes in Punjab, North India: Results from a population screening program. Eur J Endocrinol. 2015; 173(2):257–67.
15. Landon MB, Spong CY, Thom E, et al. Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. A multicenter, randomized trial of treatment for mild gestational diabetes. N Engl J Med. 2009; 361:1339–48.
16. Sreelakshmi PR, Nair S, Soman B, et al. Maternal and neonatal outcomes of gestational diabetes: A retrospective cohort study from Southern India. J Family Med Prim Care. 2015 Jul-Sep; 4(3):395–8.
17. - Löbner K, Knopff A, Baumgarten A, et al. Predictors of postpartum diabetes in women with gestational diabetes mellitus. Diabetes. 2006; 55:792–7.
18. Boney CM, Verma A, Tucker R, Vohr BR. Metabolic syndrome in childhood: association with birth weight, maternal obesity, and gestational diabetes mellitus. Pediatrics. 2005;115:e290–6.
19. Silverman BL, Metzger BE, Cho NH, Loeb CA. Impaired glucose tolerance in adolescent offspring of diabetic mothers: relationship to fetal hyperinsulinism. Diabetes Care. 1995; 18:611–7.
21. Babu GR, Tejaswi B, Kalavathi M, et al. Assessment of screening practices for gestational hyperglycaemia in public health facilities: Adescriptive study in Bangalore. J Public Health Res. 2015 Mar 9;4(1):448.
22. American Diabetes Association. Standards of medical care in diabetes - 2015. Diabetes Care. 2015;38:S1–S93.
23. Weinert LS. International Association of Diabetes and Pregnancy Study Groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy: Comment to the International Association of Diabetes and Pregnancy Study Groups Consensus Panel. Diabetes Care. 2010;33(7):e97.
24. Nallaperumal S, Bhavadharini B, Mahalakshmi MM, et al. Comparison of the world health organization and the International association of diabetes and pregnancy study groups criteria in diagnosing gestational diabetes mellitus in

South Indians. Indian J Endocrinol Metab. 2013;17(5):906–9.
25. Schmidt MI, Ducan BB, Reichelt AJ, et al.; For the Brazilian Gestational Diabetes Study Group. Gestational diabetes mellitus diagnosed with a 2-h 75 gm oral glucose tolerance test and adverse pregnancy outcomes. Diabetes Care. 2001;24:1151–5.
26. Seshiah V, Balaji V, Balaji MS, et al. Gestational diabetes mellitus in India. J Assoc Physicians India. 2004;52:707–11.
27. Mohan V, Mahalakshmi MM, Bhavadharini B, 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 Dec;51(6):1007–13.
28. Yang X, Hsu-Hage B, Zhang H, et al. Gestational diabetes mellitus in women of single gravidity in Tianjin City, China. Diabetes Care. 2002;25:847–51.
29. Keshavarz M, Cheung NW, Babaee GR, et al. Gestational diabetes in Iran: incidence, risk factors and pregnancy outcomes. Diabetes Res Clin Pract. 2005;69:279–86.