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Original Research Article

A study on the prevalence of Gestational Diabetes Mellitus in rural and urban women of Bangalore, India

B. Poornima[1], Senigala K. Anusuya[*2], Sudha Patil[3] and Veerabhadra Goud GK[4]

[1,2,3]*Department Obstetrics & Gynaecology,* [4]*Department of Biochemistry, Akash Institute of Medical Sciences and Research Centre, Devanahalli, Bangalore, India*

QR Code

***Correspondence Info:**
Dr. Senigala K. Anusuya
Assistant Professor
Department of Obstetrics & Gynaecology
Akash Institute of Medical Sciences & Research Centre, Bangalore, India

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Abstract

Introduction: As India has become diabetic hub of the world, we made an attempt to know the prevalence of GDM at Akash Institute of Medical Sciences and Research Centre (AIMS & RC), Devanahalli, which is a tertiary care center in rural setup.

Materials and methods: 500 antenatal women were included in the study. 75gms OGTT was performed during 24- 28 weeks of pregnancy and results were interpreted according to ADA criteria. Socio demographic features and metabolic characteristics, family h/o DM, GDM hypertension was noted and statistically analyzed.

Results: The prevalence of GDM in our study was 8.5%. GDM was statistically significant in high income group, with high BMI and with presence of *acanthosis nigricans*.

Conclusion: Universal screening of all antenatal women is mandatory as prevalence of GDM is increasing in India. Awareness regarding diet like intake of millets, vegetables, fruits high protein diet and physical activity, yoga, exercise needs to be popularized among people through media, NGOs, educational institutions.

Keywords: Blood glucose, GDM, OGTT, Prevalence, HTN.

1. Introduction

Gestational diabetes mellitus is one of the most common metabolic complications of pregnancy and increasing day by day globally. GDM is defined as carbohydrate intolerance of varying degrees of severity with onset or first recognition during the pregnancy.[1] The fourth international workshop-conference on GDM for the first time suggested the strategy of blood glucose testing of all pregnant women than screening only the high risk group. Those considered high risk on the basis of past or family history should undergo initial blood glucose testing early in pregnancy. [2,3]

In contrast to a screening test, an OGTT which is a diagnostic test will usually provide a definitive answer to the presence or absence of diabetes. It was found that International work shop conference and the ADA, if had been applied, a few cases (4%) with GDM would have been missed [4-6].

The disease affects women at around 24th week of pregnancy and at the same time the disease does not show any noticeable symptoms. 32 million people are living with diabetes in India, and 3-16 percent of pregnant Indian women have gestational diabetes varying with the regions. The prevalence percentage of gestational diabetes mellitus (GDM) is increasing rapidly. According to a study published in the Journal of the Association of Physicians of India, [7] an overall prevalence of GDM in their study area is about 17% in Chennai, 15% in Trivandrum, 21% in Alwaye, 12% in Bangalore, 18.8% in Erode and 17.5% in Ludhiana. The study also indicated that Indian women have high prevalence of diabetes and their relative risk of developing GDM is 11.3 times compared to [white] women. Further, Asian women are ethnically more prone to develop glucose intolerance compared to other ethnic groups. It has also been seen that pregnant women in the age group of 30

to 39 years had greater prevalence of GDM as compared with those in the age group of 20 to 29 years. [8] The prevalence of gestational diabetes has been reported in different cities of India. [9]

In India it is difficult to predict any uniform prevalence levels because of wide differences in living conditions, socio-economic levels and dietary habits. The prevalence of GDM was found to be 3.8 per cent in Kashmiri women. [7,8] In a random survey performed in various cities in India in 2002-2003, an overall GDM prevalence of 16.55 per cent was observed. In another study done in Tamil Nadu, GDM was detected in 17.8 per cent women in urban, 13.8 per cent women in semi-urban and 9.9 per cent women in rural areas. [10,11] The data regarding prevalence of GDM and the number of women affected are important to allow for rational planning and allocation of resources and the preventive strategies that may be undertaken in future. Because widely different prevalence rates have been observed in studies in different regions of India, multiple regional studies in different subtypes of populations are needed for quantifying prevalence data as well as risk factors associated with it. Considering all these facts the present study was, therefore, undertaken to study the prevalence of GDM in women attending a tertiary care hospital in and around Devanahalli, Bangalore rural, India.

2. Materials and methods

This study was conducted at AIMS & RC, Devanahalli, between October 2014 and September 2016. 500 anetenatal women during 24- 28 weeks of pregnancy attending OBG Department, were included in this study after informed consent. Ethical committee approval was taken. Pregnant women with overt diabetes were excluded in this study. Information regarding socio demographic and metabolic features like age, height, weight, education, socioeconomic status, parity, clinical features like recording of blood pressure, presence of *acanthosis nigricans* was observed. Previous h/o GDM, hypertension, hypothyroidism was noted. Family h/o DM, GDM, HTN was also recorded. BMI was calculated according to pre pregnancy weight.

Procedure: Women recruited in the study were advised to take regular diet 3 days prior to the test and to take OGTT test after observing overnight fasting (8-12 hrs). After taking fasting blood sample, 75 gms of anhydrous glucose powder dissolved in 250 ml of water was given to the women to be consumed within 5 minutes. Blood sample was taken after 1hr and 2 hrs of consumption of glucose and plasma glucose levels were estimated by glucose oxidase and peroxidase method using vitros-350 dry chemistry autoanalyzer. Interpretation of recordings was done according to American diabetic association[12] (ADA) (2016) criteria which has cutoff values of 92 mg/dl on fasting state, 180 mg/dl at 1st hour, and 153 mg/dl at 2nd hour [7].

2.1 Statistical analysis

Statistical analysis was performed using Student's test for unpaired data as appropriate, the x^2 test or Fisher's exact test (SPSS/PC statistical program, version 13.01 for Windows). Risk factors of GDM, logistic regression analysis was done with a backward model. In this analysis, GDM was taken as the dependent variable. Associated risk factors for GDM were taken as independent variables. Results are shown as arithmetic mean ± standard deviation for quantitative data and percentage for qualitative data. Odds ratio (OR) (95% CI) in logistic regression analysis was used. Value of $p < 0.05$ was considered as significant.

3. Results

Results were statistically analyzed and GDM was diagnosed in 8.5% of antenatal women. Table 1 shows the clinical and metabolic characteristics of subjects with GDM and without GDM included in this study. The mean age, house hold income, gestation period, prepregnancy BMI, weight during pregnancy, weight gain during pregnancy and height were found to be higher in pregnant women with GDM than those without GDM.

Table 2 shows relationships of GDM with various associated risk factors. Prevalence of GDM increased with age (p 0.007), with the highest prevalence in the 25-29 year-old age group (4.2%). When prepregnancy BMI is considered, a positive relationship is observed between prepregnancy BMI and prevalence of GDM ($p < 0.0001$). The prevalence of GDM increased with prepregnancy BMI. Prevalence was highest in the BMI 25-29.9 kg/m^2 group. Gestational diabetes mellitus was more prevalent in women with greater weight gain ($p = 0.0001$), with a history of GDM in previous pregnancies ($p < 0.0001$).

In the x^2 test, no relationship could be found between prevalence of GDM and other risk factors (education, occupation, household income, height, number of pregnancies, parity, family history of GDM, and DBP). To establish the independence of these variables we performed a multivariate analysis using a multiple logistic regression model. In this analysis, GDM was significantly and independently associated with older age (maternal age: 30–34 years; OR = 5.093; $p < 0.01$), socioeconomic status of upper lower income (OR = 7,124, $p < 0.0051$), increasing prepregnancy BMI (BMI 25-29.9 kg/m^2, OR = 15.5252 $p < 0.0001$), weight gain of more than 7 kg during pregnancy (≥ 7 kg, OR = 2.285, $p < 0.002$), GDM history in previous pregnancies is also high (Table 3). These risk factors were independent clinical predictors of GDM. **(**Past history of GDM was the strongest independent predictor of GDM, followed by prepregnant BMI 25-29.9 kg/m2 and maternal age = 25-29 years.)

Table 1: Baseline Clinical characteristics of women with GDM and non-GDM

Parameter	Non GDM (n=457) Mean ± SD	GDM (n=43) Mean ± SD	p Value
Age group	22±2.2	26±3.2	<0.0001
Household income (Rs)	10,500±3,500	20,200±4010	<0.0001
Gestation in weeks	26±1.4	25.9±1.6	0.6586
Prepregnancy wt (kg)	55±6.2	65.3±8.2	<0.0001
Wt during pregnancy (kg)	62±5.0	72±10.2 kg	<0.0001
Wt gain during pregnancy (kg)	7.6±3.2	10±3.3	<0.0001
Prepregnancy BMI (kg/m^2)	22.2±2.6	27.4±3.5	<0.0001
Height (cm)	152±5.2cms	153±6.1	0.2358
Parity	0.9±0.8	1.0±1.0	0.4442
SBP (mm Hg)	110±10	128±14.4	<0.0001
DBP (mm Hg)	70±6.2	82.6±8.2	<0.001
Pulse rate (beats/min)	74±8.4	78±8.6	0.0030

Table 2: Prevalence of GDM in pregnant women in and around Devanahalli by age group, level of education, socioeconomic status, prepregnancy BMI, weight gain during pregnancy, height, parity, previous h/o medical conditions, previous h/o GDM, family h/o DM and GDM, SBP and DBP

Parameter	Non-GDM		GDM	
	n=457	%	n=43	%
Age group(yrs)	**(x2= 14.09, p <0.007)**			
15-19	50.0	10.0	3.0	0.6
20-24	234.0	46.8	11.0	2.2
25-29	145.0	29.0	27.0	4.2
30-34	26.0	5.2	00	0.0
≥35	2.0	0.4	2.0	0.2
Total	457.0		43.0	
Socioeconomic status	**(x2= 117.20, p <0.0001)**			
Upper class	9.0	1.8	16.0	3.2
Upper middle	99.0	19.8	15.0	3.0
Lower middle	164.0	32.8	11.0	2.2
Upper lower	182.0	36.4	1.0	0.2
Lower	3.0	0.6	0.0	0.0
Total	457.0		43.0	
Prepregnancy BMI (kg/m2)	**(x2= 119.17, p < 0.0001)**			
<18.5	165.0	33.0	1.0	0.2
18.5-24.9	249.0	49.8	13.0	2.6
25-29.9	43.0	8.6	27.0	5.4
≥30	0.0	0.0	2.0	0.4
Total	457.0		43.0	
Weight gain during pregnancy (kg)	**(x2= 33.28, p <0.0001)**			
<7	340.0	68.0	14.0	2.8
≥7	117.0	23.4	29.0	5.8
Total	457.0		43.0	
Height (cm)	**(x2= 1.34, p 0.51)**			
<150	42.0	8.4	6.0	1.2
150-160	391.0	78.2	34.0	6.8
>160	24.0	4.8	3.0	0.6
Total	457.0		43.0	
Parity	**(x2= 2.45, p 0.48)**			
0	195.0	39.0	14.0	2.8
1	189.0	37.8	23.0	4.6
2	51.0	10.2	4.0	0.8
≥3	22.0	4.4	2.0	0.4
Total	457.0		43.0	

Table 2 Continue……				
Previous h/o medical conditions	**(x2= 3.60, p< 0.16)**			
No	427.0	85.4	37.0	7.4
Hypertension	3.0	0.6	1.0	0.2
Hypothyroidism	27.0	5.4	5.0	1.0
Total	457.0		43.0	
Previous h/o GDM	**(x2= 32.75, p <0.0001)**			
No	456.0	91.2	39.0	7.8
Yes	1.0	0.2	4.0	0.8
Total	457.0		43.0	
Family h/o GDM	**(x2= 1.02, p 0.31)**			
No	415.0	83.0	37.0	7.4
Yes	42.0	8.4	6.0	1.2
Total	457.0		43.0	
Family h/o DM	**(x2= 6.01, p <0.01)**			
No	410.0	82.0	25.0	5.0
Yes	47.0	9.4	18.0	11.6
Total	457.0		43.0	
Family h/o HTN	**(x2= 2.92, p 0.08)**			
No	433.0	86.6	38.0	7.6
Yes	24.0	4.8	5.0	1.0
Total	457.0		43.0	
SBP (mm hg)	**(x2= 5.94, p <0.01)**			
≤139	450.0	90.0	40.0	8.0
≥140	7.0	1.4	3.0	0.6
Total	457.0		43.0	
DBP (mm hg)	**(x2= 3.60, p < 0.05)**			
≤89	452.0	90.4	41.0	8.2
≥90	5.0	1.0	2.0	0.4
Total	457.0		43.0	
Acanthosis nigricans	**(x2= 122.357, p <0.0001)**			
No	412.0	82.4	30.0	6.0
Yes	45.0	9.0	13.0	2.6
Total	457.0		43.0	

Table 3: Odds ratio of risk factors for GDM among 500 pregnant women in and around Devanahalli (logistic regression analysis)

Parameter	Odds ratio	95% Confidence interval	*P* value
Age group (years)			
15-19	1.5682	0.4694-5.3243	0.4647
20-24	2.0016	1.0133-3.9538	0.0457
25-29	0.5053	0.3015-0.8468	<0.0096
30-34	5.093	0.3018-84.1324	<0.01
≥35			
Socioeconomic status			
Upper class	0.1673	0.0698-0.4011	<0.0001
Upper middle	0.6210	0.3319-1.1622	0.1362
Lower middle	1.4028	0.7065-2.7853	0.3334
Upper lower	17.1247	2.3047-125.2876	0.0051
Lower	0.6656	0.0338-13.097	0.7888
Prepregnancy BMI (kg/m^2)			
<18.5	0.1499	2.1209-113.647	0.0069
18.5-24.9	1.8022	0.9510-3.4154	0.0709
25-29.9	15.5252	0.0844-0.2660	<0.0001
≥30	0.0190	0.0009-0.4025	0.0109
Wt gain during pregnancy (kg)			
<7	0.3796	1.2302-4.2445	0.0089
≥7	2.285	0.2273-0.6340	0.0002

Table 3 Continue……..			
Height (cm)			
<150	0.6586	0.2649-1.6375	0.3688
150-160	1.0821	0.6765-1.7307	0.7421
>160	0.7527	0.2178-2.6019	0.6535
Parity			
0	1.3106	0.7008-2.4509	0.3971
1	0.7732	0.4533-1.3188	0.3450
2	2.993	0.5645-10.1983	0.2358
>3	1.0350	0.3454-4.5510	0.9637
Previous h/o GDM			
No	0.0235	0.6998-1.7295	0.6792
Yes	1.1002	0.0026-0.2152	<0.0009
Family h/o GDM			
No	0.6586	0.6668-1.6704	0.8181
Yes	1.0554	0.2649-1.6375	0.3688
Family h/o DM			
No	0.2457	0.9260-2.5714	0.0959
Yes	1.5431	0.1313-0.4598	<0.0001
Family h/o HTN			
No	0.4516	0.6297-1.6912	0.7645
Yes	1.0722	0.1640-1.2437	0.1241
SBP (mm hg)			
≤139	1.0585	0.6751-1.6598	0.8042
≥140	0.2195	0.0548-0.8799	0.0323
DBP			
≤89	1.0373	0.6633-1.6222	0.8742
≥90	0.2352	0.0443-1.2488	0.0893
Acanthosis nigricans			
No	1.2922	0.7957-2.0985	0.3001
Yes	0.3257	0.1631-0.6506	<0.0015

4. Discussion

Regardless of the criteria used, it is clear that India has a very high prevalence of GDM by global standards. Conversion rates to frank Type 2 diabetes are also very high. Healthcare resources are insufficient especially in rural areas. There is inadequate awareness among public regarding GDM. This results in a large population being hesitant to access healthcare system for diseases with not so "obvious" implications like GDM. In our study, 8.5% of antenatal women were found to have GDM. Among the 8.5 % of GDM cases (43 cases), 39.53 % of them had high fasting values. Majority people (69.76 %) of them had high 1st hour plasma glucose levels. 53.48 % of them had 2 values abnormal.

In the present study, some risk factors associated with GDM (education level, occupation, household income, prepregnancy BMI, excessive weight gain in pregnancy, height, past history of GDM, past history of selected medical conditions, past history of GDM, and family history of diabetes mellitus type 2 and GDM) were investigated. Gestational diabetes mellitus prevalence worldwide varies from 1% to 14% of all pregnancies. [12, 14] The prevalence may be variable in different regions of a country. (15) High prevalence rates have been reported in studies from Australia (Indian-born 15%, Chinese 13.9%) and the United States (Zuni Indians 14.3%). [16] These differences may reflect the effects of dynamic interactions among genetic, demographic, sociocultural and economic factors. Statistical variations are partly due to differences in the screening methods and diagnostic criteria used. [15,16]

Many studies have reported that prepregnancy BMI and obesity are associated with a higher prevalence of GDM and independent risk factors of GDM. [17,18] Some studies showed a significant association between excessive weight gain in pregnancy (≥ 8 kg) and GDM. [19,20] Women with a previous (or past) history of GDM have increased risk of developing GDM in subsequent pregnancies. [21,22] Previous GDM is also one of the strongest predictors for GDM. [23,24] In our study, we observed that the prevalence of GDM was strongly correlated with past history of GDM.

Interventions during and immediately after pregnancy provide important opportunities to improve the lives of mothers and children today and reducing diabetes in future generations. Screening and appropriate management of diabetes during pregnancy provides a unique opportunity

to prevent Type 2 diabetes in two generations. Lack of awareness in society is one of the reasons that GDM is given low priority in public health delivery system in India. [9]

In India more than 70% of population live in rural settings and facilities for diagnosing diabetes itself is limited. A single blood glucose testing is advised 2 hours after consuming 75 grams of glucose irrespective of the previous meal which is more economical in less resourceful conditions. [7] Most importantly detection and care of GDM has become a public health priority as the still birth rate is high in India and one of the causes is gestational diabetes mellitus. [25] Hence, the need is for a simple and economical test to diagnose GDM.

In conclusion, in this prospective study of pregnant women following a universal screening test which firstly examines various risk factors, we found that GDM is a moderately common pregnancy complication in the city of Bangalore.

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