Original Article#

Prevalence of Gestational Diabetes Mellitus in South India (Tamil Nadu) – A Community Based Study

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Abstract

Aim : Women diagnosed to have Gestational Diabetes Mellitus (GDM) are at increased risk of developing diabetes in future. Thus, diagnosis of GDM is an important public health issue. In a random survey 16.2% of pregnant women were found to have GDM in the Chennai urban population. Hence we undertook a planned community based study to ascertain the prevalence of GDM.

Materials and Methods : We conducted a prospective screening for GDM in the urban, semi urban and rural areas. All pregnant women irrespective of gestational weeks underwent a 75g glucose challenge test in the fasting state. Diagnosis of GDM was made if the 2hr plasma glucose was ≥ 140mg/dl (WHO criteria).

Results : A total of 4151, 3960 and 3945 pregnant women were screened in urban, semi urban and rural areas, respectively. GDM was detected in 739(17.8%) women in urban, 548(13.8%) in semi urban and 392(9.9%) in rural areas. Out of 1679 GDM women, 1204(72%) were detected in first visit and the remaining 28% in subsequent visits. A significant increase (P< 0.0001) in the prevalence of GDM was observed with family history of diabetes, increased maternal age and BMI. A trend for increased prevalence of GDM was observed in women with less physical activity, however, not statistically significant. ©

Conclusion : In this community based study, the prevalence of GDM varied in the urban, semi urban and rural areas. Age ≥ 25 years, BMI ≥ 25 and family history of diabetes were found to be risk factors for GDM.

Abbreviations: Body mass index (BMI), Gestational Diabetes Mellitus (GDM), Glucose challenge test (GCT), Impaired Glucose Tolerance (IGT), Multi Purpose Health Workers (MPHW), Normal Glucose Tolerance (NGT), Oral Glucose Tolerance Test (OGTT), Village health nurses (VHN)

Introduction

The prevalence of diabetes is increasing globally and these numbers include women with GDM. GDM is considered as a transient abnormality of glucose intolerance during pregnancy.[1] Women with GDM are at increased risk of diabetes in future as are their children and the following subsequent generations.[2] This fact should alert the physicians about the necessity to devote special attention to this segment of population especially in developing countries.[3] A random survey was performed for the first time in 2002 to determine the prevalence of GDM in our country. Of the total number of pregnant women (n=3674) screened, 16.55% were found to have GDM.[4] In the Chennai urban population, the prevalence of GDM was 16.2%.[4] As this was a random survey, we initiated a community-based project to ascertain the prevalence of GDM in our population in 2005. This study was approved by the ethical committee of the institute and the ministry of health, Government of Tamil Nadu.

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Subjects, Materials And Methods

This study was performed in Chennai city (urban), Saidapet taluk (Semi urban) and Thiruvallur district (Rural). Cross-sectional field survey was conducted to find out the prevalence of GDM at the community level in urban, semi urban and rural areas in the State of Tamilnadu, South India.

Sample size determination

The published national prevalence of GDM was 16.55% based on the random survey performed.[4] The number of pregnant women in the total population at any time was ascertained to be 10%. Assuming that the prevalence of GDM in the community will be 10% and with the absolute precision of the estimate at 1%,

and 95% confidence interval, the sample size required for this study was 3342 in each area. By considering a dropout rate of about 10%, it was decided to screen 3600 pregnant women in the urban, semi urban and rural areas.

Sampling Frame and design for GDM Screening

Urban area : Chennai is the largest city in southern India and the fourth largest in India. Chennai Corporation is divided into 10 zones consisting of a total 110 health posts. The population in one health post is in the range of 30,000 - 51,000. Health aspects of each post are monitored by the Multi Purpose Health Workers (MPHW). A random sample of ten of these health posts was selected.

Semi urban: Saidapet taluk, a community health centre catering for the population of 3,60,000 bordering Chennai and Tiruvallur district was selected to obtain the prevalence of GDM in the semi-urban population.

Rural area: Thiruvallur district is one of the administrative districts in Tamilnadu consisting of 13 blocks, with each block containing a population ranging from 1,00,000 to 1,50,000. Three blocks having a total of 10 primary health centres were randomly selected for the study. The health aspects of the population in these centres are monitored by Village health nurses (VHN).

Methods adopted for screening

Consecutive antenatal women, attending the health centres, irrespective of gestational weeks were given a 75 g glucose load in the fasting state after obtaining their informed consent. Field officers collected their venous blood sample at 2 hrs in test tubes containing potassium oxalate and sodium chloride. The plasma glucose was estimated by the glucose oxidase peroxidase (GOD POD) method in the central laboratory using Hitachi auto-analyzer. The diagnosis of GDM was based on the 2hr 75g post glucose value ≥ 140mg/dl recommended by WHO.[5] If the woman was found to have Normal Glucose Tolerance (NGT) at the initial visit, she was advised to repeat the test around 24th week and if found normal, to test again around 32nd week.

Details of family history of diabetes, history of previous pregnancies were obtained. Blood pressure was recorded using mercury sphygmomanometer, which was calibrated periodically. The body mass index (BMI) of the subjects was calculated from the pre pregnancy weight and expressed in kg/m^2. We also elicited the activity status of these women. A woman was considered sedentary if she confines to her routine household work, whereas a woman if in addition, engages herself in occupation which requires physical exertion to reach her place of work and performs duty assigned to her was considered as active.

Statistical methods used:

To compare the mean values of the three groups, one way analysis of variance was used. To compare the proportion of GDM across the age groups, BMI, gravida, family history of diabetes mellitus and physical activity Chi-square test was employed. Univariate and multiple logistic regression analysis were performed to determine the association between the risk factors and the prevalence of GDM. Analysis was two-tailed and a P value < 0.05 was considered statistically significant. Statistical analysis was performed by using SPSS version 10 package.

Results

A total of 4151, 3960 and 3945 pregnant women in Chennai city (Urban), Saidapet (Semi urban) and Thiruvallur (Rural) in the state of Tamilnadu were screened during 2005 - 2007. The demographic details of the women screened in the three areas are given in Table 1.

In this survey, 1679 pregnant women were detected to have GDM. The prevalence of GDM in the urban, semi urban and rural area was 739 (17.8%), 548 (13.8%) and 392 (9.9%), respectively (Fig. 1). The prevalence of GDM was significantly lower in the rural area (P < 0.0001) compared to the other areas. GDM was diagnosed in 1204 (72%) pregnant women in the first visit and the remaining 475 (28%) in the subsequent visits. In this study among the GDM women from all the three areas,

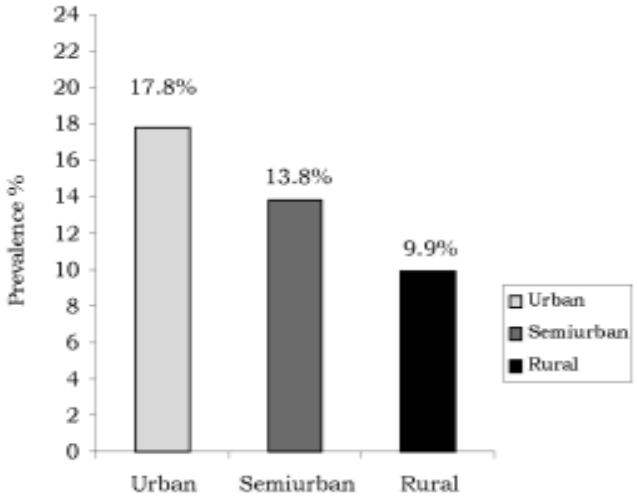

Fig. 1 : Prevalence of GDM by area

Table 1 : Characteristics of the women screened by areas

	Urban n= 4151	Semi urban n = 3960	Rural n = 3945	P value
Age (years)	23.7 ± 3.55	23.4 ± 3.30	22.5 ± 3.09	0.000
Gestational weeks	24.33 ± 7.50	27.47 ± 6.79	23.42 ± 6.49	0.000
BMI (kg/m^2)	21.9 ± 3.98	20.9 ± 3.92	20.8 ± 3.37	0.000

12.4% were detected within 16 weeks of gestation, 23% between 17 and 23 weeks and remaining 64.6 % more than 24 weeks of gestation.

The mean age of the pregnant women screened in the urban, semi urban and rural area was 23.7 ± 3.55 years, 23.4 ± 3.30 years and 22.5 ± 3.09 years, respectively. The distribution of women in the age group 20-24 years was relatively higher (66.4%) in rural areas ($P < 0.05$) compared to semi urban (60.3%) and urban areas (55.5%). The prevalence of GDM across the age group of women in urban area was ranging from 10.6% to 35.8%. Highest prevalence was observed in the age group of 30-34 years. In the case of semi urban area, the prevalence of GDM was ranging from 7.8% to 48.4% and the age-specific prevalence of GDM in 30-34 yrs was 35.7%. As regards to the rural area, the prevalence of GDM was ranging from 8.2% to 29.6% across the age groups. The pattern of significant increase ($P < 0.0001$) in prevalence of GDM as the age increases was observed in all the three areas. The prevalence of GDM by age groups is given in Fig. 2.

There was a consistent increase in the prevalence of GDM in all the three areas as BMI increased and the trend was statistically significant ($P < 0.0001$) (Fig. 3). Among the GDM women, the highest prevalence was observed in women with BMI ≥ 25 kg/m^2, and it was 28.4% in urban area, 23.8% in semi urban area and 16.1% in rural area. The prevalence of GDM was 7% more in women with BMI of ≥ 25 kg/m^2 as compared to women with BMI 23.0 – 24.9 kg/m^2 in urban and semi urban areas and this difference was 5% in rural area.

The prevalence of GDM in the physically inactive group was found to be 19.1%, 16.6% and 12.1%, whereas it was 17.6%, 12.8% and 9.7% in the physically active group in the urban, semi urban and rural areas, respectively. A trend for increased prevalence of GDM among women with less physical activity in all the three areas was observed, however, not statistically significant. Positive family history of diabetes mellitus was present in 25% of the GDM women in the urban, 19.2% in the semi urban and 14.1% in the rural area. There was a significant association ($P < 0.001$) between the family history of diabetes mellitus and the occurrence of GDM among pregnant women. The prevalence of GDM increases with increasing gravida (Fig. 4).

On univariate analysis, we observed in all the three areas, that age ≥ 25 yrs, BMI ≥ 25 kg/m^2 and family history of diabetes were significantly associated with the prevalence of GDM. On multiple logistic regression analysis taking into consideration all the three areas, family history of diabetes, age ≥ 25 yrs and BMI ≥ 25 kg/m^2 were found to have a significant independent association ($P < 0.001$) with GDM (Table 2).

Discussion

In this community based study, we preferred to perform universal screening as selective screening based on risk factors scored poorly in predicting GDM.[6,7] Universal screening for GDM detects more cases and improves maternal and offspring prognosis compared to selective screening.[8] The universal screening appears to be the most reliable and desired method for the detection of GDM,[6] particularly in those populations with high risk for GDM.[9,10] For universal screening, the test should be simple and cost effective. The two step procedure of screening with 50g Glucose challenge test (GCT) and then diagnosing GDM based on Oral Glucose Tolerance Test (OGTT) is not feasible in a country like India, because the pregnant women may have to visit the antenatal clinic twice and at least

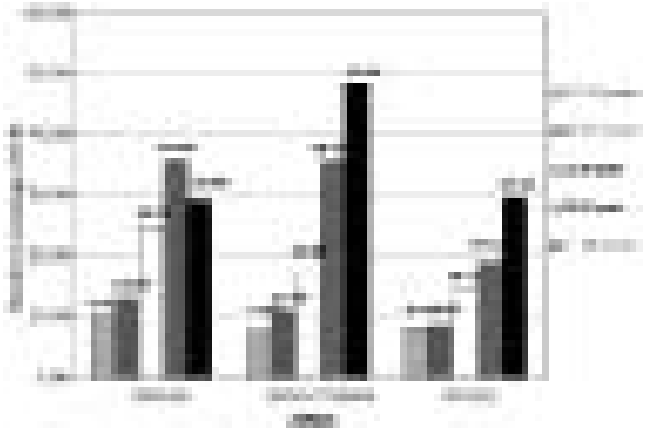

Fig. 2

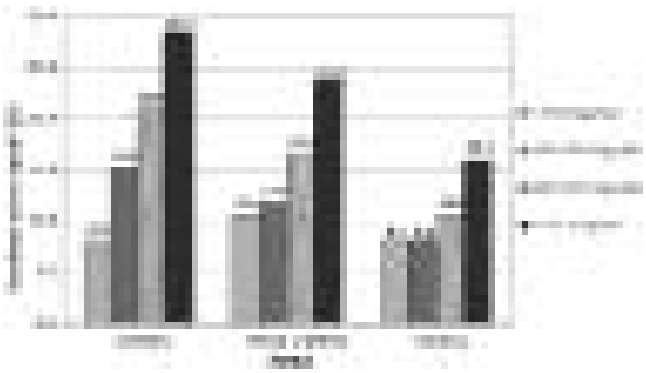

Fig. 3

Fig. 4

Table 2 : Adjusted odds ratio (OR) with 95% confidence intervals for GDM with risk factors – age, BMI and family history of diabetes

	Number with the Condition	Odds Ratio	95% CI for OR		P value
			Lower	Upper	
Age ≥ 25 yrs	794 (47.3%)	2.10	1.87	2.37	< 0.001
BMI ≥ 25 kg/m^2	359 (21.4%)	1.88	1.63	2.16	< 0.001
Family History of Diabetes	543 (32.3%)	1.58	1.39	1.79	< 0.001

3 - 5 blood samples have to be drawn, which they resent and moreover 'no show' rate is high.[4,11,12] WHO recommendation serves both as one step screening and diagnostic procedure, easy to perform besides being economical[13] and thus minimizes non responder bias in the prevalence estimate. WHO criteria of 2 hr PG ≥ 140 mg/dl identifying a large number of cases may have a greater potential for prevention.[14,15]

The current recommendation is to perform screening test between 24 and 28 weeks of gestation, though there are reports that claim about 40% - 66% of women with GDM can be detected early during pregnancy.[16,17] The ideal period to screen for GDM is around 16 weeks of gestation and even earlier in high-risk groups with a history of fetal wastage.[18] GDM diagnosis may not be missed by screening around 24 -28 weeks of gestation, but a substantial number of pregnant women who develop GDM in the earlier weeks of pregnancy are likely to have delayed diagnosis and may not receive appropriate medical care. Further, early screening for glucose intolerance and care could avoid some diabetes related complications in women with gestational diabetes and their newborns.[19] Based on these observations, we initiated the screening procedure for GDM in antenatal women irrespective of gestational weeks. Among the GDM women detected in this study, 35.4% were < 24 weeks of gestation and this includes 12.4% of GDM women <16 weeks of gestation. Women detected to have GDM in the early weeks of pregnancy may be true GDM or undiagnosed pre existing diabetes detected during screening.[20] A1c is likely to distinguish these two conditions,[21] but this study being community based, it was not economically feasible to perform the test. Another observation of this study was that women who had normal glucose tolerance in the first visit, developed GDM in subsequent visits. Hence repeat screening becomes essential. Out of 1679 GDM women, 1204(72%) were detected in first visit and the remaining 28% in subsequent visits.

In this study, we screened 4151, 3960 and 3945 pregnant women (2005 – 2007) in the urban, semi-urban and rural areas respectively. The prevalence of GDM was 17.8% in the urban, 13.8% in semi urban and 9.9% in rural areas. The prevalence of GDM varies from one region to another in the same country [22-24]. We also observed in our earlier study, wherein, the prevalence varied from 12 to 21% in different parts of the country.[4] GDM has been found to be more prevalent in women living in the urban area than in rural area.[25] The low prevalence in the rural area may be due to the less mechanized, agriculture-based lifestyle adopted by these people whereas the factors contributing to high prevalence in the urban area could be increased maternal age, obesity and sedentary lifestyle.

Established risk factors for GDM are advanced maternal age, obesity and family history of diabetes [26]. The increase in the prevalence of GDM in our study could be attributed to increased BMI, as high maternal weight is associated with a substantially higher risk of GDM.[27] In our study, the data from all the three areas showed that 16% of women had a BMI ≥ 25 kg/m^2 which confirm that increased BMI is a risk factor for GDM. Similar to the finding of Dempsey *et al*, we also observed increased prevalence of GDM in less active women.[28] Jang *et al* found that the GDM women were older, had higher pre pregnancy weight, higher BMI, higher parities and higher frequencies of known diabetes in the family.[29] In our study population all these risk factors were observed. Of all the independent risk factors for GDM, BMI emerged as a modifiable risk factor.

In conclusion, this study documents the varied prevalence of GDM in the urban, semi urban and rural areas of the community. GDM was detected in all trimesters of pregnancy. We also observed BMI as a risk factor for GDM which is modifiable. GDM women have high risk of developing diabetes in the future. They are the ideal group to be targeted for lifestyle modification or pharmacologic intervention in order to delay or postpone the onset of overt diabetes. Hence an important public health priority in the prevention of diabetes is to address maternal health both during ante and post partum period. We suggest more studies from the rest of the country.

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