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Alarming Frequency of Gestational Diabetes Mellitus (GDM) Attending a Tertiary Care Hospital in Bangladesh

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Abstract:

Objective: *The study was aimed to observe the frequency of GDM among pregnant mothers attending at antenatal clinic of Bangabandhu Sheikh Mujib Medical University (BSMMU).*

Methods: *This cross-sectional study screened 385 pregnant subjects irrespective of gestational age and risk factors for GDM (age: 26.4±4.9 yrs, BMI: 25.3±4.3 kg/m2; mean ± SD) by 75g oral glucose tolerance test (OGTT) following WHO 1999 criterion. Subjects having normal glucose tolerance (NGT) before 24 weeks, were asked for repeat test during 24 to 28 weeks. 49 subjects out of 94 with NGT before 24 weeks of gestation repeated 75g OGTT while 31 did not respond and 14 were not mature for repeat test at endpoint. Glucose was measured by glucose-oxidase method on the same day of sampling. All data were processed by utilizing SPSS program (Version 22.0) and expressed as frequencies or percentages as well as mean (±SD/SEM) as applicable.*

Results: *Frequency for GDM was 36.6% (141/385) by WHO 1999 criterion and it reached to 40.3% (155/385) when repeat test results for those who were NGT before 24 weeks were included. GDM and NGT showed significant difference for age (28.0±4.9 vs. 24.9±4.5 yrs, p<0.001), BMI (26.5±4.2 vs. 24.3±4.0 kg/m2, pÂ0.001), family history of DM (56.1% vs. 37.9%, p<0.001) and number of gravida (p=0.027). There was no statistically significant difference for GDM among trimesters [1st vs. 2nd vs. 3rd trimester: 40.9% (27/66) vs. 44.9% (75/167) vs. 48.7% (74/152); 2=1.198, p=0.549]. GDM frequency increased to 41.6% (160/385), 43.4% (167/385) and 52.2% (201/385) when the cut-off value of FPG was considered at 6.1 mmol/L, 5.6 mmol/L and 5.1 mmol/L respectively while 02HPG ≥ 7.8 mmol/L (as WHO 1999 criterion). Multiple regression showed age (p<0.001), family history of diabetes (p=0.048) and BMI (p=0.007) as independent predictors for GDM.*

Conclusion: *It is concluded that frequency of GDM in our society is quite high and alarming. Observed increased efficiency with low set cut-off for FPG needs further studies in light of pregnancy outcome. Screening should be done as early as possible irrespective of trimester and weeks of gestation.*

Key words: *GDM screening; WHO 1999 criterion*

Introduction

Screening for gestational diabetes mellitus (GDM) in pregnancy is important as it is associated with adverse fetal and maternal outcomes and because these women and their children are at risk of developing diabetes mellitus (DM) in future.[1-3] A number of clinical risk factors have been demonstrated to be associated with increased likelihood of GDM, including age, ethnicity, obesity, family history of diabetes and past obstetric history.[3] Among the risk factors identified in the literature, ethnicity appears to be the most significant one.[1] The trend toward older maternal age, the epidemic of obesity and diabetes, the decrease in physical activity and the adoption of modern lifestyle in developing countries may all contribute to an increase in prevalence of GDM.[4] As Bangladeshis belong to high risk group, screening and diagnosis of GDM is important in this context. Moreover recent data show that GDM prevalence has increased by ~10-100% in several race/ethnicity groups during the past 20 years.[4] The prevalence of GDM varies from 9.3 to 25.5% according to Hyperglycemia and Adverse Pregnancy Outcomes (HAPO) study.[5]

In Bangladesh a cross-sectional study done in rural population showed prevalence rate of 13.2%.[6] Similarly, a pilot study encompassing about 100 pregnant mothers revealed a prevalence of 7.8%.[7] In another study the overall prevalence of GDM was 6.8% and 8.2% according to fasting plasma glucose (FPG) and 2 hour after 75 plasma glucose (2HPG) which is comparable with any other population with higher prevalence of GDM.[8] Majority of women with GDM remain asymptomatic and only a small percentage displays complications or features suggestive of GDM. Furthermore, these features tend to be late signs of the effect of GDM and subsequent treatment may not be effective in time to prevent or reduce the occurrence of complications.[1] On the basis of several studies it is assumed that identifying and managing women with GDM improve perinatal outcome.[9] In 2011, a guideline for screening in Bangladesh has proposed that 24 to 28 weeks of gestation is optimum for screening; but in high risk group, screening should be done at first prenatal visit. For this purpose this guideline advocates to follow either WHO 1999 criteria of OGTT or 2-step procedure of 50g challenge test followed by full OGTT for confirmation.[10] In the context of increasing prevalence of GDM, present study was aimed to observe frequency of GDM among pregnant mothers attending antenatal clinic of BSMMU, a tertiary level hospital in Dhaka Bangladesh.

Methods

Study Subjects

The present study comprised of 385 pregnant subjects (age: 26.4±4.9 yrs, BMI: 25.3±4.3 kg/m^2; mean ± SD) who were recruited from antenatal clinic of BSMMU irrespective of week of gestation and presence of risk factors. Women with prior history of diabetes mellitus (DM) or GDM were excluded from the study. Characteristics of study subjects are shown in table-I.

Table-I | Clinical characteristics of studied subjects

Variables	All subjects	GDM	NGT	p
n	385	141	244	
Age (mean ± SD, yr)	26.4 ± 4.9	28.0 ± 4.9	24.9 ± 4.5	<0.001
BMI (mean ± SD, kg/m^2)	25.3 ± 4.3	26.5 ± 4.2	24.3 ± 4.0	<0.001
Family history of DM	185 (48.1)	106 (56.1)	69 (37.9)	<0.001
Gravida: Primigravida	181 (47.0)	78 (41.3)	96 (52.7)	0.027
Multigravida	204 (53.0)	111 (58.7)	86 (47.3)	

(Within parenthesis are percentages over column total)
BMI: body mass index;
GDM: gestational diabetes mellitus;
NGT: normal glucose tolerance

Study design

It was a cross-sectional study carried out at GDM clinic, Department of Endocrinology, BSMMU from December 2011 to June, 2013. 385 pregnant women were recruited from the antenatal clinic of BSMMU at various weeks of gestation after matching inclusion and exclusion criteria. On the morning of OGTT, written consent was taken from each subject after discussing study procedure. Then 75 g two-hour OGTT was done fulfilling WHO 1999 criteria. Clinical evaluation including estimation of height, weight, BMI (kg/m^2) and BP (mmHg) were measured by calibrated instruments. Prior to commencement of this study the research protocol was approved by Institutional review board (IRB).

WHO 1999 recommended 75 g OGTT criteria for GDM:	
Time point of OGTT	Glucose values (mmol/L)
0 hour	≥ 7.0
02 hour	≥ 7.8
OGTT-oral glucose tolerance test (Satisfying both or any of these values)	

Analytic methods

The samples were assayed on the same day by glucose-oxidase method in automated analyzer (Dade Behring, Germany). The result was deducted from computerized calculation utilizing standard curve derived from known concentrations used by the system. Samples of different subjects were run on different days in different assay runs (149 runs). A fixed known concentration for low level (5.21 mmol/l) as well as high level (16.1 mmol/l) was used in every assay run. Inter-assay Co-efficient variance (CV) for low level was 5.36%, and for high level were 5.59%.

Statistical analysis

All data were processed by utilizing SPSS program (Version 22.0) and expressed as frequencies or percentages as well as mean (±SD/SEM) as applicable. Chi Square test was applied to see the differences of frequencies among various trimesters, age groups etc. Multiple regression analysis was done to see the impact of risk factors over detection of GDM. P values equal to or <0.05 were considered significant statistically.

Results

Frequency of GDM by WHO 1999 criterion was 36.6% (141/385)which was 40.3% (155/385) when results of repeat tests were included. As shown in table-II, 94 mothers were found to have normal glucose tolerance (NGT); however, 49 responded to repeat test, 31 did not respond and 14 were due for the test at end point of study.

Table-II | Status of repeat test at/after 24 weeks in subjects who had NGT before 24 weeks of gestation (n=49)

Status at/after 24 weeks (repeat test)	Status before 24 week		Total
	GDM	NGT	
GDM	—	14 (28.6)	**14**
NGT	—	35 (71.4)	**35**
Total	—	**49**	**49**
(Within parenthesis are percentages over grand total)			
• Mothers NGT before 24 weeks and advised for repeat OGTT			**94**
• Mothers done repeat 75g OGTT at 24 wks onwards			49
• Mothers asked but not attending for repeat test at/after 24 week			31
• Not yet due for repeat test at end point of study			14
OGTT: oral glucose tolerance test; GDM: gestational diabetes mellitus; NGT: normal glucose tolerance			

GDM and NGT showed significant difference for age (28.0±4.9 vs. 24.9±4.5 yrs, p<0.001), BMI (26.5±4.2 vs. 24.3±4.0 kg/m^2, p<0.001), family history of DM (56.1% vs. 37.9%, p<0.001) and number of gravida (p=0.027). There was no statistically significant difference for GDM among trimesters [1st vs. 2nd vs. 3rd trimester: 40.9% (27/66) vs. 44.9% (75/167) vs. 48.7% (74/152); χ^2=1.198, p=0.549; Fig-1]. GDM frequency increased to 41.6% (160/385), 43.4% (167/385) and 52.2% (201/385) when the cut-off value of FPG was considered at 6.1 mmol/L, 5.6 mmol/L and 5.1 mmol/L respectively holding 02h PG value ≥ 7.8 mmol/L (as 1999 WHO criterion; Fig-2). Frequency of GDM increased significantly with increment of age (χ^2=36.083, p<0.0001; Fig-3) and significantly

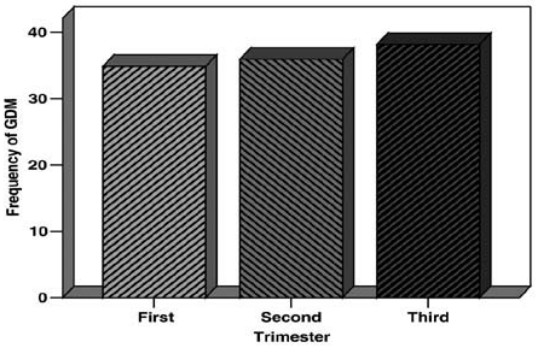

Figure 1 | Frequency of GDM in various trimesters

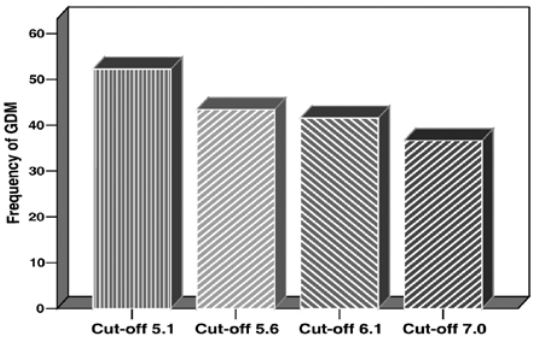

Figure 2 | Frequency (%) of GDM by WHO 1999 criterion under various cut-offs for FPG

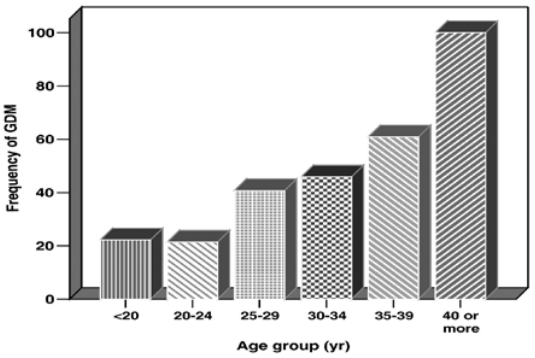

Figure 3 | Frequency (%) of GDM among various age groups

higher in subjects having age ≥ 25 years than those with <25 years (61.7% vs. 31.3%; χ^2=31.274, p<0.0001; Fig-4). Multiple regression showed age (p<0.001), family history of diabetes (p=0.048) and BMI (p=0.007) as independent predictors for GDM (table-III).

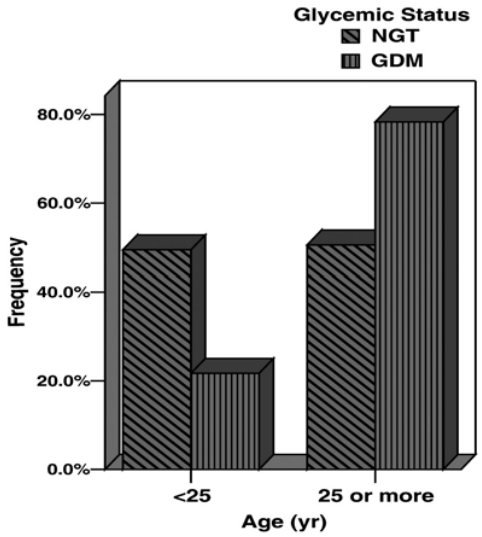

Figure 4 | Frequency (%) of GDM in age groups on cut-off at 25 yrs

Table-III | Multiple regression analysis for GDM

Variables	B	SE	p
Constant	- 0.628	0.173	<0.0001
Age	0.025	0.006	<0.0001
Family history of DM	0.101	0.051	0.048
Gravida	- 0.005	0.022	0.828
BMI	0.017	0.006	0.007

GDM: gestational diabetes mellitus;
BMI: body mass index

Discussion

Our study clearly observed that the frequency of GDM on the basis of WHO1999 criterion was alarmingly high (36.6%). It was obviously higher when repeat tests were included (40.3%).Frequency of GDM could be increased further by lowering FPG of WHO 1999 criterion at different levels. There was no significant difference in frequency of GDM in different trimesters. However, increasing age, family history of diabetes and increased BMI were independent predictors for GDM.

GDM provokes scientific and medico-social interest because of the high risk of maternal, fetal and neonatal complications[11]. The recent reported prevalence of GDM ranges from 9 to 25%[5]. But a cross-sectional study carried out in rural population of Bangladesh following WHO criteria revealed lower prevalence rate of 13.2%[6]. This dissimilarity of frequency of GDM might be attributable to decreased physical activity, increased maternal age and obesity in urban population that are applicable to our study subjects. This high frequency of GDM can be explained by the fact that Asian and South Asian ethnicity are both independently associated with increased insulin resistance.[12] Asians constitute such a high risk category that they should undergo universal screening irrespective of presence of other risk factors.[1] Moreover, a recent study on GDM prevalence reported that the prevalence of diagnosis of GDM increased by ~ 46% and increments were observed in all race/ethnicity.[4] Jenum et al. (2012) studied the impact of ethnicity on prevalence of GDM and found prevalence rate of 13 to 31.5% where the prevalence rate was more in Asians than Western European and Eastern middle East patients.[13]

It is important to note that there was no statistically significant trimester specific variation of frequency of GDM observed in this study. About 41% mothers among 66 who were tested at or before 12 weeks of gestation were detected as GDM. However, it is worth mentioning that it was not possible to discriminate whether their abnormal glycemic status antedated pregnancy. Measurement of HbA1c could help in this context. It will be incomplete without mentioning that in September, 2013 WHO has updated their criteria where GDM and undiagnosed DM in pregnancy is discriminated by cut-offs of glucose value.[14] In multiple regression analysis it was found that higher age, increased BMI and history of diabetes in first degree relatives were independent predictors for GDM. This is evident in many other studies.[2,12,15]

This alarming frequency of GDM certainly increases the number of cases and invite additional burden in our resource poor country. This will be cost-effective only when GDM diagnosis provides an opportunity for early and intensive intervention and prevention of future diabetes.

Conclusions

In conclusion, the frequency of GDM observed in our population is quite high. Screening for GDM should be done as early as possible irrespective of weeks of gestation or trimester of pregnancy and if negative before 24 weeks of gestation, should be repeated at or after 24 weeks. Ages of mother, increased BMI, family history of diabetes as well as multi-gravida are equally important as predictors for GDM during pregnancy. Observed increased efficiency with low set cut-off for FPG needs further studies in light of pregnancy outcome. Screening should be done as early as possible irrespective of trimester and weeks of gestation.

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"It is the mark of an educated mind to be able to entertain a thought without accepting it"

— Aristotle