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Association of risk factors in gestational diabetes mellitus among pregnant mothers attending at a tertiary care hospital in Bangladesh

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Abstract:

Objective: To observe association of risk factors with gestational diabetes mellitus (GDM) in a tertiary care hospital of Bangladesh.

Materials and methods: Risk factors of GDM were evaluated in pregnant subjects (n=385; age: 26.4±4.9 yrs; body mass index, BMI: 25.3±4.3 kg/m^2; mean ± SD) screened by 75 gram oral glucose tolerance test (OGTT) following WHO 1999 criterion irrespective of gestational age in the Department of Endocrinology, Bangabandhu Sheikh Mujib Medical University (BSMMU). BMI, maternal age, parity, trimester and family history of diabetes were considered as risk factors. Plasma glucose was measured by glucose-oxidase method on the same day.

Results: GDM and normal glucose tolerance (NGT) showed significant difference for age (28.2±4.9 vs. 25.3±4.6 yrs, p<0.001), BMI (26.7±4.4 vs. 24.4±3.9 kg/m^2, p<0.001), family history of DM (55.5% vs. 43.0%, p=0.017) and number of gravida (p=0.048). There was no significant difference of frequencies of GDM among various trimesters (39.4% vs. 42.5% vs. 38.2%; $\chi 2$=0.653, p=0.721). OGTT performed before 24 weeks revealed GDM in about 44% (88/202). Multiple regression revealed age (p<0.001), BMI (p=0.007) and family history of DM (p=0.048) as independent predictors for GDM.

Conclusion: It is concluded that age of mother, increased BMI, family history of diabetes as well as multigravidae are important predictors for GDM.

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Running title: Risk factors in GDM in Bangladesh

Key words: GDM, BMI, maternal age, parity, trimester, family history DM.

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Introduction:

For many years gestational diabetes mellitus (GDM) has been defined as any degree of glucose intolerance with onset or first recognition during pregnancy. It was first described about a half century ago [1]. It does not exclude the possibility that unrecognized glucose intolerance may have antedated or begun concomitantly with the pregnancy. It is important to screen for GDM in pregnancy 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 [2,3,4]. According to American Diabetes Association (ADA), women found to have diabetes at initial prenatal visit within 12 weeks of pregnancy should receive a diagnosis of overt diabetes not GDM [5]. Female who have inherited genetic predisposition to type-2 DM, would be at higher risk of developing GDM during pregnancy [6]. Specific risk factors and their degree of influence on GDM prevalence are difficult to quantify across populations. However, 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 [4]. Among the risk factors identified in the literature, ethnicity appears to be the most significant one [2]. 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 [7]. This study was aimed to find out risk factors associated with development of GDM at different trimesters of pregnancy.

Materials and methods:

Study subjects:

This study screened 385 pregnant subjects for GDM (age: 26.4±4.9 yrs, BMI: 25.3±4.3 kg/m^2; mean ±

Table-I: Characteristics of participants

Characters/variables	All subjects	GDM	NGT	p
n	385	155 (40.3)	230 (59.7)	
Age (mean ± SD, yr)	26.4±4.9	28.2±4.9	25.3±4.6	<0.001
BMI (mean ± SD, kg/m^2)	25.3±4.3	26.7±4.4	24.4±3.9	<0.001
Systolic BP (mean±SD,mmHg)	100±12	104±12	98±11	<0.001
Diastolic BP (mean±SD,mmHg)	65±8	67±8	64±8	<0.001
Family history of DM	185 (48.1))	86 (55.5)	99 (43.0)	0.017
History of abortion	129 (33.5))	59 (38.1)	70 (30.4)	0.125
Gravida:				
Primigravida	181 (47.0)	63 (40.6)	118(51.3)	0.048
Multigravida	204 (53.0)	92(59.4)	112(48.7)	
Occupation:				
Service / others	146 (37.9)	60 (38.7)	86 (37.4)	0.831
Housewife	239 (62.1)	95 (61.3)	144 (62.6)	

(Within parenthesis are percentages over column total) (Significance values stand for comparison between GDM and NGT)
14 patients who were negative before 24 weeks were due for repeat test at end point but considered as NGT on basis of initial 75g OGTT results
BMI: body mass index; GDM: gestational diabetes mellitus; NGT: normal glucose tolerance

Table-II: Frequency of GDM among various age groups

AGE group	GDM	NGT	Total	χ2, p
<20	6 (22.2)	21 (77.8)	**27**	
20-24	26 (23.2)	86 (76.8)	**112**	χ2=32.855,
25-29	63(46.7)	72 (53.3)	**135**	p<0.0001
30-34	42 (49.4)	43 (50.6)	**85**	
35-39	15(65.2)	8 (34.3)	**23**	
>40	3 (100)	0	**3**	
Total	**155 (40.3)**	**230 (59.7)**	**385**	

(Within parenthesis are percentages over row total)
14 patients who were negative before 24 weeks were due for repeat test at end point but considered as NGT on basis of initial 75g OGTT results
OGTT: oral glucose tolerance test; GDM: gestational diabetes mellitus;
NGT: normal glusose tolerance

Table-III: Frequency of GDM in various trimesters detected by initial OGTT

Trimester	GDM	NGT	Total	χ2, p
1st	26 (39.4)	40 (60.6)	**66**	
2nd	71 (42.5)	96 (57.5)	**167**	χ2=0.653,
3rd	58 (38.2)	94 (61.8)	**152**	p=0.721
Total	**155 (40.3)**	**230 (59.7)**	**385**	

(Within parenthesis are percentages over row total)
OGTT: oral glucose tolerance test; GDM: gestational diabetes mellitus;
NGT: normal glucose tolerance
04 mothers having done OGTT in 1st trimester were found Diabetes in Pregnancy according to ADA criteria

Table-IV: Frequency of GDM before and at/after 24 weeks of gestation

Week of gestation	Glycemic Status		Total	χ2, p
	GDM	NGT		
Before 24 weeks	88 (43.6)	114(56.4)	**202**	χ2=1.930, p=0.177
At or after 24 weeks	67(36.6)	116(63.4)	**183**	
Total (Combined)	**155(40.3)**	**230(59.7)**	**385**	

(Within parenthesis are percentages over row total)

14 patients who were negative before 24 weeks were due for repeat test at end point but considered as NGT on basis of initial 75g OGTT results

OGTT: oral glucose tolerance test; GDM: gestational diabetes mellitus; NGT: normal glucose tolerance

Table-V: 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

SD) by 02 sample 75g OGTT (WHO 1999 criteria). They were recruited from 'Antenatal Clinic' of BSMMU irrespective of trimester. Women with prior history of GDM or DM were excluded from the study. Informed written consent was taken from each participant. The protocol was duly approved by Institutional Review Board before running.

Study design:

It was a cross-sectional study carried out during December, 2011 to June, 2013. All the mothers were screened for GDM by 75 g oral glucose tolerance test (OGTT) irrespective of their gestational weeks. Data on demographic characteristics, parity, gravida, family history of diabetes, past history of GDM and DM etc. were recorded. Clinical evaluation including estimation of height, weight, BMI (kg/m^2) and BP (mmHg) were measured by calibrated instruments. If OGTT was found normal (NGT, n=94) before 24th week of pregnancy, the mother was advised for repeat test between 24 to 28 weeks of gestation.

***Analytic method*:**

Plasma glucose was assayed by glucose-oxidase method on the same day in automated analyzer (RA-50 analyzer (Dade Behring, Germany). 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 was 5.59%.

Statistical analysis:

All data were expressed as frequencies or mean (±SD/SEM). Risk factors were compared between GDM and NGT by Chi Square or Student's t-test as applicable. Within and between group Chi Square test was also applied to see the differences of frequencies among various trimesters and age groups. P values ≤ 0.05 were considered significant statistically.

Result:

On initial screening frequency of GDM by 75g WHO 1999 criteria was 36.6% (141/385). As shown in Table-I, frequency increased to 40.3% (155/385) when repeat test result was included. GDM and NGT showed significant difference for age (28.2±4.9 vs. 25.3±4.6 yrs, p<0.001), BMI (26.7±4.4 vs. 24.4±3.9 kg/m^2, p<0.001), family history of DM (55.5% vs. 43.0%, p=0.017) and number of gravida (p=0.048) unlike occupation which was similar (p=0.831). Table-II displays the mean (±SD) of age and BMI (±SD) of GDM and NGT subjects. As depicted in Table-II, frequency of GDM increased significantly with increment of age ($\chi 2$=32.855, p<0.001). Frequencies of GDM was 39.4% (26/66) in first trimester which were 42.5% (71/167) and 38.2% (58/152) in second and third trimester respectively ($\chi 2$=0.653, p=0.721; Table-III). About 44% (88/202) were found GDM who attended OGTT before 24 weeks in comparison to 36.6% (67/183) attending OGTT after 24 weeks ($\chi 2$=1.930, p=0.177) which is not significant statistically (Table-IV). Multiple regression analysis revealed that age (p<0.001), BMI (p=0.007) and family history of DM (p=0.048) were independent predictors for GDM (Table-v).

Discussion:

The present study observed an alarmingly high frequency (40.3%) of GDM. Increasing age, family history of diabetes and increased BMI as well as multigravidae were important predictors for GDM. There was no difference in frequency of GDM either among different trimesters or between the frequency observed before and after 24 weeks of gestation. It is well known that the factors that have been postulated to influence the risk of GDM include advancing maternal age (≥25 yrs), strong family history of diabetes, obesity, past history of abortion, multiparity etc. 3,6. Variation in the prevalence of GDM in different age group was obvious in this study. It was revealed that in the youngest age group of <20 years, 22% of participated subject was diagnosed as GDM while in the eldest age group of 40 years, it was 100%. Similar findings were observed in another comparative study in India where it was found that the prevalence of GDM increased with age from 18.5% in the age <20 yrs to 26% in the 40 yrs age group [4]. However, it should be mentioned that number of subjects in the elderly group in our study was very small showing a very high frequency. The present study also found significant differences in family history of DM and BMI between GDM and NGT groups. In agreement with this, other studies showed that prevalence of GDM was more among subjects with family history of DM compared to subjects without family history of DM [4,6,8]. In exploring body weight, Jali et al. found that the prevalence of GDM was highest

(46.3%) among women who were obese before conception and followed by 19.8% in women who were overweight before conception compared to women with ideal BMI (5.8%) [8]. It is to mention that preconception BMI could not be documented in this study. Past history of abortion and number of gravida have an impact over prevalence of GDM [6]. In current study, gravidity was significantly associated with occurrence of GDM similar to other study conducted in India where prevalence increased with gravidity from 18% in primigravida to 20% in multitigravidae [3]. However, past history of abortion was not statistically significant in this study unlike other studies which showed significant association between past history of abortion and prevalence of GDM [6].

One important finding about the prevalence of GDM is that there was no statistically significant trimester specific variation of frequency of GDM observed in this study. About 39% 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. But, HbA1C was not measured in this study. In a resource poor country like Bangladesh most of the pregnant mothers do not have their glycemic status checked before pregnancy. Therefore, we could not confidently rule out overt diabetes if some of GDM mothers developed glucose intolerance prior 12 weeks. However, 04 mothers having done OGTT in 1st trimester were found to have Diabetes in Pregnancy according to ADA criteria [5]. Considering 24th week as cut-off point about 43.6% of subjects were found to have GDM before 24 weeks compared to 36.6% who did OGTT at or after 24 weeks. It is worth mentioning that 14 subjects that belonged to NGT group before 24 weeks of pregnancy were added to the group of GDM by retesting after 24 weeks. Therefore, it can be assumed that about 43.6% GDM subjects would have not been diagnosed as GDM until 24 weeks if they would follow the conventional recommendation for performing the test of OGTT at or after 24 weeks of gestation. Apropos with this, in another study it was found that 40% of women with GDM could be detected in the early weeks of pregnancy [9]. It is already an established practice and appreciable that women with high risk factor for development of GDM should be screened at first prenatal visit with OGTT and for risk stratification ethnicity is most important and the Asians constitute very high risk ethnicity [2]. However, some authorities still continue to recommend that 24 to 28 weeks of gestation is optimum for screening high risk group [4]. Thus, it is pertinent to assume that the frequency of GDM is a bit high in our population and the risk factors are similar to many aspects with others. But, taking into account the findings of present study, concept of testing for GDM screening after 24 weeks of gestation could not be agreed; rather the findings emphasized need for early screening.

Conclusion:

In conclusion, 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. Age of mother, increased BMI, family history of diabetes as well as multigravidae are equally important as predictors for GDM during pregnancy.

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Conflict of interest:

There is nothing to disclose by authors for conflict of interest.

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