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Different risk factors associated with gestational diabetes

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Abstract
Gestational diabetes mellitus (GDM) is the most common antenatal complication. It has its association with adverse maternal and fetal outcomes. This study is a critical review of literature concerning with different risk factors of GDM. In the last section of the study discussion is made for further research point of view.

Keywords: Diabetes mellitus, Gestational diabetes mellitus, Risk factors of gestational diabetes mellitus

1. Introduction

Diabetes mellitus (DM) is an important public health problem which complicates 1-20% of all pregnancies worldwide [1, 2]. The prevalence of DM, which also includes GDM, in India is around 40.9 million in 2006 and it is expected to rise to 69.9 million by the year 2025 [2].

GDM is defined as glucose intolerance of varying degree with onset or first recognition during pregnancy [3, 4].The prevalence of GDM Mellitus in Indian women has increased to eleven fold when compared to European women [5]. In this study we have considered several risk factors e.g. maternal age>30 years, obesity, leg-to-height percentage, pre-pregnancy weight and body mass index(BMI), excessive weight gain during pregnancy, smoking, smoking during pregnancy, hormonal contraceptive use, previous history of fetal macrosomia, family history of diabetes mellitus, history of macrosomia, glycosuria, previous unexplained neonatal death, unexplained recurrent abortion, previous congenital malformations, history of hydramnios, history of stillbirth, having cesarean delivery, hypertension, history of gestational hypertension, history of pre-eclampsia, high parity, dietary history, hepatitis B surface antigen (HBsAg) carrier status, serum triglyceride and hemoglobin A1c (HbA1c) levels at first trimester, unbalanced diet, fruit intake, fondness for sweet food, gravidity, low birth weight, low stature, low level of physical activity, Han-nationality, Oriental women, Hispanics born in Puerto Rico or elsewhere outside the United States, women from the Indian subcontinent and the Middle East, older mothers, women with a history of infertility, those who delivered on the clinic service, demographic characteristics, socioeconomic status of women, belonging to minority groups, education level and occupations etc., discussed in various studies. We present here a critical review of some of the studies as to pinpoint the gaps which may be address further.

We came across a study accessing epidemiologic characteristics of gestational diabetes in an ethnically diverse cohort of 10, 187 women after a standardized screening for glucose intolerance and who delivered a singleton infant between January 1987 and December 1989at the Mount Sinai Medical Center in New York City. The overall prevalence of gestational diabetes observed, was 3.2%. Study was found showing excess risks for Oriental women, Hispanics born in Puerto Rico or elsewhere outside the United States, women from the Indian subcontinent and the Middle East, older mothers, heavier women, those with a positive family history of diabetes, women with a history of infertility, and those who delivered on the clinic service. In the same study it was also suggested that after controlling for maternal age, pre-pregnancy weight, and a family history of diabetes, some other factors e.g. Orientals, first generation Hispanics, women from the Indian subcontinent and the Middle East, those with a history of infertility, and low socioeconomic status women were found at an increased risk for gestational diabetes [6].

In one of the retrospective cohort study, based on 111 563 pregnancies delivered between 1991 through 1997 in 39 hospitals in northern and central Alberta, Canada. Risk factors considerd for GDM were found reported as age >30 years, family history of diabetes mellitus, obesity, history of macrosomia, glycosuria, previous unexplained neonatal death, unexplained recurrent abortion, previous congenital malformations, history of hydramnios, history of stillbirth, history of gestational hypertension and history of pre-eclampsia. In this study prevalence of GDM was found 2.5%. Reported risk factors for GDM included age >35 years, obesity, history of prior neonatal death, and prior cesarean section. Study also disclosed that teenage mothers and women who drank alcohol were less likely to have GDM [7].

In one of the studies considered, considered data from New South Wales, Australia, of 956,738 births between 1995 and 2005 for serving the purpose of examining the association between socio-demographic characteristics and the occurrence of GDM. Study found an increase in prevalence of GDM by 45%, from 3.0 to 4.4%. Study revealed that women born in South Asia had the highest adjusted odds ratio (OR) of any region (4.33 [95% CI 4.12–4.55]) relative to women born in Australia. It was also reported that women living in the three lowest socioeconomic quartiles had higher adjusted ORs for GDM relative to women in the highest quartile (1.54 [1.50–1.59], 1.74 [1.69–1.8], and 1.65 [1.60–1.70] for decreasing socioeconomic status quartiles). In this study increasing age was observed strongly associated with GDM, with women aged 40 years having an adjusted OR of 6.13 (95% CI 5.79–6.49) relative to women in their early 20s. Study also reported association of parity with reduced risk. There was no association found reported between smoking and GDM [8].

Another study reported age, obesity and family history of diabetes as well known risk factors for GDM. Study found positive associations with GDM between low birth weight, low stature, and low level of physical activity. Conflicting results were also presented in different cases e.g. low socioeconomic levels, smoking during pregnancy, high parity, belonging to minority groups, and excessive weight gain during pregnancy [9].
A cross-sectional study was performed at the University of Santo Tomas Hospital-Clinical Division (USTH-CD) considering 212 patients, of which 50 (23.6%) were found having GDM and 162 (76.4%) with no GDM. Reported prevalence of GDM at USTH-CD was 7.5%. In this study GDM was found significantly associated with increasing BMI (OR 1.54; 95% CI 1.06, 2.24), family history of diabetes (OR 6.27; 95% CI 2.63, 14.96) and hormonal contraceptive use (OR 8.48; 1.55, 46.52). In the same study, mothers with GDM were also found at increased risk of delivering via cesarean section (OR 2.76; 95% CI 1.13, 6.72) [10].
In another cross-sectional study of 265 pregnant women, 253 subjects were observed eligible for screening out of which, 28 (11.1 %) were found having positive GCT >7.8 mmol/l. In this study the pattern of glucose tolerance was found indicating that 232 (91.7 %) were having normal glucose tolerance, 6.7 % were having impaired glucose tolerance (IGT) while 1.6 % had overt diabetes. Previous history of fetal macrosomia was reported associated with GDM (adjusted OR 11.1; 95 % CI 2.93-42.12, P = 0.0004).This study concluded that the prevalence of GDM was relatively high among our antenatal population [11].
We came across a study considering 8 years data, from 2003 to 2010, of 222 women diagnosed with GDM. In this study it was found that of the affected women, 16.21% were managed with diet alone and 83.79% were received insulin treatment. Increased BMI, weight, marital period and positive family history for DM were reported definite influence on GDM. In the same study 92.80% of women were observed having cesarean delivery only 7.20% were observed having normal delivery [2].
In one of the studies conducted in Peshawar, Pakistan, 103 GDM and 97 healthy pregnant women (HPW) were considered. In this study women with gestational diabetes were diagnosed with 75mg Oral Glucose Tolerance Test (OGTT). Study reported that maternal age, BMI and parity of GDM were significantly higher at $P < 0.05$ as compared to HPW. Study also reported that women with previous history of gestational diabetes and family history of diabetes of GDM, as compared the control group, were found significantly higher at $P < 0.001$. No significant difference was revealed between socio-economic status, education level and occupations of GDM and HPW. This study concluded that maternal age, BMI, parity, previous history of gestational diabetes and family history of diabetes are the high risk factors of GDM and prevalence of GDM is not affected by Socioeconomic status [12].
In a study, carried out during June 2009 to January 2011 in antenatal care clinic at Post Graduate Institute of Medical Sciences (PGIMS), Rohtak, Haryana, considered participation of a total of 607 women with their estimated gestational age between 24th and 28th week. Participants considered were given a standardized 2-h 75 g (OGTT).The study made collection of information on demographic characteristics, socio-economic status, education level, parity, family history of diabetes and/or hypertension and past history of GDM. This study used American Diabetes Association (ADA) criteria for 75 g 2-h OGTT for diagnosing GDM. In the study most of the participants were observed below 26 years of age (463, 76.3%). The mean age of participants was found 23.62 ± 3.42 years (range 18-38). The prevalence rate was reported higher in women aged 26-30 and >30 years (11.57 and 34.8%, respectively) compared to women aged 16-20 and 21-25 years (4.54 and 4.53%, respectively). Results revealed diagnosis of GDM in 43(7.1%) women. Age, educational level, socio-economic status, prepregnancy weight and BMI, weight gain, acanthosis nigricans, family history of diabetes or hypertension and past history of GDM were observed significantly associated with GDM [13].
We came across another study considering a total of 250 pregnant women aged 15-44 years in their first and second trimester attending antenatal clinics in Ebonyi State University Teaching Hospital, Mile Four Maternity Hospital and Federal Medical Center Abakaliki, during the duration 2010-2011.Study was found assessing GDM using 100g oral glucose tolerance test (OGTT).In this study mean gestational age was observed 26 ±6.4 weeks, mean parity 1.5 and BMI was found 26.5(+/-3.8) kg/m^2. The prevalence rate of GDM was found 4.8%. This study clarified that value of prevalence will increase significantly with increase in the age of the women. Results of inter-relationship between GDM and maternal age, gestational age, parity and family history were found revealing that the prevalence of GDM in pregnant women within the age of 15-24years was 3.3%, 25-34years had 4.2% and 34-44years had 17.6%.in this study prevalence of GDM were reported 7.7%, 5.6% and 3.9% for the gestational age of 1st trimester, 2nd trimester and 3rd trimester respectively. The women with family history of diabetes were found having GDM prevalence of 4.5% while those without family history of diabetes had 4.8% with no significant difference (P-value = 0.953) [14].
In one of the studies 300 antenatal women were considered. Study measured fasting blood glucose after this they were given 75 g oral glucose and plasma glucose which was estimated at 2 h. Following WHO criteria for diagnosing of GDM, patients with plasma glucose >140 mg/dl were found labelled as GDM. Data collection was found observed from all subjects on demographic characteristics, socioeconomic status, education level, parity, family history of diabetes and/or hypertension, BMI, etc. and pregnancy outcome. In this study prevalence of GDM was found 8.33%. GDM was also found reported associated with age, parity, BMI, socioeconomic status, education level and with adverse pregnancy outcomes [15].
Leng J etal conducted a study of more than 12 years period, between 2010-2012 and compared the increases in the prevalence of GDM using the 1999 World Health Organization (WHO) criteria and its risk factors in Tianjin, China. Study reported registration of 18589 women within 12 weeks of gestation who had had a GCT at 24-28 gestational weeks. In this study 2953 women with 1-hour plasma glucose 7.8 mmol/L found undergoing a 75-gram 2-hour OGTT and 781 women observed with a positive GCT but with absence of OGTT.
In this study the adjusted prevalence of GDM was found 8.1%, which is a 3.5-fold increase, as it was in 1999. According to the study advanced age, higher pre-pregnancy BMI, Han-nationality, higher systolic blood pressure, a family history of diabetes, weight gain during pregnancy and habitual smoking were risk factors for GDM. As compared to the 1999 survey, the prevalence of overweight plus obesity found with an increment of 1.8 folds, age30 years with 2.3 folds, systolic BP with 2.3 mmHg over the considered period. Study also

concluded that increase in prevalence of GDM is an outcome of increasing prevalence of obesity and older age at pregnancy [16].
In one of the prospective cross-sectional survey on Turkish women, universal screening for GDM was found performed in 815 pregnant women. Screening was reported done with a 50-g oral glucose challenge test (GCT) with a 140 mg/dl cut-off point, then a diagnostic 100 γ oral glucose tolerance test OGTT was performed according to Carpenter and Coustan (CC) criteria. In this study 182(22.3%) women were found having positive GCT. Of these 182 screen positive women, 35 were found diagnosed with GDM. Four, out of the pregnancies with negative GCT but having high risk factors for GDM (n = 31), were observed diagnosed with GDM (0.5%). Prevalence of GDM was found 4.8% (n = 39) for all pregnant women. GDM was reported positively associated with advanced maternal age ($p < 0.001$), pre-pregnancy BMI ($p < 0.001$), cessation of cigarette smoking ($p < 0.001$), excessive weight gain during pregnancy ($p = 0.003$), previous history of GDM ($p < 0.001$), history of selected medical conditions ($p = 0.018$), family history of diabetes ($p < 0.001$), and existence of at least one high risk factor for GDM ($p < 0.001$) [17].
One of the prospective cohort study recruited 908 pregnant females, who had registered in West China Second Hospital of Sichuan University in the year 2011.Study showed a close correlation of maternal age, leg-to-height percentage, body mass index (BMI) before pregnancy, delivery history, dietary history, family histories of diabetes mellitus, hepatitis B surface antigen (HBsAg) carrier status, serum triglyceride and hemoglobin A1c (HbA1c) levels at first trimester with the incidence of GDM. In the same study age (OR=1.081, 95% CI 1.027~1.138), unbalanced diet (OR=3.329, 95% CI 2.167~5.116), fruit intake (OR=2.005, 95% CI 1.447~2.780), fondness for sweet food (OR=1.604, 95% CI 1.129~2.280), pre-pregnancy BMI (OR=1.095, 95% CI 1.008~1.190), gravidity (OR=1.263, 95% CI 1.107~1.442), HBsAg carrier status (OR=3.173, 95% CI 1.387~7.260), family histories of DM (OR=1.798, 95% CI 1.063~3.041), high serum triglyceride level (OR=1.315, 95% CI 1.117~1.548) and HbA1c (OR=10.272, 95% CI 4.719~22.363) were reported correlated with GDM[18].

2. Discussion

Today we know several risk factors of this disease but it seems that there is a need to work for one of the important factors, marital age, age at menarche and menses disorder. Also a question, what would be the role of different combination of different risk factors in incidence of GDM? arises.

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