

Risk Factors for Gestational Diabetes Mellitus among Ghanaian Women at the Korle-Bu Teaching Hospital

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Abstract

Several risk factors have been identified as contributing to the development of gestational diabetes mellitus (GDM). Knowing and ranking these risk factors for GDM will provide useful information for health care providers in educating women on the need to reduce the risk of developing GDM. This study aimed at establishing and ranking the maternal risk factors for GDM in the Ghanaian community. The study strongly linked women with history of still birth (OR=10.42, p=0.0004), relatives having diabetes (OR=8.08, p=0.004), history of more than two miscarriages (OR=3.15, p=0.0001), previous caesarean operations (OR=3.06, p=0.0004) and more than two parities (OR=3.03, p=0.0027) to the development of GDM. There was however no significant difference between the body mass index (BMI) of the GDMs and the controls (p>0.05).

Key words: Gestational diabetes, caesarian section, maternal risk factors, parity

Introduction

Gestational Diabetes Mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy (Zawiejska *et al.*, 2008). Risk factors for developing GDM include; a previous diagnosis of gestational or pre-diabetes, impaired fasting glycaemia, raised body mass index (BMI), a family history revealing a first degree relative with type 2 diabetes, maternal age, ethnic background and a history of previous pregnancy which resulted in a child with a high birth weight >4kg (Ross, 2006). Maternal obesity may also increase the risk of a number of pregnancy complications, including preeclampsia, GDM, and caesarean delivery (Leddy *et al.*, 2008).

It's been reported in an earlier study that 10% of GDM patients develop diabetes mellitus soon after delivery (Kjos *et al.*, 1990); while about 70% develop diabetes mellitus later (5 to 15 years) (Kim *et al.*, 2002). The risk is higher in women who required insulin for treatment (Kjos and Buchanan, 1999; Barden *et al.*, 2004). Women with GDM experience twice the number of urinary tract infections than women without GDM. The incidence of increased infection is as a result of increased amount of glucose in urine beyond the normal glycosuria during pregnancy (Gilmartin *et al.*, 2008).

Research Design and Methods

Participants were selected from pregnant women attending ante-natal care at the Maternity Unit of the Korle-Bu Teaching Hospital and the National Diabetes Management and Research Center, in Accra between the months of April and October, 2010. This was a case control study involving 100 pregnant women who had GDM and 100 pregnant women without GDM. The University of Ghana Medical School Ethical Committee reviewed the consenting process. Selection of GDMs was based on the criteria of the American Diabetes Association (ADA, 2010). Women who were diagnosed of GDM, having a glycated haemoglobin of less than 6.5%, maternal age of ≥ 25 years and gestational age of between 24 and 44 were included in the study. Controls were matched for age and screened using standard OGTT. Controls were negative for GDM. Participants who gave their consent also answered a standard questionnaire which provided information on their family history of diabetes, reproductive, socio-demographic and other medical conditions. Anthropometric measurements such as weight and height were also taken to obtain body mass index (BMI) of participants. Data was entered into a spreadsheet and analyzed using Microsoft Office Excel 2007 (Louisville, Kentucky) and the values expressed as mean plus/minus standard deviations (mean \pm SD). GraphPad Prism 3.02 (San Diego, California) was the statistical software used in this study with a level of statistical significance set at p<0.05 for all tests. Odds ratio was used in inferential statistics.

Results

General demographics and clinical characteristics

A total of 200 subjects comprising 100 pregnant women with GDM and 100 pregnant women without GDM participated in the study. For the GDM subjects, the mean age, weight, height and BMI were (33 \pm 5.07) years, (92.82 \pm 15.90) kg, (161.11 \pm 6.39) cm and (35.83 \pm 3.43) kg/m² respectively (Table 1), while for the controls, the mean age, weight, height and BMI were (32 \pm 4.79) years, (88.37 \pm 15.15) kg, (159.11 \pm 6.63) cm and (35.06 \pm 3.61) kg/m² respectively (Table 1). There was however no significant difference between the BMI of the GDMs and the controls (p>0.05).

Risk factors for GDM

Table 2 shows the association between GDM and several risk factors that predisposes an individual to GDM. Odds ratio revealed that women with at least a history of still birth (OR=10.42, p=0.0004), relatives living with diabetes (OR=8.08, p=0.004), history of more than 2 miscarriages (OR=3.15, p=0.0001), women with 2 or more caesarian sections (OR=3.06, p=0.0004) and women with more than two parities (OR=3.03, p=0.0027) were highly at risk of developing GDM.

Table 1: Demographic characteristics of the study population

	GDM (n=100)			Controls (n=100)			p-value
	Min	Max	Mean	Min	Max	Mean	
Age (years)	24	44	33±5.07	24	42	32±4.79	0.3619
Weight (Kg)	38	122	92.81±15.90	55	122	88.37±15.15	1.0004
Height (m)	150	175	161.11±6.39	146	173	159.11±6.63	0.2583
BMI (kg/m ²)	17	39.86	35.83±3.43	25.82	40.8	35.06±3.61	0.2188

Table 1 shows the demographic and clinical parameters (Age, Weight, Height and BMI) of the study population. Values are given as mean ± standard deviation (SD), BMI= body mass index.

Table 2: Associations between Risk Factors and GDM

Risk factor	OR	95%CI	p-value
PT			
0	0.4	0.21-0.83	0.5707
1-2	0.8	0.46-6.11	0.0171*
>3	3.03	1.50-6.11	0.0027*
MC			
0	0.30	0.17-0.54	0.990
1-2	0.85	0.27-2.62	0.0002*
>3	3.15	1.68-5.56	<0.0001**
CS			
0	0.29	0.15-0.58	0.6212
1-2	2.75	1.39-5.43	0.0035*
>3	3.06	0.31-29.95	0.0004*
SB			
At least 1	10.42	4.17-26.13	0.0001
RWD	8.08	4.12 – 36.15	0.004
GRWD			
F	2.00	3.16 – 34.18	0.003
M	0.49	3.08 -36.18	0.05

Table 2. shows the associations between GDM and risk factors. PT=parity, MC=miscarriages, CS=caesarian section, SB=stillbirth, RWD= relative with diabetes mellitus, GRWD= gender of relative with diabetes mellitus, F= female, M= male. CI= confidence interval, *mean difference is significant (p<0.05). **mean difference highly significant (p<0.0001)

Discussions

Risk factors for GDM are family history of DM, advanced maternal age, obesity, pregnancy weight gain and previous history of poor obstetric out come. Generally, the results of this study agree with the available literature on the association between these risk factors and GDM.

In this study, GDM was associated with family history of diabetes mellitus more especially with female relatives with diabetes mellitus (Table 2). This study was in line with earlier studies that indicated that GDM is common in women with family history of diabetes mellitus (Abrams and Parker1988; Ross, 2006). These results suggest that the development of GDM during pregnancy could be linked to genetic predisposition to diabetes mellitus especially type 2 DM (Watanabe, *et al.*, 2007). Results from this study also give an indication of a possible sex-linked involvement since most of those affected had more female relatives than their male counterparts with type 2 DM. Further detailed and comprehensive study is however required to arrive at definite conclusion.

This study also revealed that poor previous obstetric outcome was related to the development of GDM in later pregnancies. Greater number of the GDM group had a history of previous caesarean operations, indicating that they might have delivered more macrosomic babies than the controls. This is in agreement with a study done in Madrid (Weller, 1996), who found macrosomia to be more common in children of mothers who had developed gestational diabetes mellitus. A later publication also reported that macrosomia was more common in children of

women who had developed diabetes mellitus after gestational diabetes mellitus (Amraei and Azemati, 2007). Furthermore, a greater number of the GDM cases in this study had previous stillbirths and miscarriages than the control group (Table 2). The common pregnancy complication attributed to GDM is macrosomia (Xiong *et al.*, 2001; Wen *et al.*, 2000). Fetal macrosomia is the consequence of fetal hyperinsulinemia as a result of maternal-fetal transfer of glucose (Xiong *et al.*, 2001; Schwartz, 1990). During pregnancy also, there is increased synthesis of triglyceride from the liver in response to elevated oestrogen levels resulting in hyperlipidaemia. There is also elevation in plasma concentrations of placental hormones like progesterone and human chorionic somatomamotrophin as well as cortisol (Asare-Anane *et al.*, 2013). These changes are designed to provide energy and nutrition for the developing foetus by providing more glucose for the foetus, resulting in dysregulation of glucose metabolism (McMahon *et al.*, 1998). The relationship between advanced maternal age and GDM was not demonstrated by this study; however, macrosomia, stillbirth and miscarriages were higher in the GDM group than the controls (Table 2). These findings were in agreement with an earlier report (Ross, 2006; McMahon *et al.*, 1998). No significant difference between the BMI of the GDM cases and the controls was observed in this study. This indicates that pregnancy BMI may have no direct relationship with GDM. Pregnancy weight gain might be a better useful predictor of GDM. A limitation of this study was with sample size. Larger sample size needs to be used in future research for definite conclusions to be drawn.

Conclusion

Data from this study suggest that clinical and historical risk factors for GDM are valid in Ghanaians. However, using these risk factors alone to select such patients for GDM screen testing may be inadequate as some pregnant women without risk signs may be overlooked.

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