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The impact of risk factors for gestational diabetes mellitus on the outcomes of newborns in a Nigerian Teaching Hospital: a prospective open cohort study

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Abstract

Objective: The screening for GDM is largely dependent on the presence of clinical risk factors. The aim is to determine the impact of risk factors for GDM on newborn anthropometric and clinical outcomes.

Methods: This was a prospective study at the Lagos University Teaching Hospital, Nigeria. The pregnant women and their newborns were categorized into risk or control group. Glucose tolerance status of the pregnant women and anthropometric measurements of newborns were determined.

Results: Presence of multiple risk factors in the mother was associated with more adverse fetal outcomes compared with the presence of single risk factor. Maternal clinical risk factors such as excessive maternal gestational weight gain showed significant positive relationship with adverse fetal outcomes (P<0.05).

Conclusion: Maternal clinical risk factors for GDM have significant relationship with newborn outcomes in this study with gestational weight gain and presence of multiple risk factors having the strongest relationship with newborn outcomes. There is need to design a risk assessment model involving the use of multiple risk factors for GDM screening in our environment where universal screening may not be affordable.

Keywords: Anthropometrics, gestational diabetes, risk, newborn

Introduction

Gestational Diabetes Mellitus (GDM) is the commonest metabolic disorder of pregnancy and it has grave maternal and fetal consequences if not properly managed.[1] The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) Study conducted in nine countries, found a strong association between dysglycaemia and fetal complications.[1] These adverse fetal outcomes includes neonatal hypoglycemia, fetal macrosomia, and birth injuries amongst others.[1]A study conducted among Pima Indian children found that approximately 35% of attributable risk factors of type 2 diabetes (T2DM) among children could be linked to exposure to maternal hyperglycaemia in utero.[2,3]

Several environmental and clinical risk factors are associated with the development of GDM. These include previous diagnosis of GDM, unexplained still birth, family history of first-degree relatives with T2DM and maternal obesity and history of delivery of macrosomic babies amongst other.[1]The screening for GDM can either be selective or universal screening. Selective screening is done based on the presence or absence of clinical risk factors for GDM. Studies on GDM among Africans have identified certain risk factors which commonly prompt screening for GDM. The study done in Zambia indicated that baseline Body Mass Index (BMI) of greater than 30kg/m2 or more, previous delivery of baby weighing

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4000grammes or more and personal or family history of T2DM gave the strongest indicators for development of GDM and foetal macrosomia.[4] In a study at Jos, Nigeria Imoh reported that the most frequent indication of Oral Glucose Tolerance Test (OGTT) was a previous history of delivery of macrosomic baby which accounted for 30.4%, and maternal obesity 24.1%.[5] A similar study done in Lagos, identified risk factors in newly diagnosed GDM included prepregnant body mass index ≥30kg/m2 ,previous GDM, and first degree relatives with diabetes mellitus.[6]

The screening for GDM is largely dependent on the presence or absence of clinical risk factors. The impact of these risk factors on foetal outcomes is yet to be fully evaluated. The role of these risk factors on anthropometric, clinical and metabolic outcomes in newborns is yet to the evaluated among Nigerians and African population to the best of our knowledge. The knowledge of the subject matter is very limited in the literature as most studies reported in the literature were mainly on the impact of GDM on fetal outcomes. This study aimed to determine the impact of risk factors for GDM on the anthropometric and clinical outcomes of newborns. This will provide useful information to clinicians on the prediction of newborns outcomes among women with GDM.

Methods

The study was an open prospective cohort, carried out at the Lagos University Teaching Hospital (LUTH), Lagos state, Nigeria. Ethical approval was obtained from Health Research and Ethical Committee of Lagos University Teaching Hospital (ethical approval number AM/DCST/HREC/APP/862). Informed consent was obtained from all the participants before the commencement of the study. The study population from which the participants were sampled consisted of pregnant women at gestational age of 24-28 weeks who attended the antenatal clinics in LUTH during the period of recruitment and newborns of the index pregnancies. The inclusion criteria were pregnant Nigerian women with or without risk factors for GDM, pregnant women who can recall their prepregnant weight, gestational age of 24-28 weeks at the time of recruitment and those who accepted to participate and gave informed consent. The exclusion criteria were pregnant women with multiple gestation,[7] women with pre-gestational diabetes mellitus, those who cannot recall their prepregnant weight, women on medications that could cause glucose tolerance [8] and those who did not accept to participate in the study.

The sample size was determined using a correlational formula for the objective and assuming a significance level of 0.05 in a two-tailed analysis, a moderate effect size (rho=3 according to Cohen)[9] a power of 80% and allowing for 20% attrition rate in view of the prospective nature of the study. A total of 90 mother to newborn pairs were recruited for the study. The participants were recruited through simple random sampling method between first of March 2017 and 30th June 2017 from the antenatal clinics between gestational age of 24 to 28 weeks. The sampling frame consisted of all the pregnant women that attended and received care in the antenatal clinic. Eligible pregnant women, who met the inclusion criteria at each clinic day, were allotted numbers and these numbers were randomly selected. The selected pregnant women were invited to participate in the study. Women who gave consent to be part of the study were enrolled into the study until the desired sample size was attained. The study participants were categorized into either risk group or control group based on the presence or absence of clinical risk factors for GDM.

A structured study data form was used to collect information on participants' sociodemographic, medical, obstetrics and reproductive characteristics. Other information collected were the presence or absence of clinical risk factors for GDM such as previous GDM, previous delivery of macrosomic baby, family history of DM, and Gestational Weight Gain (GWG) in index pregnancy was obtained. Maternal anthropometric characteristics like prepregnant weight as recalled, height, body mass index and newborn anthropometric characteristics such as Birth Weight (BW), length, head and chest circumferences were also obtained. Newborn biochemical parameters collected after delivery were serum blood glucose and bilirubin levels.

All the study participants had 75g Oral Glucose Tolerance Test (OGTT) done between 24 to 28 weeks of gestation. Diagnosis of GDM was made based on IADPSG guidelines (Fasting glucose ≥5.1mmol/L, one hour post glucose load ≥10.0mmol/L, 2hours post glucose load ≥8.5mmol/L).[10] Women diagnosed with GDM were managed according to standard treatment protocol. All the study participants were followed up till delivery and their weight was determined at 37 weeks of gestation. Their newborns were followed for the first one week of life.

The anthropometric measurements were taken using the same standard landmark and techniques.[1] Two measurements were taken and average value was used. If the measurements differ by ≥0.5cm, a third measurement was taken and the average of the three values was used. This was to minimize intra and inter observational errors. The lengths of the newborns were measured at

birth using the infant meter. The weight of the newborn was measured to the nearest 0.1kilograms at birth using a calibrated weighing scale with the baby naked. The head circumferences of the newborns were measured with a non - stretch measuring tape at the level of the occiput and frontal bone across the parietal bone (parietal eminence) in centimeters to the nearest 0.1 cm. The chest circumferences of the newborns were measured at the level of the nipple line using a non - stretch measuring tape in centimeters to the nearest 0.1 cm. The abdominal circumferences of the newborns were measured using the midway between the lowest rib and iliac crest in centimeters to the nearest 0.1 cm.[1] The newborns were examined for birth trauma and thereafter followed up till one week of life for neonatal jaundice and hypoglycemia respectively.

Data generated from clinical and biochemical parameters were analyzed using statistical package for social science (SPSS) version 26 along with Excel.R. Descriptive statistics were presented using frequency tables. The proportion of pregnant women with glucose intolerance in pregnancy was determined. Continuous quantitative variables were presented as mean and standard deviation for normally distributed data and as median and interquartile range if skewed. Differences in these parameters were examined using Student t test and Mann Whitney u test respectively. Chi square statistics was used to compare proportions between the groups of pregnant women with risk factors for glucose intolerance and those without. Further analysis was done using risk ratio, 95% confidence interval and p value < 0.05 was considered to be statistically significant.

Results

A total of 90 women consisting of 44 women with risk factors and 46 pregnant women without risk factors for GDM were enrolled for the study. Six pregnant women and their newborns were lost to follow up because they delivered outside the hospital, giving a complete response rate of 93.3%. Their mean age was 32.6 ± 5.0 years. There was no significant difference in the mean age of the risk group (34.0±5.0 years) and that of the control group (31.0±5.1 years) (p = 0.982). There was no difference in the socio-demographic characteristics of pregnant women in the risk and control group (p value =0.123) as seen in Table 1.

Table 1. Socio-demographic characteristics of study participant

Socio demographic characteristics	**All pregnant women mean (±SD)**	**Risk group mean (±SD)**	**Control group mean (±SD)**	**p value**
Age (years)	32.6±5	34±4.3	31±5.1	0.982
Socio demographic characteristics	All pregnant women n (%)	Risk group n (%)	Control group n (%)	p value chi square
Age (years)				
20-29	19(21.1)	6 (13.6)	13 (28.3)	0.226
30-39	66 (73.3)	35 (79.5)	31 (67.4)	
40-49	5(5.6)	3 (6.8)	2 (4.3)	
Socioeconomic class				
Upper class	32 (35.6)	18 (40.9)	14 (30.4)	0.123
Middle class	32 (35.6)	11 (25.0)	21 (45.7)	
Lower class	26 (28.8)	15 (34.1)	11 (23.9)	
Tribe				
Yoruba	45 (50.0)	20 (45.5)	25 (54.3)	0.265
Ibo	28 (31.1)	14 (31.8)	14 (30.4)	
Hausa and others	17 (18.9)	10 (22.7)	7 (15.3)	
Religion				
Christianity	73 (81.1)	37 (84.1)	12 (26.1)	0.480
Islam	17 (18.9)	7 (15.9)	10 (73.9)	
Education				
Secondary school or less	18 (20.0)	6 (13.6)	12 (26.1)	0.140
Post- secondary school or more	72 (80.0)	38 (86.4)	34 (73.9)	

Upper class: managers and professional, middle class: clerical, sales and trade workers; Lower Class: elemental workers and unemployed

Table 2 showed significant difference in the pregestational weight in the risk group compared to the control group. Maternal Body Mass Index (BMI) and GWG were statistically higher and these were significant compared to the control group. Primigravida women was higher in the risk group than the control group. Also, GDM in the index pregnancy, 1 hour and 2-hour plasma glucose were higher in the risk group compared to the control group which was statistically significant.

Table 2. Clinical and biochemical risk factors for GDM in the pregnant women

Clinical Characteristics	All Number (%) n=9	Number (%) Risk group n=44	Number (%) Control group n=46	p value
Parity				
1	54 (60)	29 (65.9)	25 (54.3)	0.005
>1	36 (40)	15 (34.1)	21 (45.7)	
Previous IUFD	3 (3.3)	3 (6.8)		
Previous history of miscarriage	5 (5.6)	5 (11.4)		
Previous GDM	3(3.3)	3(3.3)		
Family history of DM	14 (15.6)	14 (31.8)		
Previous delivery of macrosomia	9 (10.0)	9 (20.5)		
BMI				
Normal	41 (45.5)	14 (31.8)	27 (58.7)	0.001
Overweight	35 (38.9)	16 (36.4)	19 (41.3)	
Obese	14 (15.6)	14 (31.8)	0 (0.0)	
GWG				
Low weight gain	16(17.8)	7 (7.8)	9 (10.0)	
Normal weight gain	54(60.0)	25(27.8)	29(32.2)	0.51
Excess weight gain	20(22.2)	12(13.3)	8(8.9)	
Height (meters)	1.6 (0.10)	**Median (IQR)** 1.6 (0.09)	1.6 (0.12)	**p value** 0.547
Pregestational Weight (kg)	67.6 (15.5)	72.5 (20.20)	63.0 (10.50)	0.001
BMI(kg/M²)	25.7(5.90)	27.7(7.30)	24.3(4.10)	0.001
Fasting glucose (mmol/L)	4.3(0.9)	4.4(1.4)	4.3(0.7)	0.487
1 hour post glucose load (mmol/L)	6.8(2.5)	7.0(3.6)	6.7(1.3)	0.047
2hour post glucose load (mmol/L)	6.6(2.9)	7.3(3.2)	6.0(2.3)	0.001
Diagnosis of GDM in index pregnancy (IADPSG)	21 (23.3)	17 (38.6)	4 (8 .7)	0.043

BMI; body mass index, GDM :Gestational diabetes mellitus, GWG: Gestational weight gain,

U: Mann Whitney U, IQR:Interquartile range

All newborns were alive at birth. The overall prevalence of delivery of macrosomic babies was 10.7% which was higher in the risk group compared to control group (p value 0.034 and 95% confidence interval of 0.779-20.531) as shown in table 3. The median BW of all newborn was 3.2kg (IQR 0.5) while the median BW in both the control and risk groups were 3.1kg (IQR 0.81) and 3.3kg (IQR 0.71) respectively. There was higher incidence of hypoglycemia in the newborn of the risk group mothers compared with the control group.

Table 3. Influence of risk factor for GDM on Clinical and Biochemical Characteristics of Newborns

Newborn Outcomes	All	Risk group Number (%)	Control group	p value
	n=84	n=42	n=42	
Jaundice	47 (55.9)	27 (64.3)	20 (47.6)	0.187
Hypoglycaemia	5 (5.6)	4 (9.5)	1 (2.4)	0.180
NNU admission	53 (63.1)	29 (69)	24 (57.1)	0.366
Birth trauma	6 (7.1)	4 (9.5)	2 (4.8)	0.676
APGAR score				
7-10	79 (94.1)	41 (51.9)	38 (48.1)	0.360
3-6	5 (5.9)	1 (20.0)	4 (80.0)	
Birth Weight				
Non macrosomic	75 (89.3)	35 (83.3)	40 95.2)	0.034
Macrosomic	9 (10.7)	7(16.7)	2 (4.8)	
	n=84	n=42 Median (IQR)	n=42	p value
Length (cm)	48.5 (4.8)	49.0 (4.0)	48.0 (5.3)	0.261
Occipitofrontal circumference	34.8 (2.3)	35.0 (2.0)	34.3 (3.0)	0.345
Birth weight (kg)	3.2 (0.8)	3.3 (0.7)	3.1 (0.8)	0.799
Abdominal circumference	32.0 (3.0)	33..0 (2.4)	32.0(2.0)	0.344
Chest circumference	33.0(2.1)	33.5(2.7)	32(3.4)	0.261

APGAR: appearance, pulse, grimace, activity and respiration), CI: Confidence interval, NNU: neonatal unit, IQR: Interquartile range.

Other outcomes such as delivery of macrosomic babies, hypoglycemia, birth trauma and anthropometric measurements (abdominal and chest circumference) were higher in the risk group when compared to control group.

Table 4 showed the relationship between the clinical risk factors and delivery of macrosomic babies, the highest impact was seen with previous GDM (risk ratio 21.1 , p value 0.029), followed by GWG (risk ratio 9.2 , p value 0.024). Logistic regression showed the presence of GDM in index pregnancy independently predicted occurrence of macrosomia.

Table 4. Relationship between Maternal Clinical Risk Factors, macrosomic birth weight and predictors of macrosomic weight

Maternal Clinical risk factors		All n(%)	Macrosomic BW n(%)	Non macrosomic BW n(%)	p value	Risk ratio (Confidence Interval)
History of intrauterine fetal death	No Yes	80(100.0) 4(100.0)	8(10.0) 1 (25.0)	72 (90.0) 3 (75.0)	0.370	3.0 (0.27-32.35)
Unexplained Miscarriage	No Yes	71(100.0) 13(100.0)	7(9.9) 2(15.4)	64 (90.1) 11(84.6)	0.624	1.7(0.31-9.01)
Previous GDM	No Yes	81(100.0) 3 (100.0)	7 (8.6) 2(66.7)	74 (91.4) 1 (33.3)	0.029	21.1(1.70-263.43)
Family history of DM	No Yes	66(100.0) 18(100.0)	4 (6.1) 5 (27.8)	62 (93.9) 13 (72.2)	0.019	6.0(1.41-25.27)
Previous macrosomic baby	No Yes	76(100.0) 8(100.0)	6 (7.9) 3(37.5)	70(92.1) 5(62.5)	0.037	7.0 (1.34-36.69)
Gestational Weight Gain	Normal Excess	63(100.0) 21(100.0)	3 (4.7) 6 (28.5)	60 (95.3) 15 (71.5)	0.024	9.2 (1.25-38.65)
GDM in index pregnancy	No Yes	61(100.0) 23(100.0)	2 (3.3) 7 (30.4)	59 (96.7) 16 (69.6)	0.001	18.6 (2.42-142.73)

Logistic regression on maternal clinical predictors of macrosomia

Maternal predictors	B	Significance	Odds ratio	95% Confidence interval
GDM in index pregnancy	2.888	0.037	17.951	1.20-269.36
Family history of DM	-0.851	0.459	0.427	0.05-40.06
Previous macrosomia	-2.458	0.084	0.088	0.01-1.40
Gestational Weight gain	3.035	0.050	20.797	1.00-433.02
Pregestational Weight	-0.442	0.733	0.643	0.05-8.18

Table 5 showed the linear regression of prediction of birth weight using gestational weight gain, pregestational weight and newborn anthropometric indices. The pregestational weight including newborn anthropometric indices such as chest circumference, abdominal circumference, length and occipitofrontal circumference predicted birth weight.

Table 5. Linear regression on predictors of birth weight

Predictors	B	SE B	β	T	Significance	95% Confidence interval
Gestational Weight gain	0.013	0.008	0.103	1.553	0.125	-0.004-0.029
Pregestational Weight	0.010	0.003	0.220	3.750	0.001	0.005-0.016
Length of newborn	0.022	0.010	0.137	2.111	0.038	0.001-0012
Chest circumference of new born	0.050	0.024	0.235	2.056	0.043	0.002-0.098
Abdominal circumference of new born	0.085	0.025	0.380	3.356	0.001	0.035-0.135
Occipitofrontal circumference	0.042	0.017	0.169	2.521	0.014	0.009-0.075

Table 6 showed the presence of combination of multiple (>1) and single risk factors in the pregnant women accounted for 42.9% and 57.1% respectively. The presence of multiple risk factors was associated with higher incidence of macrosomia, hypoglycemia, birth trauma when compared with the presence of a single risk factor.

Table 6. Impact of Multiple Risk Factors for Gestational Diabetes Mellitus on Foetal Clinical outcomes

Foetal outcomes	Single Risk Factor	Two risk factors	Three and more risk Factors	95% CI	p value
	Number (%)				
n= 42	n=24	n=3	n=15		
Macrosomia					
Yes	0 (0.0)	2 (66.7)	5 (33.3)	0.003-0.005	0.001
No	24 (100.0)	1 (33.3)	10 (66.7)		
Birth Trauma					
Yes	0 (0.0)	1 (33.3)	3 (13.3)	0.072-0.083	0.038
No	24 (100.0)	2 (66.7)	13 (86.7)		
NNU admission					
Yes	17 (70.8)	2 (66.7)	10 (66.7)	1.00-1.00	1.000
No	7 (29.2)	1 (33.3)	5 (33.3)		
Jaundiced					
Yes	15 (62.5)	2 (66.7)	10(66.7)	1.00-1.00	0.962
No	9 (37.5)	1 (33.3)	5(33.3)		
Hypoglycaemia					
Yes	0 (0.0)	1 (33.3)	3 (20.0)	0.038-0.046	0.045
No	24 (100.0)	2 (66.7)	12 (80.0)		
APGAR					
Yes	24 (100.0)	3 (100.0)	14 (93.3)	0.425-0.445	0.429
No	0 (0.0)	0 (0.0)	1 (6.7)		
		Median (95% CI)		95% CI	p Value
Length (cm)	48.0 (46.18-48.18)	51 (42.16-56.50)	51.0 (48.76- 52.03)	0.005- 0.008	0.011
Chest circumference (cm)	32.45 (31.84-33.31)	35.0 (26.21- 42.06)	34.4 (33.23- 36.05)	0.239-0.256	0.174
Abdominal circumference (cm)	**31.90 (31.42- 32.55)**	**33.00 (25.48-40.91)**	**33.60 (32.39- 34.90)**	**0.003-0.005**	**0.007**

NNU: neonatal unit admission

Discussion

The incidence of GDM was significantly higher in the risk group compared with the control group. This is similar to finding by Katarzyna et al [11] where presence of risk factors for GDM were found to be more common in women diagnosed with GDM. In this study, large proportions of participants in the risk group had overweight and obese pregestational weight with higher GWG compared to those within the control group. In a meta-analysis by Chu et al [12] there was an overall uniformity in studies reporting a higher risk of GDM with increasing maternal weight and pregestational weight.

This study found that the most common risk factor for GDM in pregnancy was family history of DM. Family history of DM accounted for the highest single risk factor for GDM. This accounted for four in ten pregnant (40%) women with risk factor for GDM.

It is interesting to note that other maternal risk factors also correlated significantly with fetal outcomes. The previous history of GDM had significant positive relationship with macrosomia. Other maternal clinical risk factors found to have significant relationship with foetal outcomes were gestational weight gain, previous GDM, previous delivery of macrosomic baby and family history of DM but did not independently predicted macrosomia as a single risk factor. Meanwhile, maternal prepregestational weight had significant positive linear association with newborn weight which independently predicted birthweight. This is consistent with the findings by Pereda [13] et al and Usta A et [14] which showed the linear association between pregestational weight, gestational weight gain and newborn anthropometric measurements. Similarly,

diagnosis of GDM in index pregnancy independently predicted occurrence of macrosomic weight.

In addition, newborns anthropometric indices such as chest, occipitofrontal, abdominal circumferences and length were independently predictive BW in our study. A study done by Azevedo showed similar findings with newborn chest circumference independently predicting weight at birth.[15] This implies the higher the chest and or abdominal circumference of the newborn, the more the BW. The presence of multiple risk factors for GDM was significantly associated with increased adverse clinical fetal outcomes including higher newborn anthropometric measurements when compared with a single risk factor. Furthermore, presence of greater than two risk factors was significantly associated with increased adverse clinical outcome compared with presence of two risk factors. The occurrence of macrosomia, birth trauma and neonatal hypoglycemia were seen only in the newborns of mothers that had multiple risk factors. In the same vein, all the newborn anthropometric indices were all significantly higher in newborns of mother with multiple risk factors when compared with those of single risk factor.

With the use of more than two risk factors, there was significant increase in the incidence of macrosomia, birth trauma, and newborn hypoglycemia among newborns of mother with more than two risk factors. Similarly, there was significant increase in the anthropometric indices of newborns' such as length and abdominal circumference with more than two risk factors compared with only two risk factors. These findings suggest that use of multiple risk factors, especially, the use of three or more risk factors is significantly associated with increased adverse newborn outcome compared with the use of less than three risk factors or single risk factor. This also suggests that use of multiple risk factors is reliable and sensitive screening method for adverse clinical foetal outcomes.

The findings in this study are consistent with the findings in the study by Katarzyna et al [11] who showed that there was no single risk factor for GDM that was adequate enough to reliably diagnose GDM. Similarly, Fawole et al [16] showed that the use of check list for risk factors increased diagnoses of GDM by four-fold. Katarzyna et al [11] also showed that the use of combination of two risk factors for GDM resulted in more diagnosis of GDM and reduced incidence of missed diagnosis. However, in this study the presence of single or multiple clinical risk factors was significantly associated with adverse newborns clinical and biochemical outcomes. There was a strong relationship between multiple clinical risk factors especially presence of more than two clinical risk factors and adverse fetal outcomes and anthropometric indices.

There were no foetal losses observed in both study groups. This is probably due to the good antenatal and intrapartum care they received. Women with GDM were managed during the antenatal period by multidisciplinary team that consisted of the Obstetrician, Neonatologist, Endocrinologist and Dietetics. Multidisciplinary care is applicable to high-risk pregnancies worldwide which is the same practice in LUTH. This multidisciplinary approach is employed in managing pregnant women with GDM, sickle cell anaemia with pregnancy among others. These newborns were admitted after delivery into the neonatal care unit for close observation. According to the NICE guidelines [17] the availability of neonatologists and intensive care unit in hospitals where women with GDM are managed is important. This study also showed that babies delivered by mothers in the risk group had higher neonatal unit admission and incidence of hypoglycaemia when compared with the babies delivered in the control group.

Some women in the control group without any risk factor for GDM, had GDM, even though the prevalence was lower than that observed among women with risk factors for GDM. Ewinghi [18]et al in Abakaliki, Nigeria had similarly showed that women without any risk factors for GDM were screened positive for GDM.[18,19] Another similar study by Adegbola et al showed 42% of women diagnosed with GDM had no risk factors and they advocated for universal screening in all pregnant women.[6] Approximately, one in ten women would have been missed if selective screening was employed in this study. All women with GDM had good glycaemic control while on medical nutritional therapy except two pregnant women who were on insulin to achieve optimal glycaemic control. This is in keeping with America Diabetes Association guidelines.[20]

Conclusion

Maternal clinical risk factors for GDM have significant relationship with foetal outcome in this study. Pregestational weight and diagnosis of GDM in index pregnancy have the strongest relationship with foetal outcomes. Other maternal clinical risk factors found to have significant relationship with foetal outcomes were gestational weight gain, previous GDM, previous delivery of macrosomic baby and family history of DM but did not independently predicted macrosomia as a single risk factor. In addition, the presence of multiple maternal risk factors (>1) is significantly associated with more adverse clinical newborn outcomes including macrosomic weight than the use of single risk factor.

A large multi-centre-based study to evaluate the impact of maternal risk factors for GDM on foetal outcome is advocated in order to further investigate the findings in this study. There is the need for further multi-Centre studies to investigate the role of multiple maternal risk factors for GDM on foetal outcomes especially in a resource challenged environment where universal screening might not be affordable. This may help in the design of the model that can be used for GDM screening in such environment. The use of multiple risk factors for GDM is advocated in the selective screening of women for GDM and in predicting occurrence of adverse foetal outcome. Assessment risk model using more than two maternal clinical risk factors could be employed to evaluate the risk of adverse foetal outcome in resource challenged setting.

Conflicts of Interest: No conflicts declared.

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