

Original Article

A comparison on the prevalence and outcomes of gestational versus type 2 diabetes mellitus in 1718 Saudi pregnancies

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Abstract: The presence of either diabetes mellitus type 2 (DMT2) or GDM constitute a high-risk pregnancy. Given the high rate of DMT2 and GDM in the kingdom of Saudi Arabia (KSA), no study has ever compared whether GDM outcomes are comparable to those with DMT2. The present study aims to compare for the first time, maternal and neonatal outcomes among Saudi patients with GDM, DMT2 and non-DM groups. This is a retrospective study covering data from 1718 pregnant patients admitted at King Fahad Medical City, Riyadh, KSA from April 2011 to March 2013. The prevalence of GDM was 13.8%, DMT2 was 0.9%. DMT2 group had the highest mean parity and shortest mean gestational age as compared to other groups. Half of all the subjects in the DMT2 group also experienced preterm labor, as opposed to only 10% in GDM and 14% in the non-DM group, respectively. Finally, neonates delivered by DMT2 mothers had the highest percentage of admissions to NICU (33%) as compared to 10% in the non-DM group and only 5% in the GDM group. Outcomes of the GDM group are almost comparable with the non-DM group. While the results of the present study reflect the efficient management of GDM cases in Saudi patients, DMT2 complicated pregnancies, which are considered to be at a much higher risk for maternal and neonatal complications, should be given equally special attention.

Keywords: Gestational diabetes, type 2 diabetes mellitus, Saudi

Introduction

The recent surge in the presence of diabetes mellitus type 2 (DMT2) in the Middle East, and in the kingdom of Saudi Arabia (KSA) in particular, raises alarming concerns in the future of public health in this developing region unless aggressive interventions are commenced [1, 2]. More threatening however, is the equal rise in the prevalence of gestational diabetes mellitus (GDM) in Saudi Arabia. While there is a lack of national data for the over-all prevalence of GDM in KSA, several studies point out to increased incidence of GDM in several major tertiary hospitals ranging from 12.5% in the year 2000 alone to as high as 18.7% in 2013 [3, 4].

Documented risk factors associated with GDM in the Saudi population include parity, advancing age [5] and maternal weight [6]. There is a prevalent view that a poor gestational environment programs the genetically susceptible for a lifetime of insulin resistance [7]. The presence of complications such as DMT2 and GDM among expectant mothers further threaten not only the maternal well-being [8], but more importantly the quality of life as well as outcome of the new born [9, 10]. It has been observed that transmissibility of insulin-resistant traits from parents to offspring can manifest as early as pre-teen years [11], and this is true for the Arab cohort, further explaining the continuous rise in chronic non-communicable diseases in the country. While there is a consid-

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Table 1. Clinical and demographic characteristics of mothers

Parameter	
N	1718
Clinical Parameters	
Age (years)	29.9 ± 5.6
Gravida*	3.4 (0-19)
Parity*	1.8 (0-13)
Gestational age (weeks)	38.2 ± 2.8
BMI (kg/m ²)	30.2 ± 5.7
Demographics	
Saudi Nationals	96.9
Folic acid supplementation	95.0
Presence of DM (all types)	14.7
GDM	13.8
DMT2	0.9
Treatment of DM	
Diet	70.4 (of all DM cases)
Insulin	29.6 (of all DM cases)
Hypertension	2.1
Pre-eclampsia	2.3
Super-imposed pre-eclampsia	0.5
Mode of Delivery	
Vaginal Delivery	57.0
Cesarean	43.0
Type of Delivery	
Elective	17.3
Spontaneous	48.9
Emergency	25.8
Induced	8.0
Preterm Labor	13.6
Perineal Lacerations/Tears	27.6
Maternal Death	0.0

Note: Clinical parameters presented as mean ± standard deviation; *presented as mean (minimum-maximum; Demographics presented in percentages (%).

erable amount of literature done with regards to GDM and neonatal outcomes in KSA, there is scarcity of information on the comparison between GDM and DMT2 mothers, their complications, and adverse maternal and neonatal outcomes.

In this single-center, cross-sectional retrospective study, we compared the severity of complications and neonatal outcomes between subjects without DM and those with known GDM and DMT2. The present study will fill the existing gap as to whether differences exist in the outcomes of both high-risk pregnancies.

Methods

Study design and setting

This is a single-center, cross-sectional retrospective study taken from a database of all subjects admitted for delivery at the Obstetrics Department of King Fahad Medical City, Riyadh, Saudi Arabia from April 2011 to March 2013.

Subjects

A total of 1718 recorded deliveries were included as the study population. For mothers, Information gathered included age, BMI, nationality, folic acid supplementation, presence or absence of GDM and treatment used for the DM type, if any. Diagnosis of both GDM and DMT2 were based solely on recorded information and cannot be verified independently. Obstetric information was also obtained which included gravidity and parity, mode and type of delivery as well as post-delivery complications. Pregnancy-related complications were also noted. For the neonates, information recorded included birth weight, APGAR scores and presence of neonatal complications. Exclusion criteria include records with other co-morbidities aside from DMT2 such as thyroid, heart, kidney, liver and infectious diseases. Those with incomplete information were also excluded.

Ethical approval

The study has been approved by the Institutional Review Board of King Fahad Medical City Research Center, Riyadh, Saudi Arabia for access in the medical records.

Data analysis

Data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 16.0. Variables were expressed as percentage (%) for frequencies and mean ± standard deviation for continuous variables. Chi Square Analysis was used to determine differences between frequencies, and analysis of co-variance (ANCOVA) was used to determine continuous variables between groups, with age and BMI as confounding variables. Significance was set at P < 0.05.

Results

Table 1 highlights the general characteristics of the subjects. Worthy to note is the high preva-

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Table 2. Clinical and demographic characteristics of neonates

Parameter	
N	1718
Clinical Parameters	
APGAR Score at 5 minutes	8.25 ± 1.6
APGAR Score at 10 minutes	9.24 ± 1.5
Weight (kg)	2.95 ± 0.68
Demographics	
Intra-uterine growth restriction	3.3
Polyhydramnios	3.0
Antenatal Fetal Distress	4.4
Apparent Congenital Malformation	3.1
Shoulder Dystocia	0.3
Intra-uterine Fetal Death	1.9
Admission to NICU	9.6

Note: Clinical parameters presented as mean ± standard deviation; Demographics presented in percentages (%).

lence of DM in the cohort which is 14.7% (N = 252), out of which 238 (13.8%) were diagnosed with GDM, while the remaining 14 cases (0.9%) had DMT2. Seven out of 10 DM cases have been treated on diet alone, while the remaining 30% were treated with insulin. While majority of the patients delivered normally, 2 out of 5 deliveries were by Cesarean section. In terms of deliver type, almost half of the patients delivered spontaneously (48.9%), followed by emergency (25.8%), elective (17.3%) and induced (8.0%). Almost 14% of the patients experienced preterm labor, and 27.6% had perineal lacerations/tears. There was no recorded maternal death. The rest of the variables are found in **Table 1**. **Table 2** shows the characteristics of newborns. The mean weight of the neonate cohort was 2.95 ± 0.68 kg, with 3.3% observed to have intra-uterine growth restriction, while another 4.4% had neonatal distress. Almost 2% of the neonates were considered dead before delivery, and 1 out of 10 neonates were admitted at NICU. The rest of the variables are found in **Table 2**.

To determine whether there is a difference in maternal outcomes in the presence of DM, we divided the subjects to three groups (Non-DM, GDM and DMT2) while adjusting for maternal age and BMI (**Table 3**). Expectant mothers who had GDM or DMT2 had significantly higher gravidity than the non-DM group. The DMT2 group also had significantly higher parity as compared

to both GDM and non-DM groups. Consequently, the DMT2 group also had the shortest gestational age as compared to other groups. In terms of co-morbidities, prevalence of hypertension was highest in the DMT2 group, although no pre-eclampsia was observed. Vaginal delivery was most common in the non-DMT2 group, while Cesarean section was most the most common mode of delivery for DMT2 subjects, accounting to 8 out of 10 deliveries delivered through cesarean section. Lastly, elective delivery was most common in the DMT2 group as well as induced labor than other groups. Half of all the subjects in the DMT2 group also experienced preterm labor, as opposed to only 10% in GDM and 14% in the non-DM group, respectively. Perineal lacerations on the other hand were more common in the non-DM and GDM group than the DMT2 group.

Lastly, comparisons were also done among the neonates of mothers based on the same grouping as **Tables 3, 4**. There were no significant differences in the APGAR scores of all groups. The GDM group had the heaviest neonates (3.12 ± 0.63 kg), and this was significantly higher than DMT2 group only. As expected, polyhydramnios was significantly more common in the GDM and DMT2 groups. Finally, neonates delivered by DMT2 mothers had the highest percentage of admission to NICU (33%) as compared to 10% in the non-DM group and only 5% in the GDM group.

Discussion

The present study highlights the differences in the maternal and neonatal outcomes of subjects with GDM and DMT2. DMT2 complicated pregnancies had the shortest mean gestational age, explaining the equally highest percentage of pre-term labor and possibly NICU admissions than other groups. The non-significant differences between GDM and non-DM groups reflect in most variables studied reflect the over-all efficiency in the management of GDM cases as opposed to DMT2. It has been theorized that high parity and diabetes is mediated by history of miscarriages whose mechanisms are still not clearly understood. While miscarriages were not provided in the results, the highest parity percentage was evident in the DMT2 group. It is worthy to note that high parity in itself is a risk factor for premature birth in KSA [12].

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Table 3. Age and BMI-adjusted maternal outcomes according to presence of DM

Parameter	Non-DM	GDM	DMT2
N	1466	238	14
Clinical Parameters			
Gravida*	3.28 (0-15)	4.33 (0-19)#	5.42 (2-13)#
Parity*	1.76 (0-13)	2.36 (0-8)	2.92 (0-7)#
Gestational age (weeks)	38.2 ± 2.9	38.4 ± 1.9	34.5 ± 4.6#
Demographics			
Hypertension	2.0	1.9	16.7#
Pre-eclampsia	2.5	1.4	0
Super-imposed pre-eclampsia	0.5	0	0
Mode of Delivery			
Vaginal Delivery	59.2	43.9	18.2#
Cesarean	40.8	56.2	81.8#
Type of Delivery			
Elective	16.3	23.9	27.3#
Spontaneous	52.1	28.8#	0#
Emergency	24.6	32.7	54.5#
Induced	7.0	14.6	18.2#
Preterm Labor	13.7	10.4	50.0#
Perineal Lacerations/Tears	28.1	25.1	8.3#

Note: Clinical parameters presented as mean ± standard deviation; Demographics presented in percentages (%); *presented as mean (minimum-maximum); #denotes significance as compared to Non-DM group; P-value significant at P < 0.05.

Table 4. Age and BMI-adjusted fetal outcomes according to presence of DM

Parameter	Non-DM	GDM	DMT2
N	1466	238	14
Clinical Parameters			
APGAR Score at 5 minutes	8.23 ± 1.61	8.38 ± 1.2	7.6 ± 1.6
APGAR Score at 10 minutes	9.23 ± 1.6	9.3 ± 1.0	8.8 ± 0.9
Weight (kg)	2.92 ± 0.66	3.12 ± 0.63#	2.57 ± 1.18
Demographics			
Intra-uterine growth restriction	3.2	3.8	0
Polyhydramnios	2.1	9.5#	8.3#
Antenatal Fetal Distress	4.3	5.2	0
Apparent Congenital Malformation	3.5	0.5	0
Shoulder Dystocia	0.3	0.5	0
Intra-uterine Fetal Death	2.2	0	0
Admission to NICU	10.0	5.3	33.3#

Note: Clinical parameters presented as mean ± standard deviation; Demographics presented in percentages (%); *presented as mean (minimum-maximum); #denotes significance as compared to Non-DM group; P-value significant at P < 0.05.

complications are independent of age and BMI. Pregnant patients with DMT2 are known to have higher risks for cesarean section, preterm delivery and neonatal complications than non-DM pregnant subjects independent of obesity [13, 14]. When DMT2 complicated pregnancy is compared to GDM on the other hand, some studies observed modest to no differences in maternal and neonatal outcomes based on insulin therapy [15]. Theoretically, a pregnancy with pre-existing diabetes can cause abnormalities as early as fertilization, while those with gestational diabetes lead more to fetal growth alterations [16]. The findings of the present study confirm such theory in terms of NICU-related admissions from DMT2 group deliveries, with almost 3 out of 10 deliveries ending up in NICU as compared to 1 out of 20 in the GDM group and 1 out of 10 in the Non-DM group. This result is also highlighted as arguably the first documentation of adverse neonatal outcomes from pregnant Saudi patients DMT2 that are far worse than those who only had GDM. Other results of the present study indicate a high incidence of GDM (~14%) in a single center design. Similar local studies also point to alarmingly higher prevalence of GDM in urban areas such as the

Not surprisingly, the most number of complications are present in the DMT2 group as compared to GDM and non-DM group, and these

capital Riyadh (18.7%) [4] as compared to areas outside the capital such as Makkah (5.9%) [17]. While the true prevalence of GDM on a national

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level is yet to be known, it is worthy to note that the studies mentioned, including the present study, utilized big sample sizes in acquiring the incidence of GDM in their respective institutions, which, being tertiary hospitals operated by the government, provide more or less a gross representation of the actual prevalence of GDM in KSA.

The authors acknowledge some limitations. The retrospective design of the study limits the findings to the information available on the records. Furthermore, the big discrepancy in the sample sizes of the groups compared should be interpreted with caution. Nevertheless, this is one of the few studies, if not the first, to compare maternal and neonatal outcomes of GDM, DMT2 and non-DM pregnant Saudi patients.

In summary, maternal and neonatal outcomes of patients with DMT2 are more severe as compared to GDM and non-DM Saudi patients. Outcomes of the GDM group are almost comparable to the non-DM group. Granted that both GDM and DMT2 are factors that merit a high-risk pregnancy, special attention should be given to expectant mothers who already harbor DMT2 to minimize complications.

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Disclosure of conflict of interest

None.

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