OBSTETRICS

Evaluating gestational weight gain recommendations in pregestational diabetes

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OBJECTIVE: The Institute of Medicine (IOM) does not provide recommendations for gestational weight gain (GWG) specific to women with pregestational diabetes. We aimed to assess the impact of GWG outside the IOM recommendations on perinatal outcomes.

STUDY DESIGN: We performed a retrospective cohort study of all singletons with pregestational diabetes from 2008 through 2013. Women were classified as GWG within, less than, or greater than IOM recommendations for body mass index per week of pregnancy. Maternal outcomes examined were cesarean delivery, preeclampsia, and percentage of visits with glycemic control (>50% blood sugars at goal). Neonatal outcomes were birthweight, small for gestational age (<10th percentile), large for gestational age (LGA) (>90th percentile), macrosomia (>4000 g), preterm delivery (<37 weeks), and birth injury (shoulder dystocia, fracture, brachial plexus injury, cephalohematoma). Groups were compared using analysis of variance and χ^2 test, as appropriate. Backwards stepwise logistic regression was used to adjust for confounding factors.

RESULTS: Of 340 subjects, 37 (10.9%) were within, 64 (18.8%) less than, and 239 (70.3%) greater than IOM recommendations. The incidence of cesarean delivery, preeclampsia, glycemic control, preterm delivery, and birth injury were not significantly different between GWG groups. The incidence of LGA and macrosomia increased as GWG category increased (adjusted odds ratio [AOR], 3.08; 95% confidence interval [CI], 1.13–8.39 and AOR, 4.02; 95% CI, 1.16–13.9, respectively) without decreasing the incidence of small for gestational age (AOR, 0.34; 95% CI, 0.10–1.19). Increases in the risk in LGA and macrosomia were not explained by differences in glycemic control by GWG groups.

CONCLUSION: Women with pregestational diabetes mellitus should be counseled to gain within the IOM recommendations to avoid LGA and macrosomic newborns.

Key words: gestational weight gain, pregestational diabetes, pregnancy, type 1 diabetes, type 2 diabetes

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Pregestational diabetes complicates 1% of all pregnancies in the United States.[1,2] The number of pregnancies complicated by diabetes is increasing[3]; the age-adjusted rate of pregestational diabetes doubled from 1996 through 2010.[3] Furthermore, currently one half of pregnant women are overweight or obese[4] and obesity increases the lifetime risk of diabetes by as much as 74% for women.[5,6]

Pregestational diabetes increases the risk for preeclampsia, primary cesarean, fetal anomalies, macrosomia, preterm delivery (PTD), stillbirth, and growth restriction. Maternal glycemic control can reduce the risk of these complications. Given the association among obesity, weight gain, and insulin resistance,[7] gestational weight gain (GWG) in this population may contribute to adverse maternal and neonatal outcomes.

The Institute of Medicine (IOM) has developed guidelines for GWG to target an ideal birthweight.[8] However, these guidelines were developed in a healthy population and no specific guidelines were created for special populations such as pregestational diabetics. GWG is directly linked to birthweight, which is in turn linked to mode of delivery and neonatal outcomes. Therefore, it is essential to evaluate these guidelines as this patient population continues to expand.

Consequently, we aimed to evaluate the effect of GWG in pregestational diabetics outside the IOM guidelines on perinatal outcomes. We predicted a high proportion of women will gain more than IOM recommendations and that these women will have more large-for-gestational-age (LGA) neonates with a higher risk of cesarean delivery, preeclampsia, PTD, and birth injury.

Materials and Methods

This was a retrospective cohort study of all singleton pregnancies at a tertiary care center complicated by pregestational diabetes from 2008 through 2013. The

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TABLE 1
Maternal characteristics by gestational weight gain group

Characteristic	Less than IOM Guidelines, n = 64	Within IOM guidelines, n = 37	Above IOM guidelines, n = 239	*P* value
Age, y	29.8 ± 6.3	27.6 ± 6.6	29.6 ± 6.1	.16
Nulliparous	28 (43.8)	13 (35.1)	92 (38.5)	.65
Race				
White	14 (21.9)	10 (27.0)	81 (33.9)	.26
Black	47 (73.4)	26 (70.3)	133 (55.6)	
Hispanic	3 (4.7)	1 (2.7)	20 (8.4)	
Government insurance	43 (67.2)	25 (67.6)	162 (67.8)	.88
Smoking	15 (23.4)	10 (27.0)	51 (21.3)	.72
Prior C/S	13 (20.3)	11 (29.7)	68 (28.5)	.40
cHTN	29 (45.3)	11 (29.7)	96 (40.2)	.30
White classification				
B	21 (32.8)	11 (29.7)	63 (26.4)	.43
C	9 (14.1)	9 (24.3)	44 (18.4)	
D	31 (48.4)	12 (32.4)	107 (44.8)	
R, F, RF	3 (4.7)	5 (13.5)	25 (10.5)	
Diabetes type				
1	14 (21.9)	14 (37.8)	68 (28.5)	.39
2	48 (75.0)	22 (59.5)	167 (69.9)	
Unknown	2 (3.1)	1 (2.7)	2 (0.8)	
Type 1 diabetes mellitus insulin pump use	5 (7.8)	4 (10.8)	24 (10.0)	.84
Prepregnancy BMI, kg/m^2	37.5 ± 9.8	33.8 ± 10.4	33.9 ± 9.0	.021
Prepregnancy BMI category				
Underweight	1 (1.6)	0 (0)	1 (0.4)	.07
Normal	5 (7.8)	10 (27.0)	28 (11.7)	
Overweight	10 (15.6)	7 (18.9)	54 (22.6)	
Obese	48 (75.0)	20 (54.1)	156 (65.3)	
Gestational weight gain, kg	0.27 ± 5.9	7.2 ± 2.0	17.74 ± 9.6	< .01
Oral medication used during pregnancy (with or without insulin)[a]	14 (21.9)	14 (37.8)	61 (25.5)	.20
Oral medication only (no insulin)[a]	7 (11.3)	5 (13.4)	18 (7.8)	.39

Values reported as absolute number of subjects in that gestational weight gain category within each parameter with percent of patients in parentheses or as mean ± SD.

BMI, body mass index; *IOM*, Institute of Medicine.

[a] Oral medications used were either glyburide or metformin, approximately evenly divided.

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study period was determined by the years when the complete electronic medical record was available for reliable data collection. Institutional review board approval was obtained from the University of Alabama at Birmingham.

Subjects were identified by a diagnosis of pregestational diabetes in our searchable electronic medical records. Subjects who reported a diagnosis of diabetes prior to pregnancy were considered to have pregestational diabetes; women diagnosed with diabetes at any point during pregnancy (even at early gestational ages) were not included in this study. Trained chart abstractors completed standardized chart abstraction forms and the principal investigator reviewed >3% of all abstracted charts. Data collected included maternal demographics, medical and obstetrical history, diabetes diagnosis and care, prenatal blood sugar logs, medication use, labor and delivery events, and neonatal outcomes. Chart abstractors reviewed each patient's blood sugar logs for each visit and determined the number of values recorded, the number of values above goal for each visit, and the number of blood sugars <60 mg/dL. All women were managed under the supervision of maternal-fetal medicine specialists. Per institutional protocol, patients met with a nutritional counselor and diabetic educator at their initial visit and as needed throughout their pregnancy. Also per institutional protocol, patients were seen every 1-2 weeks and adjustments were made to insulin regimen when either >50% of the fasting or 50% of the postprandial blood sugars were elevated. Patients with <3 fasting or 7 postprandial blood sugars recorded were assumed to have poor control. Subjects were excluded for incomplete body mass index (BMI) data, last weight measured >14 days before delivery, major maternal comorbidity unrelated to diabetes mellitus (eg, systemic lupus erythematosus, maternal cardiac disease, HIV), late prenatal care (>26 weeks at first prenatal visit), and any fetal anomalies.

GWG per week of the second and third trimesters was calculated as: (last measured weight minus prepregnancy weight) divided by (gestational age at delivery minus 13), assuming a 0.5-2 kg weight gain in the first trimester. Women were classified as GWG within, less than, or greater than the IOM recommendations for prepregnancy BMI. Prepregnancy BMI was determined by

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