

Retrospective Evaluation of the Relationship Between Glycated Hemoglobin Levels and Infant Birth Weight in Pregnant Women Diagnosed with Gestational Diabetes Mellitus

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What is already known on this topic?

- Gestational diabetes mellitus (GDM) is associated with increased risks of adverse perinatal outcomes, including higher infant birth weight, macrosomia, and increased cesarean delivery rates.
- HbA1c is widely used to assess long-term glycemic control in non-pregnant individuals; however, its role in predicting pregnancy and neonatal outcomes in women with GDM remains controversial.
- Previous studies have reported inconsistent associations between maternal HbA1c levels during pregnancy and neonatal birth weight, partly due to heterogeneity in study design, timing of measurement, and population characteristics.

What this study adds to this topic?

- In this retrospective cohort, maternal HbA1c levels at the time of GDM diagnosis were not independently associated with neonatal birth weight or the presence of neonatal complications.
- Infants born to mothers with GDM had significantly higher mean birth weights and higher cesarean section rates compared with normoglycemic pregnancies, independent of HbA1c levels.
- HbA1c alone is insufficient for predicting fetal growth in GDM and should be interpreted alongside OGTT results and other glycemic monitoring methods.

Abstract

Objective: Gestational diabetes mellitus (GDM) is any level of glucose intolerance disorder that begins or is recognized during pregnancy for the first time. Glycated hemoglobin (HbA1c) is used in DM diagnosis, treatment, and follow-up. However, there is insufficient data to make a comparable interpretation for HbA1c in pregnant women with GDM. This study aimed to investigate the differences in HbA1c levels and newborn birth weights between GDM and healthy pregnant women.

Methods: A total of 391 pregnant women were enrolled in this study. Of these, 192 were diagnosed with GDM based on the oral glucose tolerance test. Additionally, 199 healthy pregnant women with normal glucose levels were monitored as the control group. Outpatient records of patients were retrospectively scanned.

Results: A total of 192 pregnant women with GDM and 199 healthy normoglycemic pregnant women were included in the study. Among all the pregnant women, 320 (81.8%) gave birth via cesarean section (C/S), while 71 (18.2%) had a normal spontaneous vaginal birth. The frequency of C/S was found to be higher in patients diagnosed with GDM ($P < .001$). The mean birth weight of all newborns was calculated as 3127.84 ± 674.17 g. The mean birth weight of infants of mothers with GDM was greater than that of infants of healthy pregnancies ($P < .001$). Newborns with complications in GDM pregnancies had lower birth weights than newborns without complications ($P < .001$). Complications were discovered in 59 (30.7%) of the pregnant women with GDM. Preterm births in GDM pregnancies were found to be statistically significantly lower when compared to normal pregnancies ($P = .01$). No significant correlation was found between the birth weight of newborns and maternal HbA1c ($P > .05$).

Conclusion: No direct effect of HbA1c levels was found on the birth weight of newborns or the development of complications in pregnant women with GDM. These findings indicate a need for further research with larger sample sizes of pregnant women.

Keywords: Gestational diabetes mellitus, HbA1c, infant birth weight, plasma glucose

Introduction

Women's health is a cornerstone of public health, and optimizing maternal health outcomes remains a global priority. Pregnancy represents a unique physiological state, and complications that arise during this period have long-term consequences for both the mother and the child. One of the most significant metabolic complications of pregnancy is gestational diabetes mellitus (GDM), a condition marked by glucose intolerance that is first recognized during pregnancy.¹

Gestational diabetes mellitus is associated with a wide range of maternal and neonatal complications, including preeclampsia, cesarean delivery, fetal macrosomia, shoulder dystocia, and neonatal hypoglycemia. Fetal macrosomia is variably defined in the literature, most commonly as a birth

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weight of ≥ 4000 g or ≥ 4500 g.^{2,3} Beyond these immediate concerns, GDM is also a critical indicator of future cardiometabolic risk, as women with a history of GDM have an elevated likelihood of developing type 2 diabetes mellitus (T2DM) and cardiovascular disease later in life.³ Similarly, offspring of mothers with GDM face increased risks of obesity, impaired glucose tolerance, and metabolic syndrome.⁴

The global prevalence of GDM has risen markedly, reflecting increasing maternal age, obesity, and sedentary lifestyles; estimates vary by diagnostic criteria and population characteristics.⁵ Early identification and management of GDM are essential not only for improving pregnancy outcomes but also for reducing the long-term burden of noncommunicable diseases in women and their children.⁶

Glycated hemoglobin (HbA1c) is widely used in the diagnosis and monitoring of diabetes in nonpregnant individuals due to its ability to reflect average blood glucose levels over the preceding 2-3 months, but physiologic changes in pregnancy and lack of short-term variability capture limit its standalone utility in pregnancy.⁷ Continuous glucose monitoring (CGM) provides complementary dynamic glycemic information that is clinically meaningful in pregnant women with diabetes.⁴ Large cohort and guideline documents underpin current approaches to GDM diagnosis and management.^{1,2}

This study aims to evaluate the relationship between maternal HbA1c levels and infant birth weight in women diagnosed with GDM, contributing to the ongoing discourse on how best to integrate HbA1c measurements into obstetric practice. By comparing GDM pregnancies with normoglycemic pregnancies, this study aims to determine whether HbA1c can serve as a reliable marker for fetal growth outcomes and help inform targeted interventions for women at risk.⁸

Methods

Study Population

Among all pregnant women presenting to internal medicine, gynecology, obstetrics, and diabetes outpatient clinics in İstanbul Kanuni Sultan Süleyman Training and Research Hospital between June 2016 and December 2017 ($n = 391$), 192 women were diagnosed with GDM using the oral glucose tolerance test (OGTT). One hundred and ninety-nine healthy pregnant women with normal glucose levels who were monitored and delivered at the hospital during the same time frame were included as the control group. The outpatient records of both cases and controls were reviewed retrospectively, and no new examinations were requested. Complications during delivery and newborn outcomes were examined and extracted retrospectively from obstetrics and gynecology clinic records. Written informed consent for publication of anonymized data was obtained from all participants.

Pregnant women with the following criteria were excluded: a known history of diabetes, a fasting plasma glucose (FPG) ≥ 126 mg/dL, a second hour plasma glucose ≥ 200 mg/dL on 75 g OGTT, an HbA1c $\geq 6.5\%$, concomitant endocrinopathy (adrenal insufficiency; Cushing's syndrome, etc.) and patients taking medications that alter blood glucose (corticosteroid use, hormone replacement, etc.).⁹

Gestational Diabetes Mellitus Diagnosis

For GDM screening, pregnant women who participated in the study were advised to arrive at 08:00 and fast until 12:00 as per the routine outpatient protocol. First, voluntary consent was obtained and 6 cc venous blood samples were taken to study glucose and

HbA1c values. According to American Diabetes Association (ADA) 2004 criteria, glucose thresholds were accepted as 95 mg/dL at fasting (0 minutes), 180 mg/dL at 1 hour, and 155 mg/dL at 2 hours.³ According to International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria, thresholds were accepted as 92 mg/dL at fasting (0 minutes), 180 mg/dL at 1 hour, and 153 mg/dL at 2 hours.² In order to be diagnosed with GDM, at least 2 values must be equal to or higher than the ADA 2004 glucose thresholds, while at least one value must be equal to or higher than the IADPSG glucose thresholds.

Ethics Committee Approval

The ethical approval for this study was obtained from The Republic of Türkiye Ministry of Health, Public Hospitals Institution of Türkiye, İstanbul Province Bakırköy Region Public Hospitals Union General Secretariat University of Health Sciences Sadi Konuk Training and Research Hospital clinical research Ethics Committee (Approval No.: 2017269; Date: September 8, 2017).

Statistical Analysis

The SPSS version 15 (SPSS Inc.; Chicago, IL, USA) program was used for statistical analyses. Continuous variables were presented as mean \pm standard deviation (SD), with values ranging from lowest to highest. The conformity of the data to the normal distribution was evaluated using the Kolmogorov-Smirnov test. The Independent samples *t*-test was used to compare continuous data, while the Chi-square test was used to compare categorical variables. The Spearman and Pearson correlation tests were used to evaluate interdata correlation. For all tests, $P < .05$ was identified as the statistical significance level.

Results

A total of 391 pregnant women were included in the analysis; 192 (49.1%) were diagnosed with GDM and 199 (50.9%) served as controls. Laboratory results and timing of GDM diagnosis are summarized in Table 1.

In women with GDM, median (range) values were: AST 15.0 (8.0–80.0) mg/dL, ALT 12.0 (4.0–115.0) mg/dL, GGT 11.0 (2.0–139.0) mg/dL, ALP 87.5 (13.3–451.0) IU/L, and MPV 10.7 (7.2–13.8) fL (Table 1). The median/mean HbA1c values by week of diagnosis are presented in Table 2.

The overall mean birth weight was 3127.8 ± 674.2 g. Birth weight distribution for the cohort is shown in Table 3: 84/391 (21.5%) newborns weighed 2501–3000 g, 137/391 (35.0%) weighed 3001–3500 g, and 85/391 (21.7%) weighed 3501–4000 g. Using macrosomia defined as ≥ 4000 g, 6.8% ($n = 13/192$) of infants of GDM mothers and 3.5% ($n = 7/199$) of infants of non-GDM mothers met this criterion ($P = .003$).

Overall, 320/391 (81.8%) deliveries were by cesarean section (C/S) and 71/391 (18.2%) were spontaneous vaginal deliveries. Cesarean section was significantly more frequent among women with GDM than controls ($P < .001$) (Table 4). Mean birth weight was higher in infants born to mothers with GDM compared with controls (3249.5 ± 661.7 g vs. 3010.4 ± 666.7 g; $P < .001$) (Table 2).

Preterm birth (< 37 weeks) occurred in 36/192 (18.8%) of GDM pregnancies vs. 64/199 (32.2%) of controls ($P = .01$). Term deliveries (37–41+6 weeks) accounted for 148/192 (77.1%) of GDM pregnancies and 128/199 (64.3%) of controls; postterm/late term deliveries were uncommon in both groups (Table 2).

Among the 192 GDM pregnancies, 59 (30.7%) infants experienced one or more neonatal complications. Of these 59 infants, 34 (57.6%) had transient neonatal tachypnea, 15 (25.4%) had hyperbilirubinemia, 7 (11.9%) had cardiac anomaly, 2 (3.4%)

Table 1. Distribution of HbA1c and Biochemical Parameters of Patients with GDM

Laboratory Findings	Median (Min-Max)
AST (mg/dL)	15.0 (8.0-80.0)
ALT (mg/dL)	12.0 (4.0-115.0)
GGT (mg/dL)	11.0 (2.0-139.0)
ALP (mg/dL)	87.50 (13.3-451.0)
MPV (fl)	10.70 (7.2-13.8)
HbA1c (mg/dL)	n (%)
4-4.5	4 (2)
4.6-5	35 (17.1)
5.1-5.5	87 (42.4)
5.6-6	49 (23.9)
6.1-6.4	23 (11.2)
6.5-7.5	7 (3.4)
GDM Week of Diagnosis (Week)	n (%)
10	1 (0.5)
14	1 (0.5)
16	2 (1)
17	1 (0.5)
18	1 (0.5)
20	3 (1.5)
21	2 (1)
23	1 (0.5)
24	6 (3)
25	11 (5.4)
26	21 (10.3)
27	17 (8.4)
28	43 (21.2)
29	21 (10.3)
30	16 (7.9)
31	16 (7.9)
32	9 (4.4)
33	9 (4.4)
34	6 (3)
35	8 (3.9)
36	6 (3)
37	1 (0.5)
38	1 (0.5)

GDM, gestational diabetes mellitus; HbA1c, glycated hemoglobin; AST, aspartate aminotransferase; ALT, alanine aminotransferase; GGT, gamma-glutamyl transferase; ALP, alkaline phosphatase; MPV, mean platelet volume

Table 2. Evaluation of Labor-related Complications in Pregnant Women with GDM

	Complication		P
	Yes	No	
	Mean ± SD	Mean ± SD	
*Biochemical findings			
HbA1c	5.42 ± 0.54	5.41 ± 0.52	.860
AST (mg/dL)	19.9 ± 12.1	17.3 ± 9.1	.200
ALT (mg/dL)	19.3 ± 21.7	14.3 ± 12.1	.030
GGT (mg/dL)	14.6 ± 11.1	15.8 ± 21.7	.460
ALP (mg/dL)	103.1 ± 67.6	86.9 ± 28.5	.530
MPV (fL)	10.9 ± 1.3	10.6 ± 1.2	.190
*Obstetric findings			
Birth weight (grams)	2869.5 ± 786.9	3418.1 ± 518.1	<.001
GDM—Week of diagnosis	28.7 ± 4.12	28.3 ± 4.1	.550
	n (%)	n (%)	P
*Birth weight			
Low	16 (27.1)	4 (3.0)	<.001
Normal	40 (67.8)	119 (89.5)	
Macrosomia	3 (5.1)	10 (7.5)	
**Week of birth			
Preterm	23 (39.0)	13 (9.8)	<.001
Term	35 (59.3)	113 (85.0)	
Postterm	1 (1.7)	7 (5.2)	
**Week of diagnosis			
First trimester	0 (0)	1 (0.8)	.530
Second trimester	28 (47.4)	73 (54.9)	
Third trimester	31 (52.6)	59 (44.3)	

*The independent sample *t*-test was used to compare continuous data.

**The Chi-square test was used to compare categorical variables.

HbA1c, glycated hemoglobin; AST, aspartate aminotransferase; ALT, alanine aminotransferase; GGT, gamma-glutamyl transferase; ALP, alkaline phosphatase; MPV, mean platelet volume

experienced hypoglycemia, and 1 (1.7%) had diaphragmatic hernia. Infants with complications had significantly lower mean birth weight than those without complications (2869.5 ± 786.9 g vs. 3418.1 ± 518.1 g; $P < .001$).

Among infants of GDM mothers, 16/59 (27.1%) with complications were low birth weight (<2500 g) compared with 4/133 (3.0%) without complications ($P < .001$). Conversely, macrosomia (≥4000 g) was observed in 3/59 (5.1%) of infants with complications vs. 10/133 (7.5%) without complications (Table 4). Preterm delivery was more frequent among infants with complications (23/59, 39.0%) than among those without (13/133, 9.8%) ($P < .001$).

Table 3. Distribution of All Newborns' Birth Weights

	Mean ± SD
Baby birth weight (g)	3127.84 ± 674.17
Baby birth weight (g) (groups)	n (%)
1000-1500	8 (2)
1501-2000	16 (4.1)
2001-2500	41 (10.5)
2501-3000	84 (21.5)
3001-3500	137 (35)
3501-4000	85 (21.7)
4001-4500	15 (3.8)
4501-5000	4 (1)
5001-5500	1 (0.3)
Week of birth	n (%)
28	1 (0.3)
30	3 (0.8)
31	5 (1.3)
32	12 (3.1)
33	1 (0.3)
34	12 (3.1)
35	21 (5.4)
36	45 (11.5)
37	49 (12.5)
38	94 (24.1)
39	92 (23.5)
40	41 (10.5)
41	12 (3.1)
42	2 (0.5)
43	1 (0.3)

Mean maternal ALT was higher among mothers whose infants developed complications compared with those whose infants did not (19.3 ± 21.7 mg/dL vs. 14.3 ± 12.1 mg/dL; *P* = .030) (Table 2). No other routine biochemical markers differed significantly.

Maternal HbA1c was positively correlated with the week of GDM diagnosis (Spearman's rho = 0.175; *P* = .010) and with maternal ALP (rho = 0.262; *P* = .001) (Table 5). In the subgroup diagnosed between 24 and 28 weeks, no significant correlation was found between maternal HbA1c and infant birth weight. Overall, infant birth weight was not significantly correlated with maternal HbA1c, AST, ALT, GGT, ALP, or MPV (all *P* > .05).

Discussion

Gestational diabetes mellitus remains the most common metabolic disorder of pregnancy and carries a substantial global public

Table 4. Comparison of Birth Outcomes of Healthy Pregnant Women and Pregnant Women with GDM

	GDM	Healthy Pregnant Women	<i>P</i>
	Mean ± SD	Mean ± SD	
*Birth weight (g)	3249.5 ± 661.7	3010.4 ± 666.7	<.001
	n (%)	n (%)	<i>P</i>
**Method of delivery			
C/S	178 (92.7)	142 (71.4)	.001
NSD	14 (7.3)	57 (28.6)	
**Birth weight			
Low*	20 (10.4)	45 (22.6)	.003
Normal	159 (82.8)	147 (73.9)	
Macrosomia	13 (6.8)	7 (3.5)	
**Week of birth			
Preterm	36 (18.8)	64 (32.2)	.01
Term	148 (77.1)	128 (64.3)	
Postterm	8 (4.2)	7 (3.5)	

*The independent sample *t*-test was used to compare continuous data.
 **The Chi-square test was used to compare categorical variables.

health burden because of its short and long term consequences for mothers and offspring.¹⁰ Despite this, substantial uncertainty and heterogeneity persist across clinical guidelines for screening, diagnosis, and treatment, which hampers consistent prevention and management at the population level.¹¹ Growing evidence links GDM to multiple adverse perinatal outcomes and later cardiometabolic risk in both mother and child.¹² From a public health perspective, the rising prevalence of GDM—driven in part by increasing rates of obesity, delayed childbearing, and population aging—translates into higher healthcare utilization and costs, greater demand for neonatal and long term chronic disease services, and amplified health inequalities.¹³ Because maternal hyperglycemia also programs offspring risk for obesity and diabetes, effective prevention and management of GDM offer a unique opportunity to interrupt intergenerational transmission of cardio-metabolic disease and to achieve substantial population health gains.¹⁴

Perinatal risks associated with GDM are well documented: newborns of mothers with GDM have increased risk of macrosomia and perinatal complications including large for gestational age (LGA- large for gestational age—commonly defined as birth weight >90th percentile for gestational age, shoulder dystocia, brachial plexus injury, clavicle fracture, and perinatal asphyxia.¹⁵ In the study population, nearly half of GDM diagnoses (48.3%) were made in the conventional 24-28 weeks screening window and only a single patient was diagnosed in the first trimester. Because the design was case-control, clinic level incidence cannot be reported; nonetheless, the concentration of diagnoses in the mid pregnancy window reinforces the public health importance of timely screening and the need to identify and target high-risk women earlier when appropriate.

The role of HbA1c in GDM screening and monitoring remains controversial. Glycated hemoglobin reflects mean glycemia over

Table 5. Correlation of Birth Weight and HbA1c Level with Other Parameters

		HbA1C	AST	ALT	GGT	ALP	MPV
Birth weight	<i>r</i>	0.084	-0.130	-0.037	-0.006	-0.133	-0.031
	<i>P</i>	0.240	0.080	0.620	0.940	0.100	0.680
		Week of diagnosis	AST	ALT	GGT	ALP	MPV
HbA1C	<i>r</i>	0.175	-0.022	-0.012	-0.032	0.262	0.068
	<i>P</i>	0.010	0.770	0.870	0.700	0.001	0.350

Correlations were assessed using Spearman's rank correlation. HbA1c, glycated hemoglobin; AST, aspartate aminotransferase; ALT, alanine aminotransferase; GGT, gamma-glutamyl transferase; ALP, alkaline phosphatase; MPV, mean platelet volume

the preceding 8-12 weeks but does not capture short-term variability such as postprandial hyperglycemia, a pattern particularly relevant to fetal overgrowth.¹⁶ Heterogeneity in study populations, timing of measurement, and diagnostic criteria for GDM has produced inconsistent findings about which HbA1c thresholds—if any—predict adverse pregnancy outcomes.¹⁷ For example, worse outcomes have been reported among Asian Indian women with GDM at HbA1c >5.0% (31 mmol/mol),^{18,19} while other work has linked an HbA1c cutoff of 6.0% (42 mmol/mol) at diagnosis to increased risks of macrosomia, neonatal asphyxia, cesarean delivery, preeclampsia, and placental abruption.²⁰ An older Taiwanese study of high-risk women reported associations between mid-pregnancy HbA1c values below 4.5% and at 6% and adverse outcomes.²¹ These disparate findings illustrate how timing, population, and endpoint selection alter apparent associations. In contrast to these heterogeneous reports, the findings clearly demonstrated that maternal HbA1c was not associated with infant birth weight, neither in the overall cohort nor across the wide diagnostic window of 10-38 gestational weeks. This result underscores that, within the population, HbA1c at the time of GDM diagnosis did not predict fetal growth.

Because HbA1c tends to be lower in pregnancy and does not reflect daily glycemic excursions, relatively few patients cross conventional diagnostic thresholds even when glycemic control is suboptimal.²² Nevertheless, a sizable subset of women in the cohort—roughly one-third—fell into high-risk categories despite recent diagnosis. This suggests that even moderate elevations in HbA1c at diagnosis, when interpreted alongside other clinical data, may identify women needing intensified monitoring or earlier intervention.²³ However, current evidence does not support using HbA1c alone for diagnosis or as the sole monitoring tool in pregnancy; it is better used in conjunction with self-monitoring of blood glucose (SMBG) and, where available, CGM.²⁴ The results further support this view, as HbA1c alone did not reflect variations in neonatal birth weight, highlighting the limitations of relying on HbA1c as an indicator of fetal overgrowth risk.

Consistent with prior studies, increased birth weight and a higher frequency of neonatal complications were observed among infants of mothers with GDM in the cohort. Sacks et al²³ characterized direct GDM complications as LGA newborns, primary cesarean delivery, and neonatal hypoglycemia, with indirect complications including preterm birth, birth injuries, need for neonatal intensive care, hyperbilirubinemia, and preeclampsia. In the study, the most frequent neonatal complications were transient tachypnea, jaundice, and cardiac anomalies. A lower incidence of preterm birth was observed than compared with some reported series, which may reflect the multidisciplinary approach, frequent antenatal follow-up, and practice of early hospitalization for high-risk cases.

Obstetric management patterns in the cohort also deserve emphasis. Cesarean delivery was common among women with GDM (81.8% in the sample). While GDM itself is not an absolute indication for C/S, fetal overgrowth and obstetric complications (failed induction, non-progressive labor, fetal distress) increase cesarean risk; clinical guidance (e.g., ACOG) recommends consideration of elective cesarean when estimated fetal weight is ≥4500 g in diabetic pregnancies.³ The high cesarean rate likely reflects both the true increased obstetric risk in GDM and referral bias inherent to a tertiary care center, which limits generalizability.

Limitations

Since it is a retrospective and single-center study, the study has some inevitable limitations. Because the true frequency of GDM in the population where the study was conducted was not clearly known and no preliminary assessment of maternal awareness existed, the lack of complete documentation in medical files created challenges for detailed analysis. Furthermore, the assessment of perinatal complications was based solely on file records; therefore, additional clinical conditions that developed in the postpartum intensive care unit—such as intubation, mortality, or retinopathy of prematurity—could not be evaluated. Another limitation arising from the retrospective design was that the gestational age at GDM diagnosis varied widely, ranging from 10 to 38 weeks, which may have introduced heterogeneity in the interpretation of metabolic parameters and perinatal outcomes. On the other hand, the evaluation of HbA1c levels and their correlation with routinely assessed biochemical markers provided important clinical insights.

There is insufficient evidence for the follow-up on HbA1c levels alone in pregnant women, regardless of GDM presence. Therefore, monitoring HbA1c levels in pregnant women with pre-pregnancy DM seems more rational. All pregnant women with FPG, HbA1c, or random PG should be screened in the first trimester, and all pregnant women without overt diabetes or GDM should be screened with 75 g OGTT between the 24th and 28th weeks of gestation. In pregnant women with GDM, HbA1c levels should be measured in addition to the SMBG. Lifestyle changes (diet, exercise) should be recommended to all women with GDM. Pregnant women with GDM should be informed about the risk of developing T2DM during the postpartum period (4th-12th week) and should be followed up on at least every 3 years for the rest of their lives. If prediabetes (impaired fasting glucose/impaired glucose tolerance) is detected during these times, lifestyle changes (diet and exercise) should be advised.

In this retrospective single-center cohort, no significant independent association was observed between maternal HbA1c measured at diagnosis and neonatal birth weight or the frequency of perinatal complications. Routine OGTT screening at 24-28

weeks, coupled with close glycemic monitoring and individualized risk assessment, remains the most evidence-based strategy for detecting and managing GDM. To clarify the role of HbA1c in risk stratification and monitoring, large prospective multicenter studies are needed in which HbA1c is measured at standardized times (including preconception where possible), and findings are analyzed in conjunction with SMBG/CGM data and robust adjustment for confounders. Such studies will be essential to define pregnancy-specific HbA1c targets and to inform public-health strategies aiming to reduce GDM-related morbidity.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of University of Health Science, Sadi Konuk Training and Research Hospital (Approval No.: 2017269; Date: September 8, 2017).

Informed Consent: Written informed consent was obtained from the participants who agreed to take part in the study.

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