

Original Article



The Relationship Between Glycated Hemoglobin and the Control of Gestational Diabetes, Maternal and Fetal Complications: A Cross-Sectional Study

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Abstract

Introduction: Diabetes is a common medical complication that women may experience during pregnancy. HbA1c can indicate the glycemic history and glucose levels over the past two to three months. This study investigated the correlation between HbA1c and the control of gestational diabetes as well as maternal and fetal complications.

Methods: This cross-sectional study included 146 pregnant women diagnosed with GDM via OGTT at ≥24 weeks of gestation, referred to Besat Hospital, Sanandaj, between 2017–2019. FBS, 2-hour postprandial glucose, and HbA1c were monitored every 4 weeks from 24 weeks until delivery. Maternal complications (preeclampsia, cesarean delivery, preterm birth) and neonatal complications (macrosomia, IUGR, hypoglycemia) were assessed. Data were analyzed using SPSS v.21 with Fisher's exact test and t-test.

Results: The study revealed that only 9 (6.2%) pregnant women with gestational diabetes had an HbA1c level higher than 6%. All women with an abnormal HbA1c had preeclampsia (22.2% versus 2.2%). Fisher's exact test showed that there was a significant relationship between HbA1c levels greater than 6% and preeclampsia ($P=0.03$), the need for insulin therapy ($P<0.0001$), cesarean section rate ($P<0.0001$), and neonatal hypoglycemia ($P=0.016$). There was no statistically significant relationship between maternal age ($P=0.09$), body mass index ($P=0.14$), preterm labor ($P=0.4$), birth weight ($P=0.1$), and maternal HbA1c.

Conclusion: According to our study, an HbA1c level of 5% is the ideal cutoff point during pregnancy. The study also found that if the HbA1c levels exceed 6% in pregnant women with gestational diabetes, it may increase the risk of preeclampsia, cesarean section, and neonatal hypoglycemia.

Keywords: Gestational diabetes, HbA1c, Preeclampsia, Preterm labor, Cesarean section, Macrosomia

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Introduction

Diabetes is a common medical complication that can occur during pregnancy. Two types of diabetes can affect expectant mothers: overt diabetes, which is diagnosed before pregnancy, and gestational diabetes, which is diagnosed during pregnancy. Both conditions pose risks to the health of the mother and baby.^{1,2}

Insulin needs to increase during pregnancy due to greater caloric intake, weight gain, and placental hormones like growth hormone and lactogen. As pregnancy progresses, pancreatic β -cell mass rises to meet insulin demand. Inadequate β -cell expansion and insufficient insulin secretion can lead to gestational diabetes mellitus (GDM). The risk factors for GDM are clearly defined and

include advanced maternal age, obesity, ethnicity, a family history of type 2 diabetes, previous occurrences of fetal or neonatal death, congenital anomalies, prematurity, or macrosomia.³

Gestational diabetes is typically diagnosed using an oral glucose tolerance test (OGTT) conducted between 24 and 28 weeks of gestation in pregnant women who initially have normal blood sugar levels.⁴ According to a systematic review and Meta-analysis conducted by Behboudi-Gandevani et al. the overall prevalence of gestational diabetes in Iran was 10.6%.⁵

Gestational diabetes is usually screened for between 24 and 28 weeks of pregnancy in women who have normal fasting glucose levels in the first trimester. The screening



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process involves two stages. First, a blood glucose test is performed after the patient consumes 50 grams of oral glucose (the Glucose Challenge Test, or GCT). If the GCT result exceeds 140 mg/dL, a second testing stage is conducted using either a 100-gram or 75-gram Oral Glucose Tolerance Test (OGTT).⁶ Complications associated with gestational diabetes in mothers can include hypertensive disorders, preterm labor, fetal damage, and neonatal complications. These neonatal complications may consist of intrauterine growth restriction (IUGR), macrosomia, shoulder dystocia, and hypoglycemia at birth. In addition, there is an increased risk of obesity in childhood and a higher likelihood of developing overt diabetes later in life.^{6,7}

The first step in treating gestational diabetes mellitus (GDM) is to change lifestyle and diet, which in many cases is the only intervention necessary.⁸ To reduce complications, managing maternal weight, providing nutritional therapy, encouraging physical activity, and monitoring glucose levels before considering medication options are important.⁹

The first-line treatment for gestational diabetes, after lifestyle changes fail, is insulin, which is FDA-approved.³

ACOG recommends metformin as the preferred oral antihyperglycemic agent for women who decline insulin therapy or are unable to afford or safely use insulin.⁸

Research indicates that effectively managing mild gestational diabetes mellitus (GDM) has significant benefits. Treating GDM can reduce the rates of preeclampsia, cesarean sections, macrosomia, shoulder dystocia, large-for-gestational-age infants, and respiratory distress syndrome. However, it's important to note that controlling GDM does not significantly lower the risk of small-for-gestational-age infants. This lack of impact may be attributed to overtreatment and occurrences of clinical neonatal hypoglycemia, as well as potential long-term metabolic issues for the offspring.¹⁰

Glycated hemoglobin (HbA1c) was first identified by Huisman in 1958.¹¹ Elevated levels of HbA1c in diabetic patients were later reported by Rahbar in 1969.¹² The HbA1c level reflects average blood glucose over two to three months, indicating glycemic control and its association with long-term diabetes complications.¹² During the first and second trimesters of pregnancy, HbA1c levels decrease; in the third trimester, they tend to increase. Generally, about 80% of total hemoglobin is glycated. It's important to note that HbA1c levels are typically lower during pregnancy than non-pregnant individuals, reaching up to 5% in the first trimester and 6% in the second trimester.¹³ The mean HbA1c level in nondiabetic women is $5.4 \pm 0.5\%$, while it is $6.2 \pm 0.6\%$ in women with gestational diabetes mellitus (GDM). For diabetic patients with adequate glycemic control, their HbA1c levels are similar to those of normoglycemic individuals.⁴

According to a retrospective cohort study, pregnant women with HbA1c levels ranging from 5.7% to 6.4% at 20 weeks of gestation had a higher risk of developing

GDM (gestational diabetes mellitus) compared to those with normal HgbA1c values, with 27.3% and 8.7%, respectively.¹⁴ The recommended glucose level during pregnancy is a fasting blood glucose of 90 mg/dL and a 2-hour post-prandial level of 120 mg/dL, corresponding to an HbA1c level of 5.3%.^{15,16} While the HbA1c level is important as a prognostic tool, it is still unknown what the appropriate cutoff for HbA1c is in controlling patients with gestational diabetes and minimizing fetomaternal complications.¹⁷ This study aims to determine the appropriate HbA1c cutoff for controlling gestational diabetes and reducing maternal and fetal complications.

Methods

This was cross-sectional study conducted on pregnant women diagnosed with gestational diabetes via a glucose tolerance test at 24 weeks of gestation. Considering the prevalence of gestational diabetes of 10.5%, a 95% confidence level and a test power of 95%, the minimum sample of 145 people was determined. These people were selected through available sampling. We used the formula for sample size:

$$n = \left(\frac{Z^2 \times p(1-p)}{E^2} \right)$$

$$n \approx 145.44$$

These women were evaluated in a high-risk prenatal clinic in Sanandaj between 2017 and 2019. Inclusion criteria included examined pregnant women diagnosed with gestational diabetes via a glucose tolerance test at 24 weeks of gestation and exclusion criteria included chronic hypertension, overt diabetes, twin pregnancies, and underlying diseases such as lupus or renal failure, and the use of corticosteroid therapy.

Written informed consent was obtained from all pregnant women at gestational week 24 prior to their enrollment in the study.

The diabetic patients were initially treated with a diet and then monitored weekly for their fasting blood sugar (FBS) and glucose levels two hours postprandial, with HbA1c measurements every four weeks starting from 24 weeks of gestation. The patients were followed until delivery to assess insulin requirements and any fetomaternal complications, including preeclampsia, cesarean delivery, preterm delivery, maternal and fetal macrosomia, intrauterine growth restriction (IUGR), and neonatal hypoglycemia.

SPSS version 21 was used to assess the recorded data. Fisher's exact test assessed the relationship between HbA1c levels and maternal and fetal complications. A t-test was conducted to compare continuous variables, specifically normal versus abnormal HbA1c test results.

Results

The study investigated 146 pregnant women with gestational diabetes and found that 2.6% of them had

HbA1c levels exceeding 6%. An independent t-test revealed no significant differences in HbA1c levels when considering factors such as maternal age, gravidity, parity, and body mass index (Table 1).

Approximately 20.5% of patients had a history of diabetes in their previous pregnancies, while 5.29% had a family history of the condition. Patients with HbA1c levels greater than 6% faced a higher risk of complications from gestational diabetes compared to those with lower levels. Furthermore, those with a history of previous gestational diabetes were more likely to have HbA1c levels above 6% (see Table 1). No complications were observed in patients whose HbA1c levels were less than 5%.

The study found that 3.4% of participants had abnormal blood pressure levels. Among those with HbA1c levels above 6%, the incidence rates for severe preeclampsia, macrosomia, and low birth weight infants were higher, recorded at 22.2% for each condition. In contrast, patients with HbA1c levels below 6% had incidence rates of 22.2% for severe preeclampsia, 5.1% for macrosomia, and 3.6% for low birth weight infants (Tables 2-3).

The study found that only the incidence of preeclampsia was statistically significant, with a p-value of 0.03.

We found no cases of preterm labor in women with HbA1c levels above 6%. However, the cesarean section rate was significantly higher at 77.8% compared to 14.6% in women with normal HbA1c levels ($P=0.0001$) (see Table 3).

Many patients were able to manage their gestational diabetes through diet alone, while some required insulin therapy ($P=0.0001$). Among the patients, 10 (7.3%) pregnant women with HbA1c levels lower than 6% initiated insulin therapy, and 3 (2.2%) switched from insulin therapy to dietary management during their pregnancy. In contrast, with HbA1c levels above 6%, 20 (14.6%) pregnant women on a diet who had advanced gestational age needed to transition to insulin therapy.

Table 1. Relationship between glycated hemoglobin and baseline maternal characteristics

Variables		HbA1c		P*
		HbA1c<6%	HbA1c>6%	
Age		29.9±4.3	32.9±5.8	0.09
Gravidity		1.1±1.1	2.2±1.2	0.4
Parity		0.7±0.8	1±1.1	0.46
Body Mass Index		37.5±3.2	29.6±4.6	0.14
History of Previous Gestational Diabetes	Yes	27(19.7%)	3(33.3%)	0.39
	No	110(80.3%)	6(66.7%)	

*t-test and Fisher's exact-test.

Table 2. Relationship between glycosylated hemoglobin and Preeclampsia

Variables		HbA1c		P*
		HbA1c<6%	HbA1c>6%	
Preeclampsia	No	134(97.8%)	7(77.7%)	0.03
	Sever	3(2.2%)	2(22.2%)	

*Fisher's exact-test.

The incidence of insulin therapy was significantly higher, at 55.6%, for women with HbA1c levels above 6%, compared to just 3.6% for those with levels below 6% (refer to Table 3). Additionally, neonates born to mothers with HbA1c levels above 6% had a higher rate of hypoglycemia ($P=0.01$) (see Table 4).

Discussion

This study aims to determine the appropriate HbA1c cutoff for controlling gestational diabetes and reducing maternal and fetal complications. According to the study, an HbA1c level of 5% during pregnancy is the optimal cutoff point. It was found that HbA1c levels greater than 6% observed in 2.6% of pregnant women with gestational diabetes may increase the risk of several complications, including preeclampsia, cesarean section, and neonatal hypoglycemia. Additionally, higher HbA1c levels result in an increased risk of maternal, fetal, and neonatal complications such as preeclampsia and preterm delivery. Conversely, when HbA1c levels were below 5%, there were no reported maternal, fetal, or neonatal complications.

While HbA1c cannot be used as an alternative test for OGTT in the screening and diagnosis of gestational diabetes,¹⁸ Muhuza et al. showed it is a suitable method for predicting adverse pregnancy outcomes.¹⁹ However, there is not enough evidence to support the use of serial HbA1c tests during pregnancy for predicting adverse pregnancy outcomes.

A study by Sherwani et al. found that HbA1c levels exceeding 4.5–4.9% during mid-pregnancy were significantly linked to increased risks of gestational hypertension or preeclampsia, preterm delivery, neonatal

Table 3. Relationship between glycosylated hemoglobin and pregnancy outcomes

Variables		HbA1c		P*
		HbA1c<6%	HbA1c>6%	
Time of Delivery	Preterm	10(7.3%)	0	0.4
	Term	127(92.7%)	9(100%)	
Type of Delivery	Cesarean Section	20(14.6%)	7(77.8%)	0.0001
	Normal Delivery	117(85.4%)	2(22.2%)	
Treatment Regimen	Insulin	5(3.6%)	5(55.6%)	0.0001
	Diet to Insulin	17(12.4%)	3(33.3%)	
	Insulin to Diet	3(2.2%)	0	
	Diet	112(81.8%)	1(11.1%)	

*Fisher's exact-test.

Table 4. Relationship between glycosylated hemoglobin and neonatal outcomes

Variables		HbA1c		P*
		HbA1c<6%	HbA1c>6%	
Neonatal Weight	>4000g	7(5.1%)	2(22.2%)	0.1
	<4000g	130(94.9%)	7(77.8%)	
Neonatal Blood glucose	Abnormal (BS<40)	7(5.1%)	3(33.3%)	0.01
	Normal (BS≥40)	130(94.9%)	6(66.7%)	

*Fisher's exact-test.

intensive care unit admissions, low birth weight, and macrosomia.¹² Wong et al's study found that women diagnosed with gestational diabetes mellitus (GDM) and with elevated HbA1c levels (>5.4%) required close monitoring throughout their pregnancy.²⁰

Old studies demonstrated in 2010 that HbA1c levels above 7% can predict preterm delivery in diabetic pregnant women.²¹ According to the study, none of the women with abnormal HbA1c levels experienced preterm labor, as all patients had levels below 7%. However, a survey conducted by Akhlaghi and colleagues found that 26.7% of diabetic pregnant women experienced preterm labor.^{22,23}

There is a correlation between the mode of delivery and maternal HbA1c levels. In this study, 77.8% of patients with an HbA1c level above 6% underwent Cesarean sections, while only 14.6% of those with an HbA1c level below 6% had the same outcome. Ducarme and Sweeting reported increased risk of cesarean section and a significant relationship was also observed between cesarean delivery and neonatal morbidity.^{22,23} Higher maternal HbA1c levels than 5.6% are associated with an increased frequency of primary Cesarean sections.^{24,25} Uncontrolled gestational diabetes mellitus (GDM) is believed to be the underlying cause.

In This study, it was found that there is a relationship between maternal HbA1c levels and the treatment strategy required during pregnancy. If HbA1c levels are above 6%, The amount of insulin required has increased by 5.5 times. A study conducted by Ducarme and colleagues found that 36% of pregnant women required insulin therapy for glycemic control.²² Study revealed that HbA1c levels can be important in determining the need for insulin therapy. Pertot and colleagues also discovered that while irreversible factors such as family history, prior GDM, or baseline glycemia at diagnosis of GDM are important, HbA1c levels are a significant factor in predicting the need for insulin therapy.²⁶

A study found that the incidence of macrosomia was 6.5%. Pregnant women with abnormal HbA1c levels had a higher prevalence of neonatal weights exceeding 4000 grams compared to those with normal HbA1c levels. Olmos and colleagues reported a significantly increased risk of neonatal macrosomia in women with HbA1c levels greater than 6%.²⁷ Additionally, an HbA1c level above 5.9% indicates a higher risk of being large for gestational age, with a risk ratio of 2.7, and macrosomia, with a risk ratio of 3.5.²⁴

Research has shown that newborns born to mothers with an HbA1c level above 6% are at a higher risk of experiencing hypoglycemia compared to those whose mothers have an HbA1c level below 6%. This increased risk may be linked to the strict management of blood sugar levels in the mother during the final weeks of pregnancy. A study by Kiefer et al. found that for every 6 mmol/mol (0.5%) reduction in HbA1c, the likelihood of having a larger-than-average infant decreases by 12%, the risk of neonatal hypoglycemia decreases by 7%, and the risk of preterm birth also decreases. However, these benefits

were not seen in cases involving Cesarean delivery or preeclampsia.²⁸

Numerous studies have been conducted to establish an appropriate HbA1c cutoff in gestational diabetes as a diagnostic or prognostic tool.²⁹ These studies have reported that the HbA1c level cutoff point ranges from 5.3% to 5.7%, with a sensitivity of 95.6% and a low specificity of 52%.^{4,13} In a study involving 321 Korean women, researchers found that an HbA1c level cutoff point of 5.05% exhibited 91% sensitivity and 62% specificity. Based on their findings, the optimal HbA1c level cutoff point was deemed to be 5%.

One limitation of this study is that the access of pregnant women to basic health care and fetal health screening, which could affect maternal and fetal outcomes, could not be controlled.

It is recommended to conduct the study with a control group of pregnant mothers who do not have gestational diabetes.

Conclusion

The study found that patients with gestational diabetes who have HbA1c levels above 6% are at a higher risk of experiencing complications such as preeclampsia, cesarean delivery, and neonatal hypoglycemia. Conversely, when HbA1c levels are below 5%, no maternal or fetal complications were observed.

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Competing Interests

There is no conflict of interest.

Ethical Approval

The Ethics Committee of Kurdistan University of Medical Sciences approved this research with ethical code: IR.MUK.REC.14/2294/4113.

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References

1. Kampmann U, Madsen LR, Skajaa GO, Iversen DS, Moeller N, Ovesen P. Gestational diabetes: a clinical update. *World J Diabetes* 2015;6(8):1065-72. doi:10.4239/wjd.v6.i8.1065

2. Renz PB, Cavagnoli G, Weinert LS, Silveiro SP, Camargo JL. HbA1c test as a tool in the diagnosis of gestational diabetes mellitus. *PLoS One* 2015;10(8): e0135989. doi:[10.1371/journal.pone.0135989](https://doi.org/10.1371/journal.pone.0135989)
3. Lende M, Rijhsinghani A. Gestational diabetes: overview with emphasis on medical management. *Int J Environ Res Public Health* 2020;17(24):9573. doi:[10.3390/ijerph17249573](https://doi.org/10.3390/ijerph17249573)
4. Soumya S, Rohilla M, Chopra S, Dutta S, Bhansali A, Parthan G, et al. HbA1c: a useful screening test for gestational diabetes mellitus. *Diabetes Technol Ther* 2015;17(12):899-904. doi:[10.1089/dia.2015.0041](https://doi.org/10.1089/dia.2015.0041)
5. Behboudi-Gandevani S, Amiri M, Bidhendi Yarandi R, Ramezani Tehrani F. The impact of diagnostic criteria for gestational diabetes on its prevalence: a systematic review and meta-analysis. *Diabetol Metab Syndr* 2019;11:11. doi:[10.1186/s13098-019-0406-1](https://doi.org/10.1186/s13098-019-0406-1)
6. Buchanan TA, Xiang AH, Page KA. Gestational diabetes mellitus: risks and management during and after pregnancy. *Nat Rev Endocrinol* 2012;8(11):639-49. doi:[10.1038/nrendo.2012.96](https://doi.org/10.1038/nrendo.2012.96)
7. Farrar D, Duley L, Dowswell T, Lawlor DA. Different strategies for diagnosing gestational diabetes to improve maternal and infant health. *Cochrane Database Syst Rev* 2017;8(8): CD007122. doi:[10.1002/14651858.CD007122.pub4](https://doi.org/10.1002/14651858.CD007122.pub4)
8. Sandu C, Bica C, Salmen T, Stoica R, Bohiltea R, Gherghiceanu F, et al. Gestational diabetes-modern management and therapeutic approach. *Exp Ther Med* 2021;21(1):81. doi:[10.3892/etm.2020.9512](https://doi.org/10.3892/etm.2020.9512)
9. Wang C, Zhu W, Wei Y, Feng H, Su R, Yang H. Exercise intervention during pregnancy can be used to manage weight gain and improve pregnancy outcomes in women with gestational diabetes mellitus. *BMC Pregnancy Childbirth* 2015;15:255. doi:[10.1186/s12884-015-0682-1](https://doi.org/10.1186/s12884-015-0682-1)
10. Hartling L, Dryden DM, Guthrie A, Muise M, Vandermeer B, Donovan L. Benefits and harms of treating gestational diabetes mellitus: a systematic review and meta-analysis for the US Preventive Services Task Force and the National Institutes of Health Office of Medical Applications of Research. *Ann Intern Med* 2013;159(2):123-9. doi:[10.7326/0003-4819-159-2-201307160-00661](https://doi.org/10.7326/0003-4819-159-2-201307160-00661)
11. Ezeigbogu MO, Abdulsalam K. Glycated haemoglobin (HbA1c): an update on available methods. *Bayero J Pure Appl Sci* 2018;11(1):8-14. doi:[10.4314/bajopas.v11i1.2](https://doi.org/10.4314/bajopas.v11i1.2)
12. Sherwani SI, Khan HA, Ekhzaimy A, Masood A, Sakharkar MK. Significance of HbA1c test in diagnosis and prognosis of diabetic patients. *Biomark Insights* 2016;11:95-104. doi:[10.4137/bmi.S38440](https://doi.org/10.4137/bmi.S38440)
13. Ho YR, Wang P, Lu MC, Tseng ST, Yang CP, Yan YH. Associations of mid-pregnancy HbA1c with gestational diabetes and risk of adverse pregnancy outcomes in high-risk Taiwanese women. *PLoS One* 2017;12(5): e0177563. doi:[10.1371/journal.pone.0177563](https://doi.org/10.1371/journal.pone.0177563)
14. Fong A, Serra AE, Gabby L, Wing DA, Berkowitz KM. Use of hemoglobin A1c as an early predictor of gestational diabetes mellitus. *Am J Obstet Gynecol* 2014;211(6):641.e1-7. doi:[10.1016/j.ajog.2014.06.016](https://doi.org/10.1016/j.ajog.2014.06.016)
15. Kwon SS, Kwon JY, Park YW, Kim YH, Lim JB. HbA1c for diagnosis and prognosis of gestational diabetes mellitus. *Diabetes Res Clin Pract* 2015;110(1):38-43. doi:[10.1016/j.diabres.2015.07.014](https://doi.org/10.1016/j.diabres.2015.07.014)
16. Balaji V, Seshiah VJ. Management of diabetes in pregnancy. *J Assoc Physicians India* 2011;59(1):33-6.
17. Radder JK, van Roosmalen J. HbA1c in healthy, pregnant women. *Neth J Med* 2005;63(7):256-9.
18. Odsæter IH, Åsberg A, Vanky E, Carlsen SM. HbA1c as screening for gestational diabetes mellitus in women with polycystic ovary syndrome. *BMC Endocr Disord* 2015;15:38. doi:[10.1186/s12902-015-0039-9](https://doi.org/10.1186/s12902-015-0039-9)
19. Muhuza MP, Zhang L, Wu Q, Qi L, Chen D, Liang Z. The association between maternal HbA1c and adverse outcomes in gestational diabetes. *Front Endocrinol (Lausanne)* 2023;14:1105899. doi:[10.3389/fendo.2023.1105899](https://doi.org/10.3389/fendo.2023.1105899)
20. Wong VW, Chong S, Mediratta S, Jalaludin B. Measuring glycated haemoglobin in women with gestational diabetes mellitus: how useful is it? *Aust N Z J Obstet Gynaecol* 2017;57(3):260-5. doi:[10.1111/ajo.12511](https://doi.org/10.1111/ajo.12511)
21. Christiansen MS, Hesse D, Ekbohm P, Hesse U, Damm P, Hommel E, et al. Increased urinary orosomucoid excretion predicts preeclampsia in pregnant women with pregestational type 1 diabetes. *Diabetes Res Clin Pract* 2010;89(1):16-21. doi:[10.1016/j.diabres.2010.03.018](https://doi.org/10.1016/j.diabres.2010.03.018)
22. Akhlaghi F, Rajabian R, Talebi F. Correlation of HbA1c and outcome of pregnancy in insulin dependent diabetic women. *Iran J Obstet Gynecol Infertil* 2012;15(9):1-6.
23. Ducarme G, Desroys Du Roure F, Le Thuaut A, Grange J, Dimet J, Crepin-Delcourt I. Efficacy of maternal and biological parameters at the time of diagnosis of gestational diabetes mellitus in predicting neonatal morbidity. *Eur J Obstet Gynecol Reprod Biol* 2018;221:113-8. doi:[10.1016/j.ejogrb.2017.12.036](https://doi.org/10.1016/j.ejogrb.2017.12.036)
24. Sweeting AN, Ross GP, Hyett J, Molyneaux L, Tan K, Constantino M, et al. Baseline HbA1c to identify high-risk gestational diabetes: utility in early vs standard gestational diabetes. *J Clin Endocrinol Metab* 2017;102(1):150-6. doi:[10.1210/jc.2016-2951](https://doi.org/10.1210/jc.2016-2951)
25. Lowe LP, Metzger BE, Dyer AR, Lowe J, McCance DR, Lappin TR, et al. Hyperglycemia and Adverse Pregnancy Outcome (HAPO) Study: associations of maternal A1C and glucose with pregnancy outcomes. *Diabetes Care* 2012;35(3):574-80. doi:[10.2337/dc11-1687](https://doi.org/10.2337/dc11-1687)
26. Pertot T, Molyneaux L, Tan K, Ross GP, Yue DK, Wong J. Can common clinical parameters be used to identify patients who will need insulin treatment in gestational diabetes mellitus? *Diabetes Care* 2011;34(10):2214-6. doi:[10.2337/dc11-0499](https://doi.org/10.2337/dc11-0499)
27. Olmos PR, Borzone GR, Olmos RI, Valencia CN, Bravo FA, Hodgson MI, et al. Gestational diabetes and pre-pregnancy overweight: possible factors involved in newborn macrosomia. *J Obstet Gynaecol Res* 2012;38(1):208-14. doi:[10.1111/j.1447-0756.2011.01681.x](https://doi.org/10.1111/j.1447-0756.2011.01681.x)
28. Kiefer MK, Finneran MM, Ware CA, Fareed N, Joseph J, Thung SF, et al. Association of change in haemoglobin A1c with adverse perinatal outcomes in women with pregestational diabetes. *Diabet Med* 2022;39(7): e14822. doi:[10.1111/dme.14822](https://doi.org/10.1111/dme.14822)
29. Claesson R, Ignell C, Shaat N, Berntorp K. HbA1c as a predictor of diabetes after gestational diabetes mellitus. *Prim Care Diabetes* 2017;11(1):46-51. doi:[10.1016/j.pcd.2016.09.002](https://doi.org/10.1016/j.pcd.2016.09.002)