

## RESEARCH ARTICLE

# The Effect of Single/Multiple Abnormal Values in the 75 g OGTT on Maternal and Neonatal Outcomes in GDM Diagnosis

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### Abstract

**Introduction:** Although early diagnosis and management of GDM aims to reduce adverse outcomes for the mother and newborn, the prognostic value of the number of abnormal values in the 75 g OGTT remains unclear. This study investigates whether single, double, or triple abnormal values in the 75 g OGTT are associated with maternal and neonatal outcomes in women diagnosed with GDM

**Methods:** This retrospective, single-center study included 120 pregnant women diagnosed with GDM according to IADPSG criteria based on a 75 g OGTT after an 8-hour fast between April 2024 and December 2025 .Groups were defined by the number of abnormal values in the 75g OGTT (fasting  $\geq 92$  mg/dL, 1-hour  $\geq 180$  mg/dL, 2-hour  $\geq 153$  mg/dL): single (one abnormal), double (two), or triple (all three).The data collected included age, number of pregnancies, number of births, gestational age at delivery, HbA1c, treatment method, birth weight, Apgar scores, NICU admission, neonatal hypoglycemia, hyperbilirubinemia, and macrosomia.

**Results:** HbA1c was higher in Group 3 (mean difference vs. Group 1:  $1.82 \pm 0.32$ ,  $p < 0.001$ ); cesarean rates were 95% in Group 1 vs. 60% in Group 3 (absolute difference: 35%,  $p = 0.024$ ).Macrosomia, Apgar scores at 1 and 5 minutes, admission to the NICU, neonatal hypoglycemia, and hyperbilirubinemia, among other neonatal outcomes, did not differ significantly between groups.

**Conclusion:** Among pregnant women diagnosed with GDM using a 75 g OGTT, increased abnormal values were associated with higher maternal HbA1c and increased likelihood of cesarean delivery, but this did not lead to consistent differences in neonatal morbidity.

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## Introduction

Traditionally, gestational diabetes mellitus (GDM) is defined as the first detection of abnormal glucose tolerance during pregnancy at any time <sup>1</sup> and its global prevalence has been reported to be 14.7% (based on the International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria).<sup>2</sup> The recognition and management of GDM is important because it carries a potential risk for postpartum diabetes and increases the incidence of adverse maternal and fetal outcomes.<sup>3</sup> The tests used for GDM diagnosis and screening are the 50g (screening), 75g OGTT, and 100g OGTT, and there are multiple recommended sets of glycemic criteria for evaluating these tests (Table 1).<sup>4</sup>

Table 1: International consensus cut-offs for diagnosing gestational diabetes mellitus

	ADA/IADPSG	WHO
Fasting glucose, mg/dL	92	126
1-hour glucose,mg/dL	180	-
2- hour glucose,mg/dL	153	>140
3- hour glucose,mg/dL	-	-
Required for Diagnosis	At least 1 abnormal value	At least 1abnormal value

Citations ADA 2020; I ADPSG2010 WHO 2013

The cut-off values for these sets have changed over the years.<sup>5</sup> Numerous studies have examined the potential of different cut-off values and multiple abnormal values to predict adverse maternal and fetal outcomes.<sup>6</sup> While various OGTT protocols (e.g., 50 g screening, 75 g, and 100 g) and diagnostic criteria exist, this study specifically focuses on the 75 g OGTT using IADPSG criteria due to its widespread adoption in international guidelines, its alignment with global prevalence estimates (e.g., 14.7% reported prevalence), and its balance of sensitivity and feasibility in routine prenatal screening.<sup>2,4</sup> Furthermore, evaluating outcomes based on the number of abnormal values (single, double, or triple) addresses a gap in the literature, as prior research has more commonly explored threshold variations rather than the cumulative impact of multiple abnormalities within the 75 g test, which may better reflect the severity of glucose dysregulation and its prognostic implications for maternal and neonatal risks.<sup>7</sup>

The aim of this study is to observe the effect of single, double, or triple abnormal values on maternal and fetal adverse outcomes in pregnant women diagnosed with GDM using the 75g OGTT.

## Material and Methods

### 2.1. Study Population.

This study was retrospective, single-center, and conducted at a tertiary care hospital. During the study period (April 2024 to December 2025), a total of 456 pregnant women were screened for GDM via 75-gram OGTT at the Perinatology Department of Ankara City Hospital between 24 and 28 weeks of gestation. Of these, 312 met the initial IADPSG diagnostic criteria for GDM. After applying exclusion criteria (multiple pregnancies: n=48; hypertensive patients: n=32; pre-existing Type 1 or Type 2 diabetes: n=24; major fetal anomalies: n=16; missing/inaccessible data: n=32), 160 patients remained eligible. To ensure balanced group comparisons and sufficient statistical power for detecting differences in outcomes, we randomly selected 40 patients from each subgroup based on the number of abnormal values (single, double, or triple) using stratified sampling via SPSS software, resulting in equal group sizes (n=40 per group) (figure 1). Patients diagnosed with gestational diabetes after a 75-gram OGTT performed between April 2024 and December 2025 at the Perinatology Department of Ankara City Hospital between 24 and 28 weeks of gestation were included in this study. Approval was obtained from the Ankara City Hospital Ethics Committee for this study (TABED 2-24-123). The Helsinki Declaration guidelines were followed at every stage of the study.

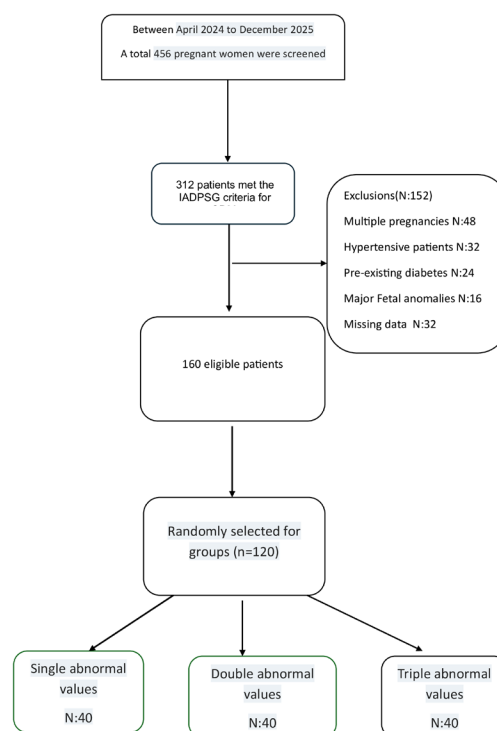


Figure 1: Study flowchart

For each patient included in this study, clinical and demographic information, age, parity, gravida, gestational age, hemoglobin A1c (HbA1c) levels measured at the time of GDM diagnosis (24–28 weeks of gestation), type of treatment received, gestational age at delivery, birth weight, Apgar scores at 1 and 5 minutes, need for neonatal intensive care (NICU), presence of hypoglycemia and hyperbilirubinemia in the newborn, and umbilical cord blood gas parameters (pH and base deficit) at birth were recorded. Newborns weighing over 4500 g were classified as macrosomic and recorded.<sup>8</sup> Neonatal hypoglycemia was defined as blood glucose <45 mg/dL within the first 24 hours, based on laboratory values requiring treatment (e.g., oral glucose or IV dextrose). Hyperbilirubinemia was defined as total bilirubin >12 mg/dL requiring phototherapy. NICU admission was defined as any admission lasting >24 hours, with primary reasons recorded (e.g., respiratory distress, infection). Macrosomia threshold (>4500 g) is now consistently stated throughout.

This study included patients diagnosed with GDM who underwent a 75-gram OGTT after an 8-hour fast at 24–28 weeks of gestation.<sup>9</sup> Diagnosis was based on the IADPSG criteria.<sup>2</sup> For patients with single or double abnormal values, these were identified across the fasting ( $\geq 92$  mg/dL), 1-hour ( $\geq 180$  mg/dL), and/or 2-hour ( $\geq 153$  mg/dL) plasma glucose measurements following the 75g glucose load; postprandial status was thus inherently assessed via the 1- and 2-hour values, while fasting status was evaluated at baseline. No additional separate fasting or postprandial assessments beyond the OGTT were performed for grouping purposes.

Institutional GDM management followed ACOG guidelines: All patients received diet counseling and self-monitoring of blood glucose (targets: fasting <95 mg/dL, 1-hour postprandial <140 mg/dL, 2-hour <120 mg/dL). Insulin was initiated if >50% of values exceeded targets despite diet, or if HbA1c >6.5% at diagnosis.

In this study, patients with multiple pregnancies, hypertensive patients, pregnant women with Type 1 or Type 2 diabetes, patients with known major fetal chromosomal and cardiac anomalies, and patients with missing or inaccessible data were excluded.

## 2.2. Statistical Analysis.

SPSS 22.0 (SPSS Inc., Chicago, IL, USA) statistical software was used for data analysis. The Kolmogorov–Smirnov test and Shapiro–Wilk test

was used to analyze the normality of the data distribution. For continuous variables, one-way ANOVA was applied to compare normally distributed data across groups, while the Kruskal–Wallis test was used for non-normally distributed variables. Descriptive analyses used the mean ( $\pm$ SD) for variables. The chi-square test was used to compare categorical variables. Post-hoc pairwise comparisons were performed using Tukey’s HSD for ANOVA or Dunn’s test for Kruskal–Wallis, with  $p < 0.05$  considered significant. To evaluate independent predictors of cesarean delivery, a multivariable logistic regression analysis adjusted for age, body mass index (BMI), parity, history of previous cesarean delivery, HbA1c levels, and study group (Group 1 as the reference category) was performed. Adjusted odds ratios (OR) and 95% confidence intervals (CI) were calculated.

## Results

A total of 120 patients were included in this study based on the results of the 75-gram OGTT test: 40 patients with 1 positive value, 40 patients with 2 abnormal values, and 40 patients with 3 abnormal values. Various obstetric and neonatal outcomes were compared between the three groups and are presented in Table 2.

There was no significant difference in the mean ages between the groups (Group 1:  $32.25 \pm 5.72$  years; Group 2:  $29.50 \pm 6.35$  years; Group 3:  $34.80 \pm 6.01$  years;  $p = 0.182$ ).

There was no significant difference in Gravida values between groups (Group 1:  $4.0 \pm 3.0$ ; Group 2:  $2.0 \pm 2.0$ ; Group 3:  $2.0 \pm 1.0$ ;  $p = 0.557$ ).

No statistically significant difference was found between the groups in terms of parity (Group 1:  $1.0 \pm 1.0$ ; Group 2:  $1.0 \pm 1.0$ ; Group 3:  $1.0 \pm 1.0$ ;  $p = 0.401$ ).

Insulin use differed significantly between groups (Group 1: 95%, Group 2: 70%, Group 3: 30%;  $p < 0.001$ ).

A significant difference was found in HbA1c levels; the HbA1c value was significantly higher in Group 3 (Group 1:  $5.26 \pm 0.44$ ; Group 2:  $5.58 \pm 0.40$ ; Group 3:  $7.08 \pm 1.21$ ;  $p < 0.001$ ). In the post-hoc test, there was no difference between Group 1 and Group 2, but a significant difference was observed between Group 1 and Group 3 ( $p < 0.001$ ). A significant difference was observed between Group 2 and Group 3 ( $p = 0.005$ ).

There was no difference between the groups in terms of gestational age (Group 1:  $37 \pm 2.13$ ; Group 2:  $36.3 \pm 3.1$ ; Group 3:  $36.0 \pm 2.9$ ;  $p = 0.673$ ).

Table 2: Patient clinicodemographic data and newborn outcomes

Variables	Group 1 N:40	Group 2 N:40	Group 3 N:40	P value
Age(years)	32.25 ± 5.72	29.5±6.35	34.8±6.01	0.182
Gravida	4.0± 3.0	2.0±2.0	2.0±1.0	0.557
Parity	1.0± 1.0	1.0±1.0	1.0±1.0	0.401
Use of insulin(%)	38(%95)	28(%70)	12(%30)	<b>&lt;0.001</b>
HbA1c(%)	5.26± 0.44 <sup>a</sup>	5.58±0.40 <sup>a</sup>	7.08±1.21 <sup>b</sup>	<b>&lt;0.001</b>
BMI(kg/m2)	28.5±4.2	29.1±3.8	30.2±4.5	0.312
Prior Cesarean History(%)	%45	%35	%40	0.567
Neonatal Outcome				
Birth week	37±2.13	36.3±3.1	36.0±2.9	0.673
Birth weight(g)	2966±643	3011±818	2589±753	0.673*
Macrosomia(%)	%15	%10	%15	0.857
Cesarean delivery(%)	38(%95) <sup>a</sup>	26(%65) <sup>b</sup>	24(%60) <sup>b</sup>	<b>0.024</b>
Apgar 1min	7.25±1.0	7.5±0.92	7.0±0.7	0.537
Apgar 5 min	8.5±0.5	8.8±0.6	8.4±0.5	0.064
Cord Ph	7.3±0.06	7.3±0.05	7.2±0.08	0.060
Base deficit(mmol/L)	5.72±3.1	3.51±2.1	3.5±3.19	0.397
NICU Admission(%)	%10	%30	%25	0.328
Neonatal hypoglycemia(%)	%5	%25	%15	0.244
Neonatal jaundice(%)	16(%40)	14(%35)	16(%45)	0.921

Hb:Hemoglobin ,NICU: neonatal intensive care unit- The chi-square test was used to compare categorical variables. ANOVA and post-hoc Tukey tests were applied for parametric variables.

\* Kruskal-Walli's test was used for non-normally distributed variables. Post-hoc Dunn's test tests were applied for nonparametric variables.  $p < 0.05$  statistically significant

Birth weights did not show a significant difference between the three groups. (Group 1: 2966±643 g; Group 2: 3011±818 g; Group 3: 2589±753 g;  $p=0.673$ ).

Macrosomia rates did not differ significantly between groups. (Group 1: 6/40 (15%); Group 2: 4/40(10%); Group 3: 6/40 15%;  $p=0.857$ ).

A significant difference was found in HbA1c levels measured at diagnosis (24-28 weeks); the HbA1c value was significantly higher in Group 3 ( $p < 0.001$ ).

The cesarean section rate was significantly higher between groups; the highest rate was observed in Group 1 (Group 1: 38/40 (95%); Group 2: 26/40 (65%); Group 3: 24/40 (60%);  $p=0.024$ ). Cesarean delivery rates were similar between Group 2 and Group 3, while this rate was higher in Group 1 ( $P=0.031$ ). The indications for cesarean section for all patients are shown in Table 3.

Table 3: Cesarean Indications

Indication	Percentage
Fetal Distress	% 25
Prior Cesarean	%40
Malpresentation	%15
Other	%20

No statistically significant difference was found between Apgar 1 and Apgar 5 scores (Apgar 1:  $p=0.537$ ; Apgar 5:  $p=0.064$ ).

The difference in cord pH values was not found to be significant ( $p=0.060$ ).

No significant difference was detected in base deficit between groups ( $p=0.397$ ).

NICU admission rates were not significantly different between groups (Group 1: 10%; Group 2: 30%; Group 3: 25%;  $p=0.328$ ).

No significant difference was detected in the rates of neonatal hypoglycemia between the groups (Group 1: 5%; Group 2: 25%; Group 3: 15%;  $p=0.244$ ).

Neonatal jaundice: No significant difference was found in neonatal jaundice rates (Group 1: 40%; Group 2: 35%; Group 3: 45%;  $p=0.921$ ).

Multivariable logistic regression analysis was performed to assess the independent predictors of cesarean delivery, adjusting for age, BMI, parity, prior cesarean, HbA1c, and study group (with Group 1 as the reference). The results are summarized in Table 4. Age was associated with an increased risk (adjusted OR 1.1072, 95% CI 1.0478-1.1699,  $p < 0.001$ ), as was parity (adjusted OR 1.3611, 95% CI 1.0703-1.7308,  $p = 0.011$ ) and prior cesarean history (adjusted OR 1.8975, 95% CI 1.1381-3.1636,  $p = 0.014$ ). HbA1c showed a trend toward significance (adjusted OR 1.5404, 95% CI 0.9322-2.5454,  $p = 0.091$ ), while BMI was not significantly associated (adjusted OR 0.0370, 95% CI 0.9705-1.1081,  $p = 0.282$ ). Compared to Group 1, both Group 2 (adjusted OR 0.2492, 95% CI 0.1344-0.4621,  $p < 0.001$ ) and Group 3 (adjusted OR 0.1750, 95% CI 0.0917-0.3341,  $p < 0.001$ ) had significantly lower odds of cesarean delivery, indicating a higher independent risk in Group 1.

Tablo 4: Multivariable Logistic Regression Result

Variables	Adjusted Odds Ratio (OR)	%95 CI Lower	%95 CI Upper	P value
Age	1.1072	1.0478	1.1699	<0.001
BMI	1.0370	0.9705	1.1081	0.282
Parity	1.3611	1.0703	1.7308	0.011
Prior Cesarean	1.8975	1.1381	3.1636	0.014
HbA1c	1.5404	0.9322	2.5454	0.091
Group 2(vs.Group 1)	0.2492	0.1344	0.4621	<0.001
Group 3(vs. Group 1)	0.1750	0.0917	0.3341	<0.001

## Discussion

This study examined maternal and neonatal outcomes based on the number of abnormal values in the 75 g OGTT test. While significant differences were observed in patients' HbA1c levels and cesarean section rates, no differences were observed in neonatal outcomes.

Prenatal care for patients with GDM focuses on identifying and managing patients with impaired glucose metabolism. The pathogenesis of the relationship between hyperglycemia and poor maternal-fetal outcomes involves insulin resistance exacerbated by placental hormones (e.g., human placental lactogen), leading to maternal hyperglycemia that crosses the placenta and induces fetal hyperinsulinemia. This “fetal fuel hypothesis” (Pedersen’s hypothesis) results in accelerated fetal growth, macrosomia, and metabolic disturbances such as neonatal hypoglycemia due to abrupt cessation of maternal glucose supply at birth.<sup>10,11</sup> Hyperglycemia also promotes oxidative stress and inflammation, contributing to endothelial dysfunction and increased risks of preeclampsia, cesarean delivery, and long-term maternal type 2 diabetes.<sup>12</sup>

Unlike patients with pre-existing diabetes, patients with true GDM are not at risk for congenital anomalies in the fetus because the onset of the disorder occurs after the major organogenesis period. Randomized trials have consistently shown that maternal hyperglycemia significantly increases the chance of having a macrosomic newborn.<sup>13</sup> Macrosomia rates were low across groups (10-15%), with no significant differences. The mean birthweights (2.6-3.0 kg) are consistent with these low macrosomia rates, as only a small proportion exceeded 4500 g.

Macrosomia is associated with an increased risk of adverse neonatal outcomes, such as operative delivery (cesarean or instrument-assisted vagi-

nal), maternal trauma, shoulder dystocia, and related complications.<sup>14</sup>

Newborns from pregnancies complicated by GDM are at increased risk for various morbidities, including hypoglycemia, hyperbilirubinemia, hypocalcemia, hypomagnesemia, polycythemia, respiratory disorders, and/or cardiomyopathy. These risks are largely related to maternal and, in turn, fetal hyperglycemia.<sup>15</sup> The study screened for hypoglycemia and hyperbilirubinemia in newborns, with a hyperbilirubinemia rate of 30%. However, no association was observed with the number of positive OGTT values.

In a meta-analysis of 25 studies, both retrospective and prospective studies found that pregnant women with an abnormal OGTT result had a significantly increased risk of adverse outcomes compared to those with a completely normal OGTT result.<sup>16</sup> Additional outcome studies specific to the 75 g OGTT, such as those from the Hyperglycemia and Adverse Pregnancy Outcomes (HAPO) study, have informed IADPSG criteria and demonstrated a continuous association between maternal glucose levels and adverse outcomes, even below diagnostic thresholds.<sup>17,18</sup> Prospective cohorts like the Atlantic DIP study further highlight that treating GDM based on 75 g OGTT reduces macrosomia and cesarean rates, emphasizing the need for tailored management.<sup>19</sup> In contrast, studies questioning single vs. multiple abnormalities in 75 g OGTT suggest that even isolated hyperglycemia may warrant intervention, though evidence is mixed.<sup>20,21</sup>

In the literature, a similar study was conducted with 100 g OGTT, comparing maternal and fetal outcomes with single or double abnormal values. No differences were observed in other maternal and neonatal outcomes except for macrosomia and insulin requirement.<sup>22</sup> In another study using a 100 g OGTT, no differences were observed in maternal and fetal outcomes when comparing pregnant women diagnosed with GDM based on a single positive value.<sup>23</sup>

The study clearly addressed this issue by comparing the effects of single, double, or triple abnormal values on maternal and neonatal outcomes in pregnant women diagnosed with GDM using a 75 g OGTT. We added the following statement to the section. Institutional GDM management performed according to ACOG guidelines may have reduced risks in high HbA1c groups, helping to explain the absence of differences in newborns. Specific and detailed variable recording: A series of clinical variables, inclu-

ding age, parity, gravidity (gravida), gestational age, HbA1c, treatment type, week of delivery, newborn weight, Apgar scores, NICU requirement, newborn hypoglycemia, and hyperbilirubinemia, were systematically recorded.

The significance of HbA1c differences and the finding of differences in cesarean rates between groups yield practical implications for treatment and follow-up.

Interestingly, insulin requirement was highest in Group 1 (single abnormal value; 95%) and decreased progressively with the number of abnormal OGTT values (70% in Group 2 and 30% in Group 3;  $p < 0.001$ ). This counterintuitive pattern may reflect differences in the underlying pathophysiology; isolated abnormalities (particularly fasting or early-postprandial hyperglycemia) could indicate more pronounced insulin resistance in some cases, prompting earlier and more aggressive insulin initiation in clinical practice, whereas multiple abnormalities might have been managed more conservatively or responded better to dietary intervention in our cohort.

### Limitations

Due to its retrospective nature, the study may limit causality inferences and carries a risk of selection bias. Furthermore, the results are limited to a single hospital and a specific population, thus limiting generalizability. The small sample size may make it difficult to statistically detect some rare complications. There is a possibility that some clinical variables may be missing or of limited reliability in retrospective records (e.g., HbA1c, treatment details).

In conclusion, the findings of this study show that an increase in the number of abnormal values in pregnant women diagnosed with GDM using a 75 g OGTT may create a significant difference in some maternal parameters, but no significant differences were found in neonatal outcomes. HbA1c levels were found to be significantly higher in Group 3, a finding that may be related to this and points to the importance of controlling maternal glucose metabolism. The difference in cesarean section rates between groups also indicates the need to review the recommended management strategies based on the clinical picture.

Overall, the study provides a valuable contribution to investigating the potential impact of different positivity levels of the 75 g OGTT on GDM management and birth outcomes. However, due to the limitations of the retrospective, single-center design, the generalizability of the findings is limited, and con-

firmation by larger, multicenter, prospective studies is recommended. Furthermore, further studies would be beneficial in terms of controlling confounding criteria and harmonizing diagnostic criteria.

### Ethics

*Ethics Committee Approval:* Approval for this study was obtained from the Ethics Committee of Ankara City Hospital Ethical Committee (TABED 2-24-123).

*Informed Consent:* The authors declared that it was not considered necessary to get consent from the patients because the study was a retrospective data analysis.

### Author contribution

*BBÖ:* Design the method to achieve results, Data collecting and processing, Literature scan, Article writing

*GRT:* Data collecting and processing

*DO:* Analysis-Comment, Critical examination

*ÖK:* Organizing the execution of the work

*DŞ:* Article writing, Critical examination

*Peer-review:* Internally peer-reviewed.

*Conflict of Interest:* No conflict of interest was declared by the authors.

*Financial Disclosure:* The authors declared that this study received no financial support.

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