

Can the 50-g oral glucose tolerance test predict macrosomia and large for gestational age in pregnant women without gestational diabetes?

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Abstract

Aim: The aim of the present study was to evaluate the relationship between the results of the 50-g oral glucose tolerance test (OGTT) and macrosomia and large for gestational age (LGA) in non-gestational diabetes mellitus (GDM) pregnant women.

Materials and Methods: Our retrospective study comprised 980 pregnant women 18–40 years old, within 24–28 weeks of gestation, and having a singleton pregnancy. GDM was screened using the 50-g OGTT. Patients were divided into three groups according to the OGTT results as follows: (1) 1-h plasma glucose levels >140 mg/dL and normal 100-g OGTT results (false-positive group), (2) 1-h plasma glucose levels between 130 and 139 mg/dL, and (3) 1-h plasma glucose levels <130 mg/dL.

Results: Maternal characteristics were similar among the groups. Fetal weight was 3050 ± 410 g in the false-positive group, 3150 ± 390 g in the 130–139 mg/dL group, and 3100 ± 420 g in the <130 mg/dL group. Fetal weight was statistically similar among the groups ($p = 0.910$). Macrosomia was determined in 2 patients (1.25%) in the false-positive group, 3 (1.07%) in the 130–139 mg/dL group, and 6 (1.1%) in the <130 mg/dL group. These rates were statistically similar among the groups ($p = 0.175$). LGA was determined in 21 patients (13.1%) in the false-positive group, 38 (13.5%) in the 130–139 mg/dL group, and 70 (12.9%) in the <130 mg/dL group. These rates were statistically similar among the groups ($p = 0.450$).

Conclusion: Our results indicated that macrosomia and LGA rates were similar among groups and 50-g OGTT seems to have a low capacity for predicting macrosomia and LGA in pregnant women without GDM.

Keywords: False-positive screening; gestational diabetes mellitus; large for gestational age; macrosomia; 50-g OGTT

INTRODUCTION

Diabetes is an increasingly common health problem throughout the world and gestational diabetes mellitus (GDM) is defined as glucose intolerance that begins during pregnancy (1). The prevalence of GDM reported in different regional studies conducted in Turkey ranged between 1.2 and 27.9% (2). Macrosomia, polyhydramnios, hypoglycemia, hyperglycemia, premature pregnancy losses, congenital malformations, preterm labor, respiratory distress syndrome, persistent diabetes, and increased maternal cardiovascular risk are the most important known complications of GDM (3-5).

The most important method by which to prevent maternal and fetal complications is to screen pregnant women for GDM. The presence of a family history of diabetes, obesity, advanced age, and previous poor perinatal outcomes accounts for only about 50% of GDM cases (6); therefore, the United States Preventive Services Task Force recommends that all pregnant women should be screened

for GDM between 24 and 28 weeks of gestation (7). For GDM screening, each clinic chooses either a one- or two-step screening process. In screening using the 50-g OGTT, ≥ 140 mg/glucose within the first hour indicates a positive result, and the presence of GDM is then confirmed using the 100-g OGTT (8).

The literature on hyperglycemia and adverse pregnancy outcomes (HAPO) have reported that maternal hyperglycemia is associated with birth weights above the 90th percentile (LGA), increased cesarean rate, neonatal hypoglycemia, and fetal hyperinsulinemia (3). Early glucose intolerance may be considered in women with high 50-g OGTT results but normal 100-g OGTT results (i.e., a false-positive test). Increasing evidence suggests that even a mild case of maternal hyperglycemia without GDM can be associated with an adverse perinatal outcome, and that pregnant women with false-positive OGTT results are also at risk for adverse perinatal outcomes, such as LGA, macrosomia, shoulder dystocia,

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and cesarean section (9,10); however, some studies did not detect these differences (11,12). In addition several clinics accept 1-h plasma glucose levels between 130 and 139 mg/dL as a positive screening and relationship between mild maternal hyperglycemia without GDM and the risk of adverse perinatal outcomes is becoming increasingly evaluated. Accordingly, the aim of our study was to investigate the relationship among the results of the 50-g OGTT and macrosomia and LGA in pregnant women without GDM.

MATERIALS and METHODS

This retrospective study was conducted in the Department of Obstetrics and Gynecology, Erciyes University Medical Faculty Hospital, Turkey, and all procedures were conducted in accordance with the Declaration of Helsinki. The study was approved by the Ethics Committee of Erciyes University (approval number: 2019/207).

Study Protocol

Pregnant women 18–40 years old, within 24–28 gestational weeks, having singleton pregnancy, and delivered at Erciyes University Medical Faculty Hospital Obstetrics Clinic between January 2010 and January 2020 and delivery data available were included in the study. Those with known systemic heart, lung, liver, and kidney disease; preeclampsia; gestational hypertension; chronic hypertension; type 1 and type 2 diabetes; GDM; and alcohol use or smoking were excluded from the study. In Erciyes University Medical Faculty Obstetrics Clinic, the two-step oral glucose tolerance test (OGTT) is conducted. After the first evaluation of 2100 pregnant women, 980 of the pregnant women who met the inclusion criteria were analyzed. Patients were divided into three groups according to the results of the 50-g OGTT as follows: (1) 1-h plasma glucose levels ≥ 140 mg/dL and normal 100-g OGTT results (false-positive group), (2) 1-h plasma glucose levels between 130 and 139 mg/dL, and (3) 1-h plasma glucose levels < 130 mg/dL (control group). Patients flow chart was illustrated in Figure 1.

Pregnant women were screened for GDM using the 50-g OGTT. In clinical practice, ≥ 140 mg/dL plasma glucose at this considered a positive result (8). Pregnant women who tested positive were then given the 100-g OGTT as the second step using the protocols of Carpenter and Coustan (8). The plasma glucose cut-off levels were determined as fasting 95 mg/dL, 180 mg/dL in the first hour, 155 mg/dL in the second hour, and 140 mg/dL in the third hour, and at least two of the values were defined as GDM (8). Patients were excluded from the study in the presence of GDM. If pre-pregnancy fasting plasma glucose ≥ 126 mg/dL or the satiety plasma glucose level at any hour ≥ 200 mg/dL was defined as type 2 diabetes and these women were excluded from the study. The gestational week was calculated according to the last menstrual period reported. If the last menstrual period date was unknown, the gestational week was confirmed using the first trimester crown-rump length. The large

for gestational age (LGA) fetus was defined as the birth weight above the 90th percentile compared to gestational week (13). Macrosomia was defined as fetal birth weight higher than 4000 gr (13).

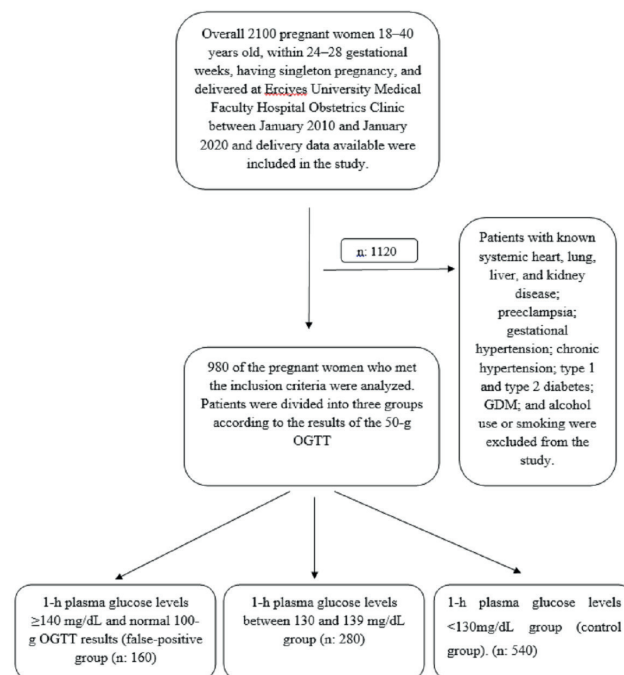


Figure 1. Flow chart of patients

Statistical Analyses

In order to compare more than two groups using Statistical Package for the Social Sciences (SPSS) version 22 (IBM Corp., Armonk, NY, USA), Tukey's post-hoc test, which is an ANOVA, was conducted. The Kruskal-Wallis H test was used to compare all groups to determine the normality of the data, and the Levene's test was used to determine the homogeneity of variance assumption. The values were expressed as the mean \pm standard deviation or n (%), median (min-max). The difference among the groups was considered statistically significant when p value was less than 0.05.

RESULTS

Our study comprised 980 pregnant women divided into the following groups: 1-h plasma glucose levels > 140 mg/dL and normal 100-g OGTT results (false-positive group) (n = 160), 1-h plasma glucose levels from 130 to 139 mg/dL (n = 280), and 1-h plasma glucose levels < 130 mg/dL (n = 540). Maternal demographic characteristics were compared and were provided in Table 1. Maternal age (p = 0.570), nulliparity (p = 0.780), body mass index (BMI) at screening (p = 0.870), ethnicity (p = 0.880), previous cesarean section history (p = 0.720), and gestational week at screening (p = 0.790) were similar among the groups.

The delivery characteristics and fetal outcomes are provided in Table 2. Gestational age at delivery (p = 0.910), spontaneous vaginal delivery rates (p = 0.870), delivery induction rates (p = 0.780), and number of males born (p = 0.890) were similar among the groups. Fetal weight was

3050±410g in the false-positive group, 3150±390g in the 130–139mg/dL group, and 3100±420g in the <130mg/dL group. Fetal weight was statistically similar among the groups ($p = 0.910$). Macrosomia was determined in two women (1.25%) in the false-positive group, three (1.07%) in the 130–139mg/dL group, and six (1.1%) in the

<130mg/dL group. These rates were statistically similar among the groups ($p = 0.175$). LGA was determined in 21 women (13.1%) in the false-positive group, 38 (13.5%) in the 130–139mg/dL group, and 70 (12.9%) in the <130mg/dL group. These rates were statistically similar among the groups ($p = 0.450$).

Table 1. Comparison of maternal demographic characteristics among the groups

Characteristic	False-positive group (n = 160)	130–139 mg/dL group (n = 280)	<130mg/dL group (n = 540)	p value*
Maternal age (year)	31.3 ± 5.2	31.5 ± 4.9	30.9±5.1	0.570
Nulliparity	41 (25.6)	71 (25.3)	142.8 (26.2)	0.780
BMI at screening (kg/m ²)	26.4 ± 2.8	26.2 ± 2.5	26.5 ± 2.9	0.870
Ethnicity (Caucasian)	154 (96.25)	271 (96.7)	519 (96.1)	0.880
Previous cesarean section	41 (25.6)	73 (26.0)	138 (25.5)	0.720
Gestational age at screening (week)	26 (24–28)	26 (24–28)	26 (24–28)	0.790

BMI, body mass index. Values are given as n% or mean + SD or median (min-max)
*All comparisons were performed by ANOVA test

Table 2. Comparison of delivery characteristics among the groups

Characteristic	False-positive group (n = 160)	130–139 mg/dL group (n = 280)	<130mg/dL group (n = 540)	p value*
Gestational age at delivery (week)	39 (37–40)	39 (37–40)	39 (37–40)	0.910
Spontaneous vaginal delivery rates	70 (43.75)	126 (44.2)	237 (43.84)	0.870
Delivery induction rates	44 (27.5)	79 (28.2)	153 (28.3)	0.780
Male newborn	86 (53.7)	154 (55)	291 (53.8)	0.890
Fetal weight (g)	3050 ± 410	3150 ± 390	3100 ± 420	0.910
Presence of macrosomia	2 (1.25)	3 (1.07)	6 (1.1)	0.175
Presence of LGA	21 (13.1)	38 (13.5)	70 (12.9)	0.450

LGA, large for gestational age. Values are given as n% or mean + SD or median (min-max)
*All comparisons were performed by ANOVA test

DISCUSSION

Screening pregnant women for GDM is common practice for determining impaired glucose tolerance. Extensive evidence suggests that GDM treatment during pregnancy can have great benefits to both the mother and her baby (14). Evidence also suggests that mild maternal hyperglycemia in the absence of GDM is associated with a poor perinatal outcome.

In the current study, we found no difference in terms of fetal weight, macrosomia, and LGA among the study groups. These relationships have been studied with different results in terms of adverse perinatal outcomes. Yee et al. (10) have retrospectively screened GDM-free pregnant women using the 50-g OGTT and reported an association between pregnant women with false-positive results and preeclampsia, cesarean delivery, and increased fetal birth weight. In addition, the 50-g OGTT results within the range of 160–179mg/dL plasma glucose is associated with LGA, and it was found that >180 mg/dL plasma glucose

increased the risk of shoulder dystocia. Stamilio et al. (9) has reported that false-positive values were associated with macrosomia, shoulder dystocia, cesarean delivery, and antenatal death; however, some studies reported no differences in these outcomes between pregnant women showing false-positive values or other adverse perinatal outcomes and those in healthy pregnant women (11,12,15). In a retrospective study by Munira Dudhbbhai et al. they showed that rate of macrosomia, cesarean delivery rates, presence of shoulder dystocia and Apgar scores are similar in false positive OGTT group and control group (11). Similarly, in the study of Peng Chiong Tan et al., 1368 pregnant women were analyzed and they reported that rate of macrosomia, cesarean delivery rates and Apgar scores were similar in the false positive OGTT group and the control group (12). In another study Chad A. Grotegut et al. declared that pregnant women with a false-positive one-hour OGTT by the Carpenter-Coustan criteria do not have higher rates of adverse perinatal outcomes (15).

The suggestion that mild maternal hyperglycemia without GDM increases the risk of adverse perinatal outcomes is becoming increasingly common. Our study found no differences among the groups in terms of fetal birth weight, macrosomia, or LGA, which can cause adverse perinatal results. The false-positive screening results in our study may be related to the pregnant women who had an early period of carbohydrate intolerance. There is little evidence to suggest how even this increased hyperglycemia can be well managed. As Coustan and Carpenter pointed out, the relationship between carbohydrate intolerance and perinatal outcomes will probably continue throughout the entire pregnancy process, and only one identification test would not be appropriate to say which pregnant is at increased risk for complications (16).

Considering that the relationship between carbohydrate intolerance and perinatal outcomes continues during pregnancy, some risk factors, such as multiparity, family history, advanced age, and excessive weight gain during pregnancy may be the determinants of adverse perinatal outcomes. Studies have reported that adverse perinatal results for pregnant women were significantly affected by false-positive values, increased maternal age, family history of diabetes, and multiparity (10,14,17). In addition, excessive weight gain during pregnancy has been reported to be an important factor (17,18). Although no intervention or treatment for pregnant women having false-positive test result has been suggested, one study has shown that treatment did improve both fetal weight and the rate of cesarean deliveries (19). Obesity and excessive weight gain during pregnancy are associated with adverse perinatal outcomes; therefore, excessive weight gain in pregnant women with false-positive test results will most likely also have adverse perinatal outcomes. Considering that weight gain during pregnancy is a modifiable risk factor, close monitoring of BMI of these women, diet planning, and lifestyle changes could provide positive weight control when it is necessary to reduce the risk of adverse perinatal outcomes. In further prospective studies that analyzed mild maternal hyperglycemia during pregnancy with modifiable risk factor, close monitoring of BMI of these women, diet planning, and lifestyle changes can clarify these situations.

LIMITATIONS

We are aware that our study has some limitations. A retrospective design of study and small sample size seems to be important limitations. Secondly the absence of trimester specific weight gains and nutrition features of patients are other limitations of the study.

CONCLUSION

Our results indicated that macrosomia and LGA rates were similar among groups and 50-g OGTT seems to have a low capacity for predicting macrosomia and LGA in pregnant women without GDM.

Competing Interests: The authors declare that they have no competing interest.

Financial Disclosure: There are no financial supports.

Ethical Approval: The study was approved by the Ethics Committee of Erciyes University (approval number: 2019/207).

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