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# The effect of diet on pregnancy outcomes among pregnants with abnormal glucose challenge test

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**Abstract. – OBJECTIVES: Gestational diabetes mellitus (GDM) is defined as glucose intolerance, first time detected in pregnancy. Diagnostic criteria for GDM have changed over the decades. The aim of the study was to examine the effect of diet on birth weight, number of large for gestational age (LGA) (birth weight > 90th percentile) babies, total maternal weight gain, gestational age and route of delivery among patients with positive 50 g glucose challenge test (GCT) and negative 100 g oral glucose tolerance test (OGTT).**

**PATIENTS AND METHODS: A prospective randomized controlled study was conducted among patients with positive 50 g GCT and negative 100 g OGTT. A plasma glucose value of 140 mg/dL was used as the threshold to define an abnormal GCT result. In group 1 50 patients were given a caloric diet and compared with group 2 with 50 patients without a given diet. Patients were followed up until delivery and evaluated for birth weight, number of LGA babies, total maternal weight gain, gestational age and route of delivery.**

**RESULTS: There were no significant differences between the groups in maternal age, parity, body mass index and gestational age at delivery. There were significant differences in birth weight, number of LGA babies, total maternal weight gain during pregnancy. The mean gestational age at delivery was 38.7±1.2 weeks in group 1 and 38.9±1.1 weeks in group 2 ($p$ = 0.615). The mean birth weight in group 1 was 3328±399 g and 3623±485 g in group 2 ($p$ = 0.007), cesarean rate was 32% in group 1 and 40% in group 2 ($p$ = 0.405).**

**CONCLUSIONS: In the management of patients with positive 50 g GCT and negative 100 g OGTT, patients who were prescribed medical nutrition therapy by a dietitian experienced in GDM management had better perinatal outcomes.**

*Key Words:*

Gestational Diabetes Mellitus, Screen, Diet, Pregnancy outcome.

## Introduction

GDM is defined as glucose intolerance, first time detected during pregnancy[1]. The International Association of Diabetes and Pregnancy Study Group (IADPSG), recommended a change to this terminology. In this system, diabetes diagnosed during pregnancy is classified as overt or gestational[2]. Diagnostic criteria for GDM have changed over the time. According to The American Diabetes Association (ADA) a diagnosis of gestational diabetes can be made in women who meet either of the following criteria[3]: Fasting plasma glucose ≥ 92 mg/dL (5.1 mmol/L), but < 126 mg/dL (7.0 mmol/L) at any gestational age [fasting plasma glucose ≥ 126 mg/dL (7.0 mmol/L) is consistent with overt diabetes]; at 24 to 28 weeks of gestation: 75 g two hour oral glucose tolerance test (GTT) with at least one abnormal result: fasting plasma glucose ≥92 mg/dL (5.1 mmol/L), but < 126 mg/dL (7.0 mmol/L) or one hour ≥ 180 mg/dL (10.0 mmol/L) or two hour ≥153 mg/dL (8.5 mmol/L)

Hypertensive disorders, preterm delivery, shoulder dystocia, stillbirths, clinical neonatal hypoglycemia, hyperbilirubinemia, and cesarean deliveries are perinatal complications associated with GDM. Obesity and impaired glucose tolerance in the offspring and diabetes and cardiovascular disease in the mothers are some of the postpartum complications[4]. Recognition and appropriate management strategies can decrease co morbidities associated with GDM. The aim of the study was to examine the effect of diet on birth weight, route of delivery and gestational age at delivery among patients with positive 50 g GCT and negative 100 g OGTT.

## Patients and Methods

A prospective randomized controlled study was conducted among a total of 100 patients with



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positive 50 g GCT and negative 100 g OGTT between 24 and 28 weeks' gestation. A plasma glucose value of 140 mg/dL but < 180 mg/dL was used as the threshold to define an abnormal GCT result. The 100 g three hour OGTT (fasting-95 mg/dL, 1 hour, 180 mg/dL, 2 hour, 160 mg/dL, 3 hour, 140 mg/dL) was defined positive when two elevated glucose values were detected as recommended by The American College of Obstetricians and Gynecologists (ACOG)[5]. Women were included if they had a test between 24 weeks 0 days and 28 weeks 6 days of gestation. Exclusion criteria included preexisting diabetes, prior gestational diabetes, a history of stillbirth, multiple gestation, active chronic systemic disease.

After positive 50 g GCT, women were advised to fast for 8 hours the night before the test. Blood samples were obtained after the overnight fast, one, two and three hours after the receipt of the 100 g glucose load. Randomization was performed with the use of days of a week; women who referred to antenatal polyclinic on Monday, Wednesday and Friday were assigned to the intervention group (n=50) received individualized dietary advice from a qualified dietitian. Patients who were seen on Tuesday and Thursday constituted control group and received routine antenatal-care (n=50).

Women in the study group received nutritional advice from a trained dietitian. Total daily calories were calculated for each patient by taking into consideration women's prepregnancy weight, activity level, dietary intake, and weight gain. The diet was tailored for women of different body mass index (BMI) by recommending a normocaloric intake in the range of 1800-2500 cal/day. Approximately for BMI of 20-25 kg/m$^2$, 30 kcal/kg/day; for BMI of 25-30 kg/m$^2$, 25 kcal/kg/day; for BMI of 30 kg/m$^2$ and more, 15-20 kcal/kg/day were given. Calories were divided over three meals and three snacks. Carbohydrate intake was restricted to 45 percent of calories, with the remainder divided between protein (about 20 percent) and fat (about 35 percent). Vegetables and foods high in fiber were encouraged. In the study group, patients were followed weekly for the first month after diagnosis and in every two weeks until delivery. Glucose target was 95 mg/dl for fasting and 140 mg/dl for two hours postprandially. Women randomized to the unmonitored group were not given a dietary advice and routine antenatal care was performed.

All patients evaluated for birth weight, number of LGA (large for gestational age), SGA (small for gestational age) (birth weight < 10$^{th}$ percentile) babies, total maternal weight gain, gestational age and route of delivery, preterm delivery, neonatal intensive care unit (NICU) admission, birth injury, preeclampsia (elevation in blood pressure together with proteinuria) and other complications. The local Ethics Committee approved this study. Formed consent was obtained from all patients.

### Statistical Analysis

The SPSS package (SPSS Inc, Chicago, IL, USA) was used to perform statistical analysis. Distribution of the groups was analyzed with one sample Kolmogrov-Smirnov test. All normally distributed data were compared using a Students' two-tailed *t* test. When the results were not normally distributed, nonparametric Mann-Whitney U test was used for testing differences between groups. A $p$ value < 0.05 was considered statistically significant.

## Results

A total of 100 patients were randomized during the study period. Clinical characteristics of women in the groups were shown in Table I. There were no significant differences between two groups regarding to their age, parity, body mass index (BMI) and gestational age at delivery. The mean gestational age at delivery was 38.91±1.02 weeks in group 1 and 38.69±1.14 weeks in group 2 ($p$ = 0.296). There were significant differences in birth weight, number of LGA babies and total maternal weight gain during pregnancy among two groups. The mean birth weight in group 1 was 3310±342.36 g and 3587±460.20 g in group 2 ($p$ = 0.001). There were 10 (20%) infants with birth weight greater than 4000 g in control group, while it was only 1 (2%) in the study group, ($p$ = 0.004). We found no differences in primary cesarean rate, preterm delivery or number of SGA babies and neonatal intensive unit (NICU) admission between the two groups. Table II summarizes clinical outcome of patients between groups. There were no cases of neonatal birth injury or 5-minute Apgar score < 7 in both groups. Mild preeclampsia was developed in two patients in group 1. There was 1 patient of postpartum uterine atonia in the control group, and hysterectomy was performed. She was 38 years old multiparous and delivered 4650 g baby by vaginal

**Table I.** Baseline characteristics of the women.

| Characteristics | Intervention group (n = 50) | Routine-care group (n = 50) | p |
|---|---|---|---|
| Maternal age (years)* | 29.46 ± 5.82 | 31.22 ± 5.58 | 0.126 |
| BMI ($m^2$/kg)* | 28.01 ± 3.60 | 29.10 ± 4.83 | 0.203 |
| Gravida** | 3 (1-7) | 2 (1-6) | 0.54 |
| 50 g OGCT (mg/dL) | 155 (140-180) | 151.50 (140-180) | 0.510 |

*Values are mean ± SD; **Values are median (minimum-maximum). *Abbreviations:* SD: standard deviation; BMI: Body mass index; OGCT: oral glucose challenge test.

route. Third degree perineal laceration was seen in another patient in the control group. She was 25 years old primiparous and delivered 3750 g baby by vaginal route.

## Discussion

There is no consensus about the appropriate screening/diagnostic test or diagnostic thresholds for GDM. In our Hospital all pregnant women are screened for GDM between the 24th and 28th week of gestation. We perform two-step approach, women are initially screened by measuring plasma glucose 1 hour after a 50 g glucose load; women with glucose concentration ≥ 140 mg/dl, undergo a 100 g OGTT on a separate day, the diagnosis of GDM is established by the Carpenter and Coustan criteria, as recommended by ACOG[5]. Women with negative 100 g OGTT receive routine antenatal-care and no further investigation is performed for GDM. The aim of the study was to examine the effect of diet on fetal and maternal outcomes among patients with positive 50 g GCT and negative 100 g oral OGTT.

The effect of GDM treatment is controversial. There are insufficient data about the effects of treatments for impaired glucose tolerance on perinatal outcome, according to a 2003 Cochrane collaboration systematic review[6]. The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study was the first study provided direct association between maternal glucose levels and pregnancy outcome[7,8]. Gestational diabetes is associated with excessive fetal growth, increased rates of cesarean section and increased frequency of birth injuries such as shoulder dystocia, fractures and nerve palsies. A previous report by Bancroft et al[9] failed to demonstrate any benefit from intensive management of impaired glucose tolerance in pregnancy, but later randomized studies have demonstrated that identification and treatment of even mild gestational diabetes can improve outcomes[10,11]. In our work, women in the study group who received nutritional advice from a trained dietitian had better outcomes in birth weight, number of large for gestational age (LGA) babies (birth weight > 90th percentile), total maternal weight gain during pregnancy comparing to the group who were not given a dietary advice and received routine antenatal care.

**Table II.** Pregnancy outcomes of women.

| Characteristics | Intervention group (n = 50) | Routine-care group (n = 50) | p |
|---|---|---|---|
| Birth weight (g) | 3310 ± 342.36 | 3587 ± 460.20 | 0.001 |
| Gestational age at delivery (wk) | 38.91 ± 1.02 | 38.69 ± 1.14 | 0.269 |
| Total maternal weight gain (kg) | 12.62 ± 3.85 | 16.10 ± 4.09 | 0.001 |
| LGA n (%)* | 2 (4) | 11 (22) | 0.007 |
| Macrosomic infant (> 4000 g) n (%) | 1 (2) | 10 (20) | 0.004 |
| SGA n (%) | 5 (10) | 3 (6) | 0.461 |
| Cesarean delivery n (%) | 16 (32) | 20 (40) | 0.405 |
| Preterm delivery (< 37 wks) n (%) | 1 (2) | 4 (8) | 0.363 |
| NICU admission n (%) | 8 (16) | 16 (32) | 0.061 |
| Antenatal preeclampsia n (%) | 2 (4) | 0 (0) | – |
| Perineal trauma n (%) | 0 (0) | 1 (0.5) | – |
| Postpartum atonia n (%) | 0 (0) | 1 (0.5) | – |

Values are mean ± SD. *Abbreviations:* LGA: Large for gestational age; SGA: small for gestational age; NICU: Neonatal intensive care unit; SD: standard deviation.

There were 10 (20%) infants with birth weight greater than 4000 g in control group, while it was only 1 (2%) in the study group. The mother of the largest infant (4650 g) had postpartum atonia and hysterectomy was performed. Her 50 g GCT was 165 mg/dl and the 100 g three hour OGTT was 76, 180, 116 and 45 mg/dl. She was randomized to routine antenatal-care group and delivered by vaginal route.

There were no differences in the mean gestational age at delivery, primary cesarean rate, preterm birth, number of SGA babies or neonatal intensive care unit (NICU) admission between the two groups. There were no birth injuries, no perinatal death in both groups.

GDM is associated with the development of preeclampsia[12]. The HAPO) study also showed a continuous linear association between the results of glucose-tolerance tests and rates of preeclampsia. In the present study, preeclampsia developed only in two patients. They were both in the study group and managed expectantly. One of them delivered at 37 gestational weeks by cesarean section for the indication of cephalopelvic disproportion and the other delivered at 40 gestational weeks by vaginally.

Infants examination after birth was performed by pediatricians in another clinic; therefore, we could not diagnose other possible metabolic complications and any therapeutic interventions. Moreover, because of our hospital's registration system, we could not reach patients for long term follow-up to assess later complications.

## Conclusions

We can state that in the management of patients with positive 50 g GCT and negative 100 g OGTT, patients who were prescribed medical nutrition therapy by a dietitian experienced in GDM management had better perinatal outcomes. Two step approach for screening for gestational diabetes must be revised with larger randomized studies.

### Conflict of Interest

None declared.

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