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Research Article

Is Fasting Blood Glucose Sufficient for the Diagnosis of Gestational Diabetes?

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Abstract

Objectives: Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance diagnosed during pregnancy. GDM is known to have a significant association with perinatal morbidity and mortality. Therefore, GDM patients who may go undiagnosed during the early stages are of great importance. The aim of this study was to discuss the necessity of the 75 g oral glucose tolerance test (OGTT), which is used for routine GDM diagnosis and which has become controversial in recent years, and to examine whether it is possible to diagnose GDM solely with a fasting blood glucose (FBG) test, as well as to determine how many GDM patients go undetected due to FBG-only testing.

Methods: A total of 944 pregnant women at between 24 and 30 weeks of gestation who presented at the clinic were included in the study. Following a retrospective evaluation of 75 g OGTT results, 61 of these women were diagnosed with GDM. The demographic details, birth weight, and the length of the babies delivered were recorded, and a statistical evaluation was performed.

Results: This was a retrospective study of 944 pregnant women. In all, 61 of these 944 women were diagnosed with GDM (6.4%) based on 75 g OGTT results. No statistically significant difference was found regarding birth weight, length, or sex between women with or without a GDM diagnosis.

Conclusion: The 75 g OGTT is the gold standard diagnosis method for GDM. The objective of this study was to investigate whether FBG alone is sufficient for GDM diagnosis. FBG detected 80.3% of GDM cases. The additional characteristics of the 19.7% of women whose GDM was not detected with FBG remain unknown.

Keywords: Fasting glucose, gestational diabetes mellitus, oral glucose tolerance test

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Gestational diabetes mellitus (GDM) prevalence is increasing. Gestational diabetes increases LGA (Large for Gestational Age), birth complications and the likelihood of mother and baby to develop type 2 diabetes in the future.[1–4] According to Confidential Enquiry into Maternal and Child Health (CEMACH) reports, GDM causes four-fold risk increase in stillbirths, two-fold in congenital malformations, three-fold in neonatal deaths, three-fold in macrosomia and ten-fold risk increase in Erb's palsy.[5] In clinical practice, main objective of GDM treatment is to control glucose metabolism and, therefore, to reduce fetal macrosomia, obstetric complications, to prevent obesity in affected children. Effects of fetal macrosomia is hoped to be reduced by GDM treatment.[6-7] In 2012, The International Association of the Diabetes and Pregnancy Study Groups recommended new criteria that include body fat index, umbilical cord c-peptide levels and abnormal birth weights with their Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study. HAPO study suggests screening of fasting blood glucose, HbA1c or blood glucose at any time during the first

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visitation of patients. The study recommends repeating 75 gr OGTT at 24-28 week gestation if BG is found to be <92. In NICE guidelines, they recommended OGTT with 75 gr glucose at 24-28 weeks, however, FBG (fasting blood glucose), hbA1c, random blood glucose measurement were not recommended in GDM evaluation. The HAPO study found that single serum glucose measurement at approximately 28 weeks of gestation was more effective than hbA1c for the prediction of perinatal outcomes.[9, 10] International Association of the Diabetes and Pregnancy Study Groups (IADPSG) suggested that performing just 75 gram gestational diabetes screening, instead of the previous two-step procedure that is consisted of 50 gr and 100 gr tests, was not only more cost-effective but also cost saving at the same time and they recommended that each country should form their own screening programs by taking their own ethnic characteristics into consideration.[11]

In light of all these results, by taking genetic predisposition of individuals to diabetes, single time glucose measurement seems more convenient economically for countries with poor socioeconomic conditions.

For GDM, we planned our study to examine how helpful 75 gr OGTT test, which is a necessary test to investigate how effective it is for the prediction of birth weight, could be to detect the birth weights. We aimed to observe whether fasting blood glucose would be predictive for the diagnosis of gestational diabetes.

Methods

In our study, pregnant women between 18 and 40 years of age, who have admitted to the Amasya University Sabuncuoglu Serefeddin Training and Research Hospital Gynecology and Obstetrics polyclinics in 2015-2017 and have had two-hour oral glucose tolerance tests (OGTT) with 75 gr glucose during 24-30 weeks of gestation were retrospectively examined. Records of 75 OGTT fasting, 1-hour and 2-hour serum glucose results were collected. Postnatal baby weight, sex and length information of included pregnant women was recorded. Serum glucose levels, which were studied in Beckhman Coulter AU5800 biochemistry autoanalyzer, were used. Individuals who had at least one of the following values higher than their respective reference values were considered to have diabetes: fasting blood glucose 95 mg/dl, 1-hour BG 180 mg/dl, 2-hour BG 153 Patients who had OGTT test performed but baby records were not available and patients who had at least one missing OGTT value in the system were excluded from the study. Patients with hypertension and other chronic diseases were excluded from the study. GraphPad Prism version 6.00 (GraphPad Software, La Jolla California USA) software was used for statistical analyses. Normality of the distribution in the groups was established with Shapiro-Wilk normality test. T-test was used for the comparison of quantitative data. Results were evaluated in 95% confidence interval with significance level of $p < 0.05$. Sex of babies, birth weight and length, and OGTT values for healthy (group 1) and gestational diabetes (group 2) patients, which were classified according to the 0-hour, 1-hour and 2-hour OGTT results of pregnant women, were presented as descriptive statistics in Table 1. Chi-square test was used to understand baby sex differences. Results were evaluated in 95% confidence interval with significance level of $p<0.01$ (Table 2). OGTTH0 (oral glucose tolerance test, fasting), OGTTH1 (oral glucose tolerance test, 1-hour) and OGTTH2 (oral glucose test, 2-hour) values were recorded.

Results

Our study was conducted retrospectively by recording the demographic characteristics obtained through file screenings and the 75 gr OGTT results. Results of total of 944 pa-

Table 1. Comparison of OGTT, birth weight and length

	Healthy (n=883)	Gestational diabetes (n=61)	p
OGTTHO	82.39±9.385	102.1±12.26	<0.0001
OGTTH1	132.9±27.10	195.0±24.30	<0.0001
OGTTH2	110.1±23.05	158.3±30.31	<0.0001
Length (cm)	50.01±1.13	50.16±0.916	0.1525
Weight (gr)	3343±427.6	3455±550.5	0.1281

Values are represented as mean ± standard deviation.

Table 2. Comparison of birth weight and length for OGTTH0 60-80 and 81-95

	OGTTH0 between 60-80 (n=383)	OGTTH0 between 81-95 (n=462)	p
Weight (gr)	3315±402	3362±455.2	0.0834
Length (cm)	50.04±0.535	49.97±1.49	0.6950

Table 3. Sex difference among groups

	Gestational diabetes (n=63)		Healthy (n=897)		χ^2	p
Sex	n	%	n	%		
1	33	52.4	404	45	1.280	0.258
2	30	47.6	493	55		

Distribution of sex among groups was not found to be statistically significant.

tients were evaluated and 61 of these were diagnosed with GDM. Diabetes was diagnosed based on reference values of fasting blood glucose >95, 1-hour BG >180 and 2-hour BG >153. If at least one of these 0, 1, 2-hour blood glucose values were higher than their respective reference values, related patients were assigned to the diabetes group. Two groups were formed for 61 patients diagnosed with diabetes and 833 patients with normal OGTT, and their information of age, chronic disease, gestation week of birth, birth length and weight of babies, and sex of babies were recorded. Patients with chronic diseases were excluded from the study and patients with 39-40 weeks of gestation at the time of birth were included in the study. Distribution of sex among groups of baby was not found to be statistically significant. (Table 3)

Baby weight comparison for patients with OGTT0 values of 60-80 and 81-95 were shown in Table 3. 61 patients were diagnosed with GDM and 49 of these patients (80.3%) had 95 and higher OGTTH0 values. There were 12 patients (19.7%) who were diagnosed with GDM while having OGTTH0 values under 95. 51 patients (46.7%) out of 109 who had OGTTH0 values higher than 95 were diagnosed with GDM. Comparison of birth weight and length of babies for patients with GDM having OGTTH0 values higher and lower than 95 is shown in Table 4.

There was no statistically significant difference among weight and length values of babies for healthy women and women diagnosed with gestational diabetes ($p<0.05$). OGTTH0, OGTTH1, OGTTH2 values were found to be statistically significant among healthy women and women with gestational diabetes ($p<0.0001$). No statistical significance was found for the comparison of birth weight and length among groups of OGTTH0 60-80 and OGTT0 81-95.

Comparison of birth weight and length for OGTTH0 over 95 and OGTTH0 under 95 was not found to be statistically significant.

Conclusion

Total of 944 patients were screened for GDM in our study and 61 of them were diagnosed with GDM, which corresponds to approximately 6.4%. We aimed to determine whether it is absolutely necessary to perform OGTT for GDM screening and we detected that majority of GDM patients (80.3%) had OGTTH0 (fasting blood glucose) values 95 and over. This situation may provide us with information that majority of GDM patients can be diagnosed with solely fasting blood glucose. Our study had no information about diabetes in family history; therefore, failure to diagnose 19.7% of patients with solely FBG could be due to the absence of family history and lack of other aspects. ACOG reported the prevalence of GDM as 7%.[12] In our study, we determined the GDM prevalence as 6.4% which is a little under the overall ratio. No significant difference was detected among baby weights between patients with and without GDM. However, our GDM patient group was diagnosed with GDM at their 24-28 weeks of gestation and they continued their pregnancy either with diet or insulin treatment. We believe, the reason why GDM did not affect baby weights was due to the fact that it was diabetes-regulated. In fact, we aimed to determine a cut off value between blood glucose and load tests, and baby weights. However, regulation mechanism has limited this aspect of the research.

Hughes AE et al.[13] investigated the effect of fasting blood glucose of the mother and the genotype of the fetus on birth weight of the baby in a study they conducted with 2051 mother and their babies. According to this study, blood glucose of the mother plays an important role in the growth and weight of the fetus. However, they observed that, instead of maternal blood glucose, fetal genetic structure played a major and independent role in fetal growth and they reported that genetic structure is more prominent. In a study conducted by Herrera E et al.,[14] they investigated the effect of maternal lipid profile on weight and adipose tissue of the fetus. They observed that blood glucose was associated with fetal growth and macrosomia in pregnant women without gestational diabetes, however, they determined that maternal lipids (triglycerol and non-esterified fatty acid) were more effective in patients with gestational diabetes. In other words, they highlighted that lipid profile was more effective and prominent than glycemia for overweight macrosomiac births in mothers with gestational diabetes. A study conducted by Hashemipour et al. on 305 gestational diabetes patients found that maternal lipid levels and triglyceride levels were effective on overweight and macrosomiac births in mothers who were not obese but had GDM, and these findings support the study of Herrera et al. Panyakat WS et al. conducted a study on 47 gestational diabetes patients that investigates how glycemic changes during third trimester affect the fetus weight. Similar to our study, no significant relation was found between glucose levels and fetus weight during this trimester. However, these 47 individuals were GDM patients

Table 4. Comparison of birth weight and length of babies for patients with GDM having OGTTH0 values higher and lower than 95

	OGTTH0 under 95 (n=12)	OGTTH0 over 95 (n=51)	p
Weight (gr)	3314±153.5	3496±77.01	0.2916
Length (cm)	50.00±0.2462	50.20±0.1284	0.6741

who don't need insulin.[16] We had no information if the patients smoked. Studies to be conducted on wider populations and individuals with different genetic structures will reveal more information. In our country, there were negative feedbacks about OGTT by some physicians on oral and print media organs and majority of pregnant women developed an understanding that OGTT was harmful during pregnancy. This situation caused pregnant women to abstain from this test. In this study, we observed that 80% of patients could be diagnosed without performing OGTT. These findings suggest that the necessity to perform OGTT may be eliminated by including some additional aspects into the research criteria, however, wider studies should be conducted.

Disclosures

Ethics Committee Approval: The study was approved by the Local Ethics Committee.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship contributions: Concept – P.K.; Design – P.K.; Supervision – A.D.D.; Materials – P.K., B.S.; Data collection &/or processing – P.K., A.A.G.; Literature search – P.K.; Writing – P.K., A.D.D.; Critical review – O.F.K.

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