



Utility of Pregestational Body Mass Index and Initial Fasting Plasma Glucose in Predicting Gestational Diabetes Mellitus



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ABSTRACT

Objective: The present study aimed to evaluate the pregestational body mass index (preBMI) and initial fasting plasma glucose (FPG) in predicting gestational diabetes mellitus (GDM) in southern Chinese women.

Study Design: A total of 327 pregnant women were recruited from the third affiliated hospital of Sun Yat-Sen University, Guangzhou, China. The preBMI and initial FPG at 16-18 weeks' gestation were measured. Oral glucose tolerance test was performed at 24-28 weeks' gestation. The sensitivity and specificity of preBMI and initial FPG as predictors for GDM were evaluated by receiver-operator characteristic curve analysis.

Results: Both preBMI and initial FPG correlated with the 0-hour, 1-hour and 2-hour plasma glucose during oral glucose tolerance test ($P < 0.05$). The area under receiver-operator characteristic curve was 0.63 (95% CI: 0.57–0.68) for preBMI and 0.68 (95% CI: 0.61–0.72) for initial FPG in diagnosing GDM. The optimal cutoff for preBMI was 21.5 kg/m² (sensitivity 52.1% and specificity 69.2%) and 4.6 mmol/L (sensitivity 64.6% and specificity 65.2%) for initial FPG. Interestingly, the initial FPG had a better sensitivity compared to preBMI when the specificity was the same. Multivariate logistic regression analysis showed that initial FPG but not preBMI was the independent risk factor for the later development of GDM. After adjustment for the preBMI and the maternal age, the odds ratios of initial FPG and parity were 3.57 (95% CI: 1.72–7.45) and 2.11 (95% CI: 1.20–3.72).

Conclusions: Although both preBMI and initial FPG could be used as indicators for GDM, the initial FPG may be more suitable for predicting GDM in southern Chinese women.

Key Indexing Terms: Gestational diabetes mellitus; Fasting plasma glucose; Pregestational body mass index; Predicting. [Am J Med Sci 2016;351(4):420–425.]

INTRODUCTION

Gestational diabetes mellitus (GDM) affects approximately 14% of all pregnant women.^{1,2} The GDM leads to increased maternal and perinatal complications including macrosomia, cesarean section, birth trauma and diabetes mellitus later in life.^{1,2} Most cases of GDM are usually diagnosed at approximately 24–28 weeks of pregnancy by oral glucose tolerance test (OGTT). A previous study indicated that approximately 10% of patients with GDM could be diagnosed in the first trimester.³ Early prediction of women at high risk of GDM is likely to improve pregnancy outcome because appropriate diet and medication interventions can reduce later GDM development and its associated maternal and perinatal complications.^{4–6} However, there are no uniform worldwide indexes for early prediction of GDM.

Pregestational body mass index (preBMI) is a traditional risk factor for GDM^{7–10} and can be used as an early predictor for GDM. Most studies have examined pregnancies in women who have a BMI ≥ 25 kg/m² (overweight or obesity).^{11–13} However, owing to racial differences, the mean BMI levels are generally lower in

Asians compared to people in other races^{14,15} and the value of lower preBMI in predicting GDM is little known.

In nonpregnant adults impaired fasting plasma glucose (FPG) can be used to diagnose diabetes. In pregnant women, FPG also could provide an indicator for subsequent GDM diagnosis.^{16,17} The FPG as a predicting index offers some advantages. It is easy to administer, well tolerated, inexpensive, reliable and reproducible. However, FPG in early pregnancy is not well studied¹⁸ and there is no universally accepted FPG threshold for the diagnosis of GDM. In 2010, the International Association of Diabetes and Pregnancy Study Groups (IADPSG) formulated new guidelines for screening and diagnosis of diabetes in pregnancy.¹⁹ These criteria have been adopted by the World Health Organization²⁰ and the American Diabetes Association.²¹ It proposed that a one-time value of FPG of ≥ 5.1 mmol/L at any time of the pregnancy was sufficient to diagnose GDM.²² However, Riskin-Mashiah et al³ reported that despite a normoglycemic range, higher first trimester FPG constituted an independent risk factor for developing GDM in young pregnant women.

In the present study, we determined the diagnostic accuracy of preBMI and initial FPG in predicting GDM by

using OGTT as gold standard in diagnosing GDM in southern Chinese pregnant women.

MATERIALS AND METHODS

Subjects

This retrospective study used the data collected from the third affiliated hospital of Sun Yat-Sen University, Guangzhou, China, from April 2013–October 2013. This study was approved by the Human Research Ethics Committee of Sun Yat-Sen Hospital. Singleton pregnant women who received prenatal care services and delivery in this hospital were recruited in the study. Subjects with already diagnosed pregestational diabetes or autoimmune disorders were excluded. Subjects who had a fetal loss before 24 weeks of gestation were also excluded.

Methods

All subjects had their characteristics (including age, parity, height and pregestational weight) registered by self-report at the first prenatal visit and delivery data (including gestational age at delivery and neonatal birth weight) measured and registered in the hospital. Neonatal birth weight was measured using a digital scale. The BMI was calculated by weight (kg) divided by height (m^2). Initial FPG test was performed at 16–18 weeks' gestation after overnight fast (at least 8 hours). Plasma glucose was determined by the glucose oxidase method. All subjects were asked to return between 24 and 28 weeks for a 75-g OGTT that was defined as gold standard. The diagnosis criteria was based on the IADPSG as described previously that any 1 of the following values is met or exceeded in the 75-g OGTT: 0-hour (fasting) ≥ 5.10 mmol/L, 1-hour ≥ 10.00 mmol/L and 2-hour ≥ 8.50 mmol/L. A total of 2 trained physicians completed a training program that familiarized with both the aims of the study and the methods used. They were trained to obtain subjects characteristics, anthropometric measurements and blood specimens.

Statistical Analysis

All statistical analyses were performed using SPSS19.0 software (SPSS Inc., Chicago, IL). Continuous variables were presented as mean (standard deviation), except for skewed variables (medians [interquartile range]). Difference in continuous variables between groups was tested using Student's *t* test (assuming a Gaussian distribution) or Mann-Whitney test (assuming a non-Gaussian distribution). Spearman correlation analysis was performed to investigate the association between preBMI and initial FPG with the plasma glucose of 0-hour, 1-hour and 2-hour during 75-g OGTT. The sensitivity and specificity of preBMI and initial FPG as predictors for GDM were determined by performing receiver-operator characteristic (ROC) curve analysis. The optimal cut-off point was the point on the ROC curve closest to the (0, 1) point. The areas under the ROC curves (AUC) were calculated. DeLong test²³ was used to compare AUC. We calculated positive predictive values, negative predictive values, positive likelihood ratio and negative likelihood ratio for different preBMI and initial FPG threshold values in predicting GDM. Multivariate logistic regression analysis was utilized to explore the independent associated factors of GDM (backward method was used). A *P* < 0.05 was considered statistically significant.

RESULTS

A total of 327 women were included in this study and 48 (14.7%) women were diagnosed as having GDM through a 75-g OGTT that was performed at 24–28 weeks. The clinical characteristics of the subjects are shown in Table 1. The median age of these pregnant women was 29 (interquartile range: 27–31) years, the median preBMI was 20.7 (interquartile range: 19.0–22.2) kg/ m^2 , and the median initial FPG was 4.5 (interquartile range: 4.2–4.7) mmol/L. However, in the GDM group, the subjects were older, presented greater parity, had higher BMIs (including preBMI and BMI at delivery)

TABLE 1. Clinical characteristics of women and newborns.^a

Characteristics	Total (n = 327)	No GDM ^b (n = 279)	GDM (n = 48)	P Value
Maternal age (years)	29 (27–31)	29 (26–31)	30 (28–35)	0.000
Parity	1 (1–2)	1 (1–2)	1.5 (1–2)	0.002
Pregestational BMI (kg/ m^2)	20.7 (19.0–22.2)	20.5 (18.8–22.0)	21.7 (SD 2.4)	0.005
BMI at delivery (kg/ m^2)	21.0 (19.4–22.5)	21.0 (19.1–22.5)	22.0 (SD 2.6)	0.008
Fasting plasma glucose (mmol/L)	4.5 (4.2–4.7)	4.5 (4.2–4.7)	4.7 (4.5–5.0)	0.000
OGTT 0-h (mmol/L)	4.3 (4.1–4.6)	4.3 (4.1–4.3)	4.7 (4.3–5.2)	0.000
OGTT 1-h (mmol/L)	7.3 (6.2–8.8)	6.0 (5.1–7.0)	9.9 (8.9–10.5)	0.000
OGTT 2-h (mmol/L)	6.6 (5.8–7.6)	6.4 (5.6–7.2)	8.9 (8.0–9.6)	0.000
Gestational age at delivery (weeks)	39.3 (38.4–40.1)	39.3 (38.6–40.1)	38.9 (38.1–40.1)	0.039
Neonatal birth weight (kilograms)	3.2 (2.9–3.5)	3.2 (2.9–3.5)	3.3 (2.9–3.6)	0.495

BMI, body mass index; GDM, gestational diabetes mellitus; OGTT, oral glucose tolerance test; SD, standard deviation.

^a Values are medians (interquartile ranges) unless stated otherwise.

^b Compared with GDM group.

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