

## Original Article



# The Association of Maternal Body Composition and Dietary Intake with the Risk of Gestational Diabetes Mellitus during the Second Trimester in a Cohort of Chinese Pregnant Women\*

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## Abstract

**Objective** To investigate the association of maternal body composition and dietary intake with the risk of gestational diabetes mellitus (GDM).

**Methods** A total 154 GDM subjects and 981 controls were enrolled in a prospective cohort study in 11 hospitals from May 20, 2012 to December 31, 2013. Bioelectrical impedance analysis and dietary surveys were used to determine body composition and to evaluate the intake of nutrients in subjects at 21-24 weeks' gestation (WG). Logistic regression analysis was applied to explore the relationships of maternal body composition and dietary intake with the risk of GDM morbidity.

**Results** Age, pre-pregnant body weight (BW), and body mass index (BMI) were associated with increased risk of GDM. Fat mass (FM), fat mass percentage (FMP), extracellular water (ECW), BMI, BW, energy, protein, fat, and carbohydrates at 21-24 WG were associated with an increased risk of GDM. In contrast, fat free mass (FFM), muscular mass (MM), and intracellular water (ICW) were associated with a decreased risk of GDM.

**Conclusion** Maternal body composition and dietary intake during the second trimester of pregnancy were associated with the risk of GDM morbidity.

**Key words:** Gestational diabetes mellitus; Body composition; Dietary intake

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## INTRODUCTION

The prevalence of gestational diabetes mellitus (GDM) is increasing rapidly worldwide, with reported morbidity of GDM in Southwest China as high as 24.5% according to the International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria<sup>[1]</sup>. GDM is one of the most common complications of pregnancy, and threatens both mothers and their offspring because of hyperglycemia. Perinatal complications associated with GDM include hypertensive disorders, preterm delivery, shoulder dystocia, stillbirths, clinical neonatal hypoglycemia, hyperbilirubinemia, and cesarean deliveries<sup>[2-3]</sup>. Postpartum complications include obesity and impaired glucose tolerance in the offspring and diabetes and cardiovascular disease in the mothers<sup>[4-5]</sup>. Management of GDM during pregnancy includes monitoring of blood glucose and medical nutrition therapy with caloric restriction, physical activity, and insulin therapy<sup>[6]</sup>. The management and control of blood glucose during pregnancy can significantly improve or avoid adverse outcomes in both mothers and offspring<sup>[7]</sup>.

Age, parity, genetic factors, previous GDM, hepatitis B virus infection, smoking, and an improper diet are factors known to increase the risk of GDM in pregnant women<sup>[8-9]</sup>. Many studies also show that overweight and excessive gestational weight gain are the risk factors<sup>[10-11]</sup>. Research has increasingly found that body composition, especially body fat, is closely related to glucose metabolism in humans<sup>[12-13]</sup>. However, few reports on the relationship between body composition and GDM morbidity during pregnancy are found. Furthermore, the results of studies on the relationship between GDM morbidity and dietary intake in pregnancy are not consistent. This study aimed to explore the relationship between second trimester maternal body composition or dietary intake and the risk of GDM in a cohort of Chinese pregnant women.

## MATERIALS AND METHODS

### Subjects

This study was performed in a cohort of 1261 Chinese women enrolled at 11 hospitals from May 20, 2012 to December 31, 2013. The study was approved by the Human Subjects Committees of the PLA General Hospital, and each subject was asked to provide

written informed consent before participation.

The inclusion criteria were pregnant Chinese women with a singleton pregnancy and regular pregnancy check-ups. The exclusion criteria were a history of GDM or any type of pregestational diabetes mellitus (DM), or any other concomitant disease such as chronic hypertension, thyroid disease, etc., for which medical treatment might affect glucose metabolism. Subjects who were not singleton pregnancies ( $n=69$ ), had incomplete dietary survey ( $n=26$ ), or body composition ( $n=23$ ) records at 21-24 weeks' gestation (WG), or who were lost to follow-up ( $n=8$ ) were excluded. A total 1135 pregnant women were enrolled for the final analysis; of these, 981 had normal glucose tolerance (NGT), and 154 developed GDM [classified by the International Association of the Diabetes and Pregnancy Study Groups (IADPSG) criteria] at 24-28 WG.

### Experimental Design

A questionnaire was used to collect basic information about the subjects when they were enrolled in the study. After the subjects were incorporated into the cohort, body weight (BW) and height were measured to the nearest 0.1 kg and 0.1 cm, respectively. Body mass index (BMI) was calculated by dividing weight by the square of height ( $\text{kg}/\text{m}^2$ ), and fidelity was  $0.01 \text{ kg}/\text{m}^2$ .  $\text{BMI} < 18.5 \text{ kg}/\text{m}^2$  was classified as lean,  $18.5-24 \text{ kg}/\text{m}^2$  as normal,  $24-28 \text{ kg}/\text{m}^2$  as overweight, and  $> 28 \text{ kg}/\text{m}^2$  as obese, according to the BMI classification for Chinese<sup>[14]</sup>. Measurements of body composition were accomplished using bioelectrical impedance analysis (BIA) apparatus with 8-point tactile electrodes (NQA-PI; Sihaihuachen, Beijing, China). This BIA analyzer uses an alternating current of  $200 \mu\text{A}$  at variable frequencies of 5, 50, 100, 250, 500, and 1000 kHz. Evaluations were performed during the second trimester (between 21 and 24 WG) before screening for GDM. A dietary survey (24 h dietary recall on 3 consecutive days) was used to evaluate the intake of energy, protein, fat, carbohydrate, and dietary fiber at 21-24 WG. The nutrients in all the foods were quantified according to the Chinese Food Composition Table. Screening for GDM was performed on all subjects at 24-28 WG using a one-step 75 g oral glucose tolerance test, and GDM was diagnosed if one or more plasma glucose values met or exceeded the level of the IADPSG criteria<sup>[15]</sup> (fasting:  $5.1 \text{ mmol}/\text{L}$ , 1 h:  $10.0 \text{ mmol}/\text{L}$ , and 2 h:  $8.5 \text{ mmol}/\text{L}$ ).

### Statistical Analysis

Statistical analysis was performed with SPSS

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