MATERNAL OBESITY AND ASSOCIATED RISK OF ADVERSE PREGNANCY OUTCOMES IN WOMEN WITH HYPERGLYCEMIA

Mi Kyoung Kim, MD¹, Junguk Hur, PhD², Seo Young Lee, MD¹, Yoo Lee Kim, MD³, Kyung Sun Park, MD⁴, Seok Won Park, MD, PhD⁴, Kyung Ju Lee, MD, PhD¹

¹Department of Obstetrics and Gynecology, Gangnam CHA Medical Center, CHA University, Seoul, Korea; ²Department of Neurology, University of Michigan Medical School, Ann Arbor, USA; ³Department of Internal Medicine, Gangnam CHA Medical Center, CHA University, Seoul; ⁴Department of Internal Medicine, Bundang CHA Medical Center, CHA University, Seongnam, Korea

Objective
We designed this study to explore the pregnancy outcomes in women with hyperglycemia according to their prepregnancy body mass index (BMI) and to identify risk factors of poor pregnancy outcomes.

Methods
A total of 1,056 pregnant women, who took a standard 100 g oral glucose tolerance test, were recruited between July 1, 2007 and December 31, 2009. The participants were stratified into 3 groups (group 1 [BMI < 18.5 kg/m²], group 2 [BMI 18.5-24.9 kg/m²], and group 3 [obese] [BMI ≥ 25 kg/m²]) based on their prepregnancy BMI following the World Health Organization Asia-Pacific guidelines.

Results
Older age and multi-parity, and family history of diabetes were significantly higher in the obese group. Development of hypertension and gestational diabetes mellitus were also significantly increased with obesity. Maternal weight gain, however, was inversely correlated pattern with prepregnancy BMI. Poor pregnancy outcomes are increased with older age, multi parity, gestational ages at delivery, increased prepregnancy BMI, maternal high glucose status and weight gain rate. Particularly, prepregnancy BMI had higher risk than maternal hyperglycemia on macrosomia (odd ratio [OR] 5.0, 95% confidence intervals [CI] 2.28-11.02 vs. OR 3.0, 95% CI 1.63-5.85), and on primary cesarean section rate (OR 2.5, 95% CI 1.46-4.46 vs. OR 1.6, 95% CI 1.14-2.43).

Conclusion
Pregnant women with obesity are more likely to have poor pregnancy outcomes than pregnant women without obesity. Therefore, with prepregnancy BMI considered, effective management during pregnancy should be designed and intervention trials are needed to identify individuals at risk before developing hyperglycemia.

Keywords: Prepregnancy body mass index; Pregnancy outcomes; Hyperglycemia
negatively associated with both pregnancy outcomes and hyperglycemic state [7-10].

In 2009, the American Institute of Medicine (IOM) issued guidelines for appropriate weight gain, assigning target ranges based on maternal prepregnancy body mass index (BMI). The recommended ranges of gestational weight gain are 12.5-18 kg for underweight women (BMI < 18.5 kg/m²), 11.5-16.0 kg for normal weight women (BMI 18.5-24.9 kg/m²), 7.0-11.5 kg for overweight women (BMI 25-29.9 kg/m²), and 5.0-9.0 kg for obese women (BMI ≥ 30 kg/m²) [11]. The recommended rates of weight gain during 2nd and 3rd trimester are 1 lb/week for underweight women, 1 lb/week for normal weight women, 0.6 lb/week for overweight women and 0.5 lb/week for obese women.

Normally pregnant women are in diabetic condition during pregnancy because of their babies. The elevation of maternal glycemia is a consequence to a rise in maternal insulinaemia, which facilitate fetal growth [12]. Increased maternal BMI during pregnancy and glucose status contribute to offspring birth size and birth outcomes. Although a positive association between prepregnancy BMI and disturbance in glucose metabolism has been established [13-15], it is not clearly known if prepregnancy BMI can affect the pregnancy outcomes of women with at risk of gestational diabetic condition.

In this context, we designed this study to explore the pregnancy outcomes in women at risk of hyperglycemic state with respect to prepregnancy BMI and to identify the risk factors of poor pregnancy outcome.

Materials and Methods

This study used data from pregnant women whose 100 g oral glucose tolerance (OGTT) test was performed between July 1, 2007 and December 31, 2009 at CHA Gangnam Medical Center (Seoul, Korea). Pregnant women at risk of hyperglycemia were suggested by a positive result of 50 g glucose challenge test followed by a confirmatory 100 g fasting glucose 3-hour tolerance test (OGTT). This study was approved by the Institutional review board of CHA Medical Center, CHA University. Data of 1,215 pregnant women were collected, among which 159 participants with twin pregnancies, fetal anomalies, hypertensive disorders before pregnancy, pre-existing diabetes and other diseases, and missing medical records were excluded.

Prepregnancy BMI (kg/m²) were calculated using self-reported prepregnancy weight and height. The participants (n = 1,056) were divided into three groups: group 1 (BMI < 18.5 kg/m², n = 178); group 2 (BMI 18.5-24.9 kg/m², n = 769); and group 3 (BMI ≥ 25 kg/m², n = 109) according to the guidelines of World Health Organization (WHO) Asia-Pacific [16,17] and considering IOM [11]. In the current study, we designated the group 3 as obese group, and other two groups as non-obese group. The overweight prepregnancy BMI in the WHO Asia-Pacific guidelines corresponds to normal prepregnancy BMI in the IOM guidelines. Therefore, so we grouped participants with BMI between 18.5 kg/m² and 25 kg/m² into a single group (group 2).

At the first clinic visit before gestational 10 weeks, participants reported pre-pregnant weight, height and their medical history, which were double checked by their obstetricians. Gestational age was calculated based on her last menstrual period and adjusted by sonographic findings at the first clinic visit. Gestational weights were recorded at second trimester glycemic screening test between 24 and 28 weeks and at delivery. We examined blood pressure and urine analysis due to evaluation of pregnancy complications such as hypertension and proteinuria. Additional data were also collected on maternal age, parity, family history of diabetes or hypertension.

At 24-28 weeks, all participants who had more than 140 mg/dL of 1-hour glucose level in the venous blood sample on a routine glycemic screening as a non-fasting oral glucose challenge test, underwent additional 100 g fasting glucose 3-hour tolerance test. Normal OGTT results were based on Carpenter and Coustan criteria (<95 mg/dL) at fasting state, <180 mg/dL at 1 hour, <155 mg/dL at 2 hours, <140 mg/dL at 3 hours [18]. Gestational diabetes mellitus (GDM) was defined by the presence of at least two abnormal OGTT glucose values. If participating women were diagnosed with GDM, they received diet and exercise instructions, and insulin therapy, if needed.

In terms of pregnancy outcomes, preterm delivery was defined as delivery at less than 37 weeks of gestation; macrosomia was defined as birth weight of 4,000 g or greater; Large for gestational age (LGA) was defined as birth weight more than 90 percentile; small for gestational age (SGA) was defined as birth weight less than 10 percentile; the conditions of primary cesarean section included from failure to progress, fetal malpresentation, and past history of uterus operation.

Data were demonstrated using descriptive statistics as mean ± standard deviation and percentage in the order of group 1, group 2 and group 3 followed by P-values from statistical tests, unless otherwise stated. The differences of variables between and among groups were analyzed with Fisher’s exact test and one way analysis of variance (ANOVA) test with Bonferroni post-Hoc test.