Pre-pregnancy Body Mass Index, Gestational Weight Gain and Infant Birth Weight in Taiwanese primiparous women (conference abstract)

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Background: Pre-pregnancy body mass index (BMI) and gestational weight gain (GWG) are established modifiable factors for perinatal outcomes, including infant birth weight, an important precursor for child health and development. In response to obesity epidemic in western developed countries, BMI-specific guidelines for GWG were developed by US institute of medicine (IOM). Taiwan started facing obesity issue on a national scale in the past years, and since 2016 Taiwan Health Promotion Administration (HPA) adopted IOM guidelines and presented them in maternal health handbook. Previous studies on GWG and infant birthweight mostly focused on Western population. Since the adoption of the BMI-specific GWG guidelines in Taiwan, there has been no nationwide study on the effect of GWG on birthweight. Our study objectives were set to investigate the role of pre-pregnancy BMI and BMI-specific GWG ranges in associations with infant birth weight, including low birth weight (LBW), small for gestational age (SGA), large for gestational age (LGA). The interaction between pre-pregnancy BMI and GWG was also assessed.

Methods: Our study was based on 6 pooled cross-sectional breastfeeding surveys commissioned by Taiwan HPA in years 2011-2016. Data were collected through telephone interviews, using structured questionnaires with randomly selected mothers, who gave birth in

those years. For statistical analyses, we included primiparous mothers with singletons, with gestational age of 37-41 weeks. We excluded observations with GWG≤0, and prenatal weight outside 3 standard deviations of the sample. Pre-pregnancy BMI was categorized by Taiwanese cutoffs of 18.5, 24 and 27 kg/m^2 for underweight, overweight, and obesity, respectively. Inadequate and excessive GWG was categorized according to BMI-specific guidelines of IOM. Based on infant birth weight from hospital records 4 birth outcomes were assessed: low birth weight (LBW, <2500g), small for gestational age (SGA, $<10^{th}$ percentile, adjusted for gestational week and infant sex), large for gestational age (LGA, $>90^{th}$ percentile, adjusted for gestational week and infant sex) and macrosomia (>4000g). For each of the birth weight outcomes, crude and adjusted odds ratios (aOR) were calculated for BMI and GWG with logistic regression. Multivariate logistic regression model was adjusted for year of birth, maternal age, education, working status, immigration status and caesarean section. Interaction term between BMI and GWG was introduced to the logistic regression model to test for significance and to calculate BMI-specific OR. Level of significance was set to two-sided $\alpha=0.05$.

Results: In the sample of 30,573 primiparous women with singletons and normal term, we observed 3.7% LBW, 11.5% SGA, 7.9% LGA, and 1.3% macrosomia outcomes. 20.2% of mothers were underweight (BMI<18.5), 8.2% overweight (BMI≥24 and <27), and 4.5% obese (BMI≥27). 30.7% gained inadequate gestational weight under IOM recommended range, and 29.8% gained excessive gestational weight over IOM range. Adjustment for confounders attenuated OR for BMI and GWG towards null effect, but still maintained the statistical significance in all 4 outcomes, except for associations between LBW and overweight/obese BMI groups. In comparison to normal BMI, underweight women were more likely to have LBW (aOR=1.27) and SGA (aOR=1.38), but less likely to have LGA (aOR=0.60), or macrosomia

(aOR=0.50). LGA was positively associated with overweight (aOR=1.46) and obese (aOR =2.03). Similar direction of effect was found for macrosomia ($aOR_{overweight}$ =1.68, aOR_{obese} =2.37). Inadequate GWG was positively associated with LBW (aOR=1.73) and SGA (aOR=1.49), and negatively with LGA (aOR=0.64) and macrosomia (aOR=0.59). Reverse relationships were observed for excessive GWG and LBW (aOR= 0.67), SGA (aOR= 0.72), LGA (aOR= 1.72), and macrosomia (aOR= 2.06).The interaction term was significant only between underweight BMI and inadequate GWG in association with LBW. Likelihood of LBW in a group with inadequate GWG and underweight BMI was 2.23 times higher, compared to the group with normal GWG and normal BMI.

Conclusions: During 2011-2016 in Taiwan less than half of primiparous women with singletons gained gestational weight within the recommended range by IOM guidelines. Underweight was the second largest group (20%), next to normal weight. Overweight and obese mothers and mothers with excessive GWG had higher odds of LGA and macrosomia. Underweight mothers and mothers with inadequate GWG had higher odds of LBW and SGA. GWG and BMI were independently associated with adverse birthweight, except for the interaction joint effect of underweight BMI and inadequate GWG on LBW. While BMI-specific recommendations were tailored in response to obesity epidemic, our analysis pointed out underweight women with inadequate GWG as another vulnerable group for low birth weight. We recommend that underweight women in Taiwan should not be overlooked and be advised to gain more weight during pregnancy.