Maternal weight gain and birth weight

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Adequate maternal nutrition and essential elements replacement are a critical component for the fetus development and growth.[1–4] However, it is not easy to define whether maternal nutrition is adequate or not. Gestational weight gain (GWG), a reflective of multiple characteristics, including maternal fat accumulation, fluid expansion, and the growth of the fetus, placenta, and uterus, has long-termly believed as one of most simple tools to evaluate the maternal nutrition status,[5] based on the following evidence, such as the strong correlation between GWG and adverse maternal and infant outcomes,[6–10] and additionally, inappropriate (inadequate or excessive) GWG may have a lasting impact beyond the fetus period, by influencing growth or development in the offspring throughout neonatal period and subsequently early childhood period.[5] Despite the association between adequate GWG and healthy fetal growth, the recommendation seems to be relatively confusing in definition of adequate GWG, since the data seems to be varied greatly between developed and developing or underdeveloped countries.[5–7,10,11]

During pregnancy, there are two critical aspects determining pregnancy outcomes, and one is preconception obesity (maternal prepregnant body mass index [BMI]) and the other is excessive GWG, of which both increase the risk of hypertensive complications (pregnancy-induced hypertension, preeclampsia), gestational diabetes mellitus, low Apgar score, hypoglycemia, admission to the neonatal intensive care unit, preterm birth, macrosomia, cesarean delivery, and as well as infant adiposity, childhood obesity, glucose, insulin, and cardiometabolic dysregulation.[9,11] Conversely, insufficient weight gain increases the risk for fetal growth restriction (intrauterine growth retardation [IUGR]) and preterm birth.[5] Based on the aforementioned findings, the Institute of Medicine (IOM) suggested that total GWG can be based on prepregnant BMI as 12.5 to 18 kg in underweight (<18.5 kg/m^2), 11.5 to 16 kg in normal weight (18.5-24.9 kg/m^2), 7 to 11.5 kg in overweight (25.0-29.9 kg/m^2), and 5 to 9 kg in obese (≥30.0 kg/m^2).[12] Additionally, IOM also suggested the rate of GWG in the second and third trimesters, including 0.51 kg/wk (range between 0.44 and 0.58 kg/wk) in underweight, 0.42 kg/wk (range between 0.35 and 0.50 kg/wk) in normal weight, 0.28 kg/wk (range between 0.23 and 0.33 kg/wk) in overweight, and 0.22 kg/wk (range between 0.17 and 0.527 kg/wk) in obese.[12] However, it is sometimes difficult to follow this simple and general rule recommended by IOM. Our previous study found the prospective role of less GWG during pregnancy, which could lower maternal and neonatal complications in the Taiwanese pregnant women, and this finding is relatively against the IOM guideline.[9] By contrast, our finding was in agreement with previous reports (recommendation by IOM) showing the worse outcome in pregnant women with significantly increased GWG.[3,6,7,9] Although the real reason is uncertain, we can suppose that recommended total GWG and recommended GWG in the second trimester may not be a good reference in the developed countries, because we suppose that deficiency of nutrition (calorie intake) can be neglected in developed countries, including Taiwan.[9] In theory, the fetal growth is significantly and dramatically increased in the third trimester compared with those in the early pregnancy and even in the second trimester. Therefore, the correlation of pregnancy outcome between GWG and the later stage of gestational age (32 weeks of gestational age as an example) may be more useful in the clinical practice.

This hypothesis has been tested in the current issue of the *Journal of the Chinese Medical Association*.[13] The authors retrospectively evaluated 156 pregnant women and identified 30 pregnant women who delivered low birth weight and premature babies.[13] The authors found that GWG after 32 weeks of gestational age was negatively associated with a higher probability of low birth weight or premature birth, because a higher GWG after 32 weeks was less likely to cause a low birth weight and premature birth, while GWG within the first, second, and third trimesters was not significantly associated with the aforementioned worse outcome.[13] Although it is a retrospective study, the information obtained from the current study provided a very useful information to augment our previous belief that the GWG should be carefully monitored every week, and an increased GWG can be encouraged in the late gestational weeks, and 32 weeks of gestational age may be a good reference. We welcome a prospective, randomized trial to test this hypothesis in the near future.

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