

Mid-Gestation Weight Gain Predicts Greater Newborn Size in Rural Bangladesh but the Effect Size Varies by Maternal Nutritional Status and Season

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Objectives: Assess association between mid-gestation weight gain and birth size by maternal nutritional status and season.

Methods: During an antenatal micronutrient trial in 2008–12, 14,801 rural Bangladeshi mothers were measured for wt (kg) and ht (cm) < 12 wk gestation [median (IQR): 9 (7–10) wk] and at 32 (32–33) wk, with single, term (37–42 wk gestational age, GA) newborns measured for wt < 72 hours of birth (BW, kg). Mid-gestation rate of wt gain (GWG) per wk was calculated as the difference between maternal wt measures divided by interval length in wk. Initially, BW was modeled as a function of GWG, adjusted for maternal age, body mass index (BMI), parity, height, newborn sex, GA at birth, birth month and wealth index to yield adjusted increments in BW (in kg) per kg of GWG (β^{\wedge}). This outcome was then analyzed and compared between mothers with low (<18.5 kg/m², n = 4008) vs normal (18.5–24.9, n = 4770) BMI,

across seasons of birth [Sep–Nov (season 1, post-monsoon), Dec–Feb (2, winter) and Mar–May (3, hot/dry) and Jun–Aug (4, monsoon)], and between mothers by BMI in each season of birth.

Results: 46% of mothers had a BMI < 18.5 and 53% were < 150 cm in ht. Mean GWG per wk was 0.28 kg for thin, and 0.21 kg for normal BMI mothers. Overall, BW was positively associated with GWG per wk [β^{\wedge} = 0.87 kg; 95% CI: 0.80–0.94], being greater for mothers of low [β^{\wedge} = 0.84: 0.74–0.94] vs normal [0.68: 0.59–0.77] 1st trimester BMI, and varying by season (β^{\wedge}_1 = 0.74, β^{\wedge}_2 = 1.06, β^{\wedge}_3 = 0.86 and β^{\wedge}_4 = 0.78, with 95% CI excluding the average (0.87) for seasons 1 and 2). Comparing β^{\wedge} i between mothers with low vs normal BMI, GWG per wk was associated with a (a) lower mean BW increment in season 1 (0.59 vs 0.82 kg), (b) comparable BW increment in season 2 (β^{\wedge}_2 = 1.08 vs 0.99 kg), (c) greater BW increment in season 3 (β^{\wedge}_3 = 1 vs 0.68 kg) and the largest incremental difference in season 4 (β^{\wedge}_4 = 0.99 vs 0.56 kg) when 95% CIs were exclusive.

Conclusions: Birth weight increased with rate of mid-gestation wt gain, especially for thin vs normal wt mothers. Season of birth modified the association, most clearly during monsoon when food is more secure, aligning with mid-gestation intervals spanning the winter season. Maternal nutritional status and season may alter efficiencies of materno-fetal nutrient/energy transfer reflected by birth weight.

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