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Brief report

Infant temperament and maternal parenting self-efficacy predict child weight outcomes

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ABSTRACT

Relationships between infant negative reactivity and self-regulation, parenting self-efficacy, and child weight outcomes were examined. Greater observed negative reactivity predicted more child weight gain when mothers had lower parenting self-efficacy. Lower mother-reported self-regulation predicted a greater child weight status. Results highlight potential early risk/protective factors.

Rates of childhood obesity are high (Ogden, Carroll, Kit, & Flegal, 2012), but there are individual differences in obesity risk. Early temperament is one factor that appears to differentially predict weight outcomes in the current environment (Anzman-Frasca, Stifter, & Birch, 2012). Rothbart and colleagues define temperament as individual differences in reactivity and self-regulation (Rothbart & Bates, 2006), and both of these aspects of temperament have been linked to weight outcomes (Anzman-Frasca et al., 2012). Greater negative reactivity has been linked to a greater weight status or weight gain in infancy and early childhood, and greater self-regulation has been associated with a lower weight status.

While temperament predisposes individuals to certain behaviors, outcomes are dependent on many factors, including parenting. In other words, certain parenting environments moderate the relationship between temperament and child outcomes. While temperament-by-parenting interactions predicting psychosocial adjustment have been well established (Putnam, Sanson, & Rothbart, 2002), less is known about relationships between aspects of temperament, parenting, and physical health outcomes like weight gain and obesity. Wu, Dixon, Dalton, Tudiver, and Liu, (2011) recently found that infant negative reactivity was related to subsequent obesity risk only when coupled with insensitive parenting, demonstrating that relationships between temperament and obesity risk may be obscured if aspects of parenting are not considered. In the current study, we assessed parenting self-efficacy, which is defined as parents' beliefs that they can adequately care for their child and can handle situations involving their child (Johnston & Mash, 1989); this construct has been identified as a robust predictor of parent discipline, competence, and sensitivity (e.g., Sanders & Woolley, 2005; Teti & Gelfand, 1991).

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In addition to including interactions with a parenting construct, this study also adds to the literature by measuring both mother-reported and observed infant negative reactivity and self-regulation, as most research in this area has focused on reported negative reactivity (Anzman-Frasca et al., 2012). Parent reports offer a global assessment of the child's behavioral tendencies across a number of contexts but may also be influenced by parents' own personalities and experiences (Kagan, Snidman, McManis, Woodward, & Hardway, 2002; Rothbart & Goldsmith, 1985). In contrast, laboratory-based measures provide a more fine-grained and objective snapshot of infant behavior within a particular context designed to elicit individual differences in reactivity and self-regulation (Rothbart & Goldsmith, 1985). Our goal was to examine whether maternal reports and laboratory observations of infant negative reactivity and self-regulation were related to concurrent and subsequent weight outcomes and to determine whether these relationships were moderated by early maternal parenting self-efficacy. We hypothesized that maternal parenting self-efficacy would moderate positive associations between reported and observed infant negative reactivity and weight outcomes, such that negative reactivity would predict greater weight gain in infants of mothers with lower self-efficacy. We also hypothesized that there would be a direct, inverse relationship between reported and observed infant self-regulation and weight outcomes.

Mothers were recruited from the maternity ward of an academic medical center in Pennsylvania and were eligible if they were primiparous, English-speaking, and intended to breastfeed and to follow up with a University-affiliated primary care provider. More detailed information about inclusion and exclusion criteria has been reported by Paul et al. (2011). Dyads were assessed at infant birth and ages 3 and 16 weeks and 1 year, and 110 mother-infant dyads completed the one-year study. Additional data were collected from a subsample of participants whose medical charts were available at child age 3 years ($n = 75$). Among the 110 dyads who completed the one-year study, 51% of the infants were female, and the mean birth weight for gestational age percentile was 45.0 (SD = 28.7). The majority of mothers were non-Hispanic (94%), White (91%), and college-educated (65%), with family incomes of more than $50,000 per year (65%). Analyses predicting outcomes at age 1 year include the 110 dyads who completed the one-year study, and analyses predicting weight gain through age 3 years focus on the subsample for whom follow-up data were collected. This subsample did not differ from the sample of study completers on demographic variables or weight status at 1 year. Some participants were randomized to intervention groups (Paul et al., 2011), which were not the focus of the current study; models were adjusted for intervention participation.

Negative reactivity and self-regulation were reported and observed at age 1 year. Mothers completed the Infant Behavior Questionnaire-Revised (Gartstein & Rothbart, 2003), which yielded negative reactivity and self-regulation super-factors. Infants were also observed during an adapted version of the LAB-TAB Toy Removal Task (Goldsmith & Rothbart, 1996). Trained research assistants coded infant negative reactivity and self-regulation when an interesting toy was taken away and placed within sight. Weighted intensity scores were calculated from the proportion of time the infant showed mild, moderate, and high intensity negative reactivity: (0*proportion of time spent exhibiting non-negative emotions) + (1*mild negative reactivity proportion score) + (2*moderate negative reactivity proportion score) + (3*high negative reactivity proportion score); these scores reflect observed negative reactivity. Also coded was the proportion of time the infant spent engaging in self-comforting behaviors during the Toy Removal (e.g., twirling hair, sucking fingers); these scores reflect observed self-regulation. Mothers completed the Parenting Sense of Competence Scale (Gibaud-Wallston & Wandersman, 1978) at infant age 3 weeks, yielding a measure of early parenting self-efficacy.

Infant weights and lengths were measured by research nurses at age 1 year. Infant weights were measured using a calibrated Medela BabyChecker™ scale (McHenry, IL), and lengths were measured using the Seca 210 Mobile Measuring Mat for Infants and Toddlers (Hanover, MD). BMI-for-age z-scores were calculated using the World Health Organization growth charts (Grummer-Strawn, Reinold, Krebs, & Centers for Disease Control and Prevention, 2010). Birth weight was obtained from medical charts and was included as a covariate. Weight ($n = 75$) and height ($n = 72$) data from routine medical office visits were also collected from a subsample of participants at age 3 years. Residualized weight gain scores were calculated from the residuals of regression models where child weight at age 3 years was regressed on weight at age 1 year.

A series of eight regression analyses were conducted using SAS Version 9.2, to test whether maternal parenting self-efficacy moderated relationships between the four infant behavior variables (observed and reported negative reactivity and self-regulation at age 1 year) and two weight outcomes (BMI-for-age *z*-scores at 1 year and residualized weight gain from 1 to 3 years) and to investigate main effects of negative reactivity and regulation. Infant sex, birth weight, intervention group(s), and feeding mode at 16 weeks (breastfeeding versus formula-feeding, with breastfeeding defined as ≥80% of milk feeds as breast milk) were included as covariates in all analyses. Predictors were standardized, and significant interactions were probed as described by Aiken and West (1991).

Descriptive statistics showed that the sample's average standings on variables of interest were fairly consistent with the literature (Gartstein & Rothbart, 2003). Mean mother-reported infant negative reactivity at age 1 was 3.14 (SD = 0.55), and mean mother-reported self-regulation was 4.75 (SD = 0.64), on a 1–7 scale. The average BMI-for-age z-score at age 1 was 0.30 (SD = 0.93), and at age 3 it was 0.57 (SD = 1.06), showing that on average, children were above growth standards for their age and sex, consistent with national data (Ogden et al., 2012). Corresponding mother-reported and observed measures of negative reactivity ($r = 0.00$, $p = 0.98$) and self-regulation ($r = -0.02$, $p = 0.85$) were uncorrelated. Results revealed a significant interaction between observed negative reactivity and maternal parenting self-efficacy in predicting weight gain from 1 to 3 years ($\beta = -0.35$, $p < 0.01$), such that greater infant negative reactivity predicted greater weight gain when mothers had lower self-efficacy (−1 SD; $\beta = 0.38$, $p < 0.05$); the relationship was opposite when mothers had higher self-efficacy (+1 SD, $\beta = -0.37$, $p < 0.05$; Fig. 1). There were no significant interactions or main effects of reported negative reactivity on weight