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Longitudinal associations between maternal feeding and overweight in low-income toddlers

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ABSTRACT

Maternal feeding is a frequent intervention target for the prevention of early childhood obesity but longitudinal associations between feeding and child overweight are poorly understood. This observational cohort study sought to examine the cross-lagged associations between maternal feeding and overweight across ages 21, 27, and 33 months. Feeding was measured by maternal self-report (n = 222) at each age. Child weight and length were measured. Cross-lagged analysis was used to evaluate longitudinal associations between feeding and overweight, adjusting for infant birth weight, maternal body mass index, maternal education, and maternal depressive symptoms. The sample was 50.5% white, 52.3% male and 37.8% of mothers had a high school education or less. A total of 30.6%, 29.2%, and 26.3% of the sample was overweight at each age, respectively. Pressuring to Finish, Restrictive with regard to Amount, Restrictive with regard to Diet Quality, Laissez-Faire with regard to Diet Quality, Responsiveness to Satiety, Indulgent Permissive, Indulgent Coaxing, Indulgent Soothing, and Indulgent Pampering each tracked strongly across toddlerhood. There were no significant associations between maternal feeding and child overweight either in cross-sectional or cross-lagged associations. Our results do not support a strong causal role for feeding in childhood overweight. Future work longitudinal work should consider alternative approaches to conceptualizing feeding and alternative measurement approaches.

1. Introduction

Maternal feeding is often conceptualized in five domains. Pressuring feeding is characterized by seeking to increase the amount of food consumed. Restrictive feeding is characterized by seeking to limit the types and quantity of food consumed. Responsive feeding is characterized by attending to hunger and satiety cues. Indulgent feeding is characterized by not limiting the quantity or quality of food consumed. Laissez-faire feeding is characterized by not limiting food and also interacting little during feeding.

Maternal feeding is believed to contribute to childhood obesity risk, and has frequently been a target for interventions to prevent obesity in early childhood (Campbell et al., 2008; Daniels et al., 2009; Savage, Birch, Marini, Anzman-Frasca, & Paul, 2016; Taveras et al., 2011). The literature examining associations between maternal feeding and child obesity risk, however, is conflicting (Faith, Scanlon, Birch, Francis, & Sherry, 2004; Vollmer & Mobley, 2013). Measuring both maternal feeding and child weight status longitudinally provides the opportunity to evaluate temporal associations, which can identify potential intervention targets. For example, if pressuring or restrictive feeding temporally precede the development of overweight, they may be targets for intervention. If, on the other hand, maternal feeding changes following the development of child overweight, feeding may be reactive as opposed to causal and therefore a less viable intervention target.

Few observational studies have measured both maternal feeding

Abbreviations: WLZ, weight-for-length z-score.

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and child weight status longitudinally (Afonso et al., 2016; Faith et al., 2004a,b; Gregory, Paxton, & Brozovic, 2010; Jansen et al., 2014; Lumeng et al., 2012; Rhee et al., 2009; Rodgers et al., 2013; Thompson, Adair, & Bentley, 2013; Tschann et al., 2015; Webber, Cooke, Hill, & Wardle, 2010; Worobey, Islas Lopez, & Hoffman, 2009) and findings have been mixed. Findings may be mixed due to differences in study populations or differences in measurement of maternal feeding. For example, the ages of children in prior work range from 3 months (Thompson et al., 2013; Worobey et al., 2009) to 10 years (Thompson et al., 2013). Samples were recruited from Australia (Gregory et al., 2010; Jansen et al., 2014; Rodgers et al., 2013), Portugal (Afonso et al., 2016), the United Kingdom (Webber et al., 2010a,b), and the United States (Faith et al., 2004a,b; Lumeng et al., 2012; Rhee et al., 2009; Thompson et al., 2013; Tschann et al., 2015; Worobey et al., 2009). The number of longitudinal measurement points were primarily two (Afonso et al., 2016; Faith et al., 2004a,b; Gregory et al., 2010; Jansen et al., 2014; Rhee et al., 2009; Rodgers et al., 2013; Tschann et al., 2015; Webber et al., 2010a,b) occasionally three (Lumeng et al., 2012; Worobey et al., 2009), and in one study five (Thompson et al., 2013). Intervals between these measurements ranged from a minimum of three months (Thompson et al., 2013; Worobey et al., 2009) to a maximum of three years (Afonso et al., 2016), with most studies having an interval of about two years (Faith et al., 2004a,b; Gregory et al., 2010; Jansen et al., 2014; Rhee et al., 2009; Webber et al., 2010a,b). Study cohorts were primarily white, with few exceptions (Thompson et al., 2013; Tschann et al., 2015). Sample sizes ranged broadly from fewer than 100 (Faith et al., 2004a,b; Worobey et al., 2009) to more than 4000 (Jansen et al., 2014), with most studies having sample sizes from 100 to 400.

Approaches to measurement of maternal feeding in these longitudinal studies varied broadly. Some studies used videorecorded observational measures (Lumeng et al., 2012; Worobey et al., 2009). Most studies used the Child Feeding Questionnaire (Afonso et al., 2016; Birch et al., 2001; Faith et al., 2004a,b; Gregory et al., 2010; Jansen et al., 2014; Rodgers et al., 2013; Webber et al., 2010a,b). One study used a single question items (Rhee et al., 2009). Other questionnaires used included the Infant Feeding Styles Questionnaire (Thompson et al., 2009, 2013, Preschool Feeding Questionnaire (Baughcum et al., 2001; Rodgers et al., 2013), Parent Feeding Style Questionnaire (Rodgers et al., 2013; Wardle, Sanderson, Guthrie, Rapoport, & Plomin, 2002), Control Over Eating Questionnaire (Ogden, Reynolds, & Smith, 2006; Rodgers et al., 2013), Comprehensive Feeding Practices Questionnaire (Musher-Eizenman & Holub, 2007; Rodgers et al., 2013), the Parental Feeding Practices Questionnaire (Tschann et al., 2013, 2015), the Overt/Covert Control Scale (Ogden et al., 2006), and the Maternal Feeding Attitudes Scale (Kramer, Barr, Leduc, Boisjoly, & Pless, 1983; Worobey et al., 2009). Each of these measures conceptualizes feeding slightly differently. Finally, few of these longitudinal studies have examined stability of feeding over time (Afonso et al., 2016; Faith et al., 2004a,b; Gregory et al., 2010; Lumeng et al., 2012; Thompson et al., 2013; Webber et al., 2010a,b), and all but two of these (Lumeng et al., 2012; Thompson et al., 2013) were in children who were preschool aged or older.

Overall, few studies have examined these associations in children younger than age 3 years (Lumeng et al., 2012; Rodgers et al., 2013; Thompson et al., 2013; Worobey et al., 2009). Of studies involving United States populations (Faith et al., 2004a,b; Lumeng et al., 2012; Rhee et al., 2009; Thompson et al., 2013; Tschann et al., 2015; Worobey et al., 2009), few included a cohort that was diverse with regard to race/ethnicity and included a substantial proportion of low-income children (Thompson et al., 2013; Tschann et al., 2015). Examining potential contributors to excessive weight gain among low-income children is especially important given the higher prevalence of overweight in this population (Cunningham, Kramer, & Narayan, 2014). Therefore, within a diverse cohort of low-income children followed longitudinally at ages 21, 27, and 33 months, we sought to address two main objectives: (1) To describe maternal feeding and its change or stability across this age range; and (2) To examine the cross-lagged associations between maternal feeding and overweight during toddlerhood.

2. Subjects and methods

2.1. Participants and recruitment

Recruitment occurred between 2011 and 2014. Participants were recruited via flyers posted in community agencies serving low-income families. The study was described as examining whether children with different levels of stress eat differently. Inclusion criteria were: (1) the biological mother was the legal guardian; (2) mother had an education level less than a 4-year college degree; (3) mother was at least 18 years old; (4) the family was eligible for Head Start, Women, Infants and Children (WIC) Program, or Medicaid; (5) the family was English-speaking; (6) the child was between 21 and 27 months old; (7) the child was born at a gestational age $\geq$ 36 weeks; and (8) the child had no food allergies or significant health problems, perinatal or neonatal complications, or developmental delays. Mothers provided written informed consent. The University of Michigan Institutional Review Board approved the study.

Mother-child dyads were invited to participate in three waves of data collection at child ages 21, 27, and 33 months. The data collection procedures at each age spanned across 5 days. Data were collected regarding eating behavior and biobehavioral self-regulation. A total of 244 dyads participated. Most (n = 186) dyads entered the study when the child was age 21 months, but 58 entered the study when the child was age 27 months to maximize recruitment. Measures obtained at study entry are henceforth referred to as “baseline” measures. This report is limited to children whose mother completed the feeding questionnaire for at least one age point and children who provided at least one anthropometric measurement.

A total of 222 of the 244 participants completed a feeding questionnaire during at least one age point and anthropometry during at least one age point. These 222 participants included in this analysis did not differ from the excluded participants with regard to child sex, child age, maternal BMI, maternal education, maternal depressive symptoms, food security, family structure, or race/ethnicity. A total of 42 children (18.9%) participated at only one age point, 73 (32.9%) participated at only two age points, and 107 (48.2%) participated at all three age points. Mother-child dyads who participated at two or three age points did not differ at baseline from those who participated at only one with regard to child sex, child age, maternal BMI, maternal education, maternal depressive symptoms, food security, or family structure. Non-Hispanic white children were more likely to participate at two or three age points, compared to Hispanic or non-white children ($p = 0.01$).

2.2. Measures

We used the Infant Feeding Styles Questionnaire (IFSQ) to measure mothers’ feeding (Thompson et al., 2009). The IFSQ was chosen because of its strengths in comparison to other available measures in the literature at the time the study began. First, other available measures asked mothers to report on behaviors only in the first 12 months of life (Baughcum et al., 2001; Hurley, Black, Papas, & Caufield, 2008), or were validated in children (Birch et al., 2001; Hughes, Power, Fisher, Mueller, & Nicklas, 2005)