



The critical period of infant feeding for the development of early disparities in obesity



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ABSTRACT

Childhood obesity is an increasing public health problem, particularly among minority infants and young children. Disparities in overweight prevalence persist and widen with age, highlighting the need to identify factors contributing to early excess weight gain. We review the behavioral, social and macro-environmental factors contributing to the development of obesogenic early feeding practices among African-American infants and young children. We then examine the sociodemographic, household factors, feeding beliefs and infant characteristics associated with age-inappropriate feeding of liquids and solids (inappropriate feeding) among mothers and infants participating the U.S. Infant Care and Risk of Obesity Study, a cohort study of 217 low-income, first-time mothers and infants followed from 3 to 18 months of age. Maternal and infant anthropometry, infant diet, and maternal and household characteristics were collected at home visits at 3, 6, 9, 12 and 18 months of age. Mixed logistic regression was used to estimate the association between maternal and infant characteristics and inappropriate feeding. Rates of age-inappropriate feeding are high; over 75% of infants received solids or juice by 3 months of age. The odds of age-inappropriate feeding were higher among mothers who were single, depressed or believed that their infant is a “greedy” baby. Inappropriate feeding was associated with higher daily energy intake in infants ($\beta = 109.28$ calories, $p = 0.01$) and with increased odds of high infant weight-for-length (WFL; OR = 1.74, 95%CI: 1.01–3.01). Our findings suggest that age-inappropriate complementary feeding influences current energy intakes and infant WFL, factors that may increase long-term obesity risk by shaping infant appetite, food preferences, and metabolism. Given the intractability of pediatric obesity, understanding the role of early feeding in shaping long-term health disparities is critical for developing prevention strategies to stem obesity in early childhood.

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Introduction

The prevalence of pediatric obesity has increased dramatically in recent years and African-American infants and young children are at disproportionate risk. According to recent figures from the Pediatric Nutrition Surveillance Study, 10.4% of African-American infants aged 0–11 months and 15.8% of those aged 12–23 months have weights-for-length above the 95th percentile, levels higher than those seen in white infants (Polhamus et al., 2009). The gap in overweight prevalence persists and widens with age, particularly among women. By childhood and adolescence (ages 2–19), the prevalence of overweight in African-American girls is 23.8% compared to 14.8%

for non-Hispanic white girls (Ogden et al., 2006). By adulthood, African-American women have the highest rates of obesity, with 50.3% of reproductive-aged women being obese compared to 24.8% of white women (Ogden et al., 2006). This widening gap, the occurrence of obesity-related health problems at increasingly younger ages (Weiss et al., 2004), and the persistence of childhood obesity through the life course (Dietz, 1998) highlight the need to identify factors contributing to early excess weight gain.

The importance of early life exposures in shaping long-term risk of obesity and the development of concomitant cardiometabolic disease is increasingly recognized within social science and public health (Benyshek, 2007; Gillman, 2005). Positing that early life physical, social, familial, psychological and cultural environments become biologically embodied in the developing individual, the life course approach highlights the importance of context in shaping health trajectories and emphasizes the historical embeddedness of social experiences (Alwin & Wray, 2005; Ben-Shlomo & Kuh, 2002).

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This perspective is critical for understanding the impact of early life factors on health disparities in obesity rates; however, few studies with a life course perspective have explicitly focused on infant feeding as an important component of the early environment.

Accumulating evidence indicates that early life nutritional disparities are likely to explain some of the higher prevalence of pediatric obesity among minority groups (Perez-Escamilla & Bermudez, 2012). Breastfeeding initiation, exclusivity, and continuation, factors associated with moderately lower childhood obesity risk in a large number of studies (Arenz, Ruckerl, Koletzko, & von Kries, 2004; Owen, Martin, Whincup, Smith, & Cook, 2005), are significantly lower among African-American women (Scanlon et al., 2010). Similarly, the timing of solid food introduction may also increase obesity risk in early childhood (Huh, Rifas-Shiman, Taveras, Oken, & Gillman, 2011; Moorcroft, Marshall, & McCormick, 2011) and differ by race/ethnicity status (Burdette, Whitaker, Hall, & Daniels, 2006). The confounding effects of what is fed to infants have less often been considered, but social gradients in diet quality emerge early in childhood (Smithers, Golley, Brazionis, & Lynch, 2011). Further, in addition to their nutritive effects, early feeding practices shape long-term eating and health behaviors by teaching children how, what, when and how much to eat and transmitting cultural and familial beliefs, attitudes, and practices surrounding food and eating (Birch & Fisher, 1998). Parents and caregivers play a key role in structuring early feeding, which, in turn, is embedded in the larger micro- and macro-environments that shape parental beliefs, decisions and practices (Savage, Fisher, & Birch, 2007).

Identifying the feeding practices that place infants and young children at risk for the development of obesity is important for determining which factors of the early environment can be modified and thus are amenable to intervention. In this paper, we first review the demographic, structural, and sociocultural factors contributing to obesogenic early feeding practices among African-American mothers focusing on factors associated with breastfeeding initiation and duration. This literature review informs our primary analysis testing whether similar factors influence the age-inappropriate feeding of solids and liquids in first-time, low-income African-American mothers in central North Carolina participating in the Infant Care Study (Slining, Adair, Goldman, Borja, & Bentley, 2010; Thompson et al., 2009; Wasser et al., 2011). Finally, we test whether inappropriate feeding is associated with greater energy intake and high weight-for-length (WFL) in infancy with the goal of identifying whether inappropriate feeding acts as a potentially modifiable risk factor in the development of early childhood overweight.

Part 1: Review of the structural and sociocultural determinants of breastfeeding

Demographic and structural determinants of infant feeding

National breastfeeding rates differ by race/ethnicity (Li, Darling, Maurice, Barker, & Grummer-Strawn, 2005; Singh, Kogan, & Dee, 2007) with 54.4% of African-American women initiating breastfeeding and 26.6% breastfeeding to 6 months compared to 74.3% and 43.4% of white women, respectively (Scanlon et al., 2010). These racial/ethnic differences are greatly reduced, however, when controlling for socioeconomic status or maternal education. While markedly lower among low-income mothers participating in the federal Women, Infants and Children (WIC) supplemental nutrition program (McCann, Baydar, & Williams, 2007), breastfeeding rates do not significantly differ between white and African-American participants (Hurley, Black, Papas, & Caufield, 2008). Breastfeeding initiation also does not differ by maternal race/ethnicity among higher income women with access to breastfeeding-supportive

health systems (Celi, Rich-Edwards, Richardson, Kleinman, & Gillman, 2005). Along with income, maternal education is a strong predictor of breastfeeding initiation and duration (Forste, Weiss, & Lippincott, 2001; Wright, Bauer, Naylor, Sutcliffe, & Clark, 1998). In the nationally-representative Feeding Infants and Toddler Study (FITS), having a college education was more strongly associated with positive feeding behaviors than any other maternal characteristic with college-educated mothers more likely to follow American Academy of Pediatrics (AAP) breastfeeding and solid-feeding recommendations (Hendricks, Briefel, Novak, & Ziegler, 2006).

Yet some persistent racial and ethnic differences in feeding remain when income and education are taken into account. In their analysis of data from the National Family Growth Study, Forste et al. (2001) found that white mothers were more likely to have the characteristics associated with the decision to breastfeed—higher income and education levels, marriage, living in the West and having a planned pregnancy—than were black women. These differences resulted in a strong racial disparity in breastfeeding, with African-American women 40% less likely to breastfeed than white women. While finding no difference in breastfeeding practices by race, Hurley et al. (2008) also found that African-American women, who have a higher rate of single motherhood, were more likely to report the need to return to work as a reason for breastfeeding cessation than white mothers. Welfare reform and the requirement that women receiving welfare return to work before 6 months postpartum have also been linked to shorter breastfeeding duration (Haider, Jacknowitz, & Schoeni, 2002).

Ethnographic research among low-income African American women has identified financial hardship, fears for safety and stress as important factors shaping their daily parenting decisions (Bentley, Gavin, Black, & Teti, 1999; Cricco-Lizza, 2004). African-American women attending a WIC clinic in inner-city New York recounted how they struggled with the effects of poverty and discrimination on a daily basis, struggles that, in turn, influenced their perceptions of breastfeeding and child care (Cricco-Lizza, 2004). Mothers felt that infants needed to be strong and independent and were concerned that breastfed infants would be too “lazy” or “spoiled” and, thus, unable to survive in their dangerous neighborhoods.

Sociocultural determinants of infant feeding

These continuing disparities highlight the importance of the numerous structural factors shaping the communities in which mothers live, communities which in turn shape maternal feeding decisions. Social support plays a key role in the initiation and continuation of breastfeeding (Cricco-Lizza, 2004) and cultural beliefs, shared through kin, friend and neighbor networks, may serve to promote or limit breastfeeding. Fathers' and grandmothers' opinions strongly, and contrastingly, influence breastfeeding initiation and duration (Avery & Magnus, 2011). Fathers' support of breastfeeding, for example, was associated with a 12-fold higher intention to breastfeed in an urban African-American sample (Mahoney & James, 2000). Infants' grandmothers, on the hand, may promote early solid feeding or putting cereal in the bottle due to concerns that milk “runs right through” and is not enough to satisfy the needs of a “greedy” baby, even if this advice conflicts with that received from medical professionals (Bentley et al., 1999). Advice from family and friends may be more highly valued than that of healthcare providers, who themselves may be less likely to advise African-American women to breastfeed and more likely to provide advice about bottle feeding (Sharps, El-Mohandes, Nabil El-Khorazaty, Kiely, & Walker, 2003).

The devaluation of breastfeeding and preference for formula feeding has a complex history in African-American communities.

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