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Predictors of Preschool Children's Body Mass Index: Breastfeeding Duration, Child Eating Behaviors, and Parental Feeding Practices

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PREDICTORS OF PRESCHOOL CHILDREN'S BODY MASS INDEX: BREASTFEEDING DURATION, CHILD EATING BEHAVIORS AND PARENTAL FEEDING PRACTICES.

by

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The current study examined how breastfeeding duration, child eating behaviors (Satiety and Food Responsiveness), and parental feeding practices (Environment and Parental Control over Food) are related to body mass index (BMI) among preschool-aged children. Participants were 224 primary caregivers (*M* age = 30.36; 90% mothers) of preschool-aged children (*M* age = 4.22 years, 55% male) from three Midwestern preschools serving low-income children. Mediated multiple regression analyses examined the effects of the various child eating behaviors and parental feeding practices as mediators of the relation between breastfeeding duration and child BMI. Three main findings emerged. There was a significant negative correlation between breastfeeding duration and child BMI and a significant direct effect for breastfeeding duration on child Satiety Responsiveness, Food Responsiveness, and Environment. Only Food Responsiveness had a direct effect on child BMI percentile, and Food Responsiveness fully mediated the relation between breastfeeding duration and child BMI. Results may be beneficial to early care and education programs in supporting and encouraging healthy eating behaviors and parental feeding practices early on. Helping to decrease children's external food cue responsiveness may aid children in maintaining healthy weight status.

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TABLE OF CONTENTS

TABLES AND FIGURES

CHAPTER 1

INTRODUCTION

Childhood obesity is a significant public health concern in the United States that can impact the quality of a child's life with effects continuing throughout adulthood (Centers for Disease Control and Prevention, 2014; Landau et al. 2012; Must & Strauss, 1999: Neef et al., 2013). According to the Centers for Disease Control and Prevention (2014), approximately 13 million children and adolescents, aged 2-19 years, in the United States are obese. The prevalence of childhood obesity varies by race, age, ethnicity, and socio-economic status with children from lower-income households at greatest risk for developing obesity (Anderson &Whitaker, 2009; Ogden, Carroll, Kit, & Flegal, 2014; CDC, 2014; 2011a). Early childhood is an important developmental period which provides the groundwork for health, learning and behaviors across the lifespan making it a critical time to investigate what behaviors and early life experiences contribute and/or serve as protective factors against the development of obesity. Child eating behaviors and parental feeding practices have been associated with weight status in early childhood, and several studies have provided mixed evidence as to whether a relationship between breastfeeding and later body weight exists. However limited research is available on how breastfeeding duration affects preschool-aged children's eating behaviors and parental feeding practices, and also how the combination of such affects preschool-aged children's body mass index levels (BMI). To address the gap in the literature, the present study seeks to examine child BMI in relation to breastfeeding duration, parental feeding practices and child eating behaviors among low-income preschool children.

Overview of Early Childhood Obesity

Childhood obesity is a serious health concern that can have harmful and long-lasting effects on children and families. Despite a significant decline in the overall prevalence of obesity among all children aged 2-5 from 13.9% in 2003-2004 to 8.4% in 2011 and 2012; the rate of obesity among low-income preschool children remains high (Ogden, Carroll, Kit, & Flegal, 2014; Centers for Disease Control and Prevention, 2011a). The 2009 Pediatric Nutrition Surveillance System (PedNSS) data reports approximately one-third of the 3.7 million low-income children aged two to four years surveyed were obese or overweight, of those 541, 000 were obese (CDC, 2011b). Children who are considered overweight have a Body Mass Index (BMI) in the 85^{th}-94^{th} percentile and children who are considered obese have a BMI $\geq 95^{th}$ percentile (Barlow, S.E, & the Expert Committee, 2007).

There are significant differences in the prevalence of obesity among racial and ethnic groups. The highest rates of preschool-aged obesity are found among children from minority backgrounds: American Indian/Native Alaskan children have the highest rates of obesity (31.2%), followed by Hispanic (22.0%) and non-Hispanic black children (20.8%); non-Hispanic white (15.9%) and Asian (12.8%) children had the lowest prevalence of obesity (Anderson &Whitaker, 2009; CDC, 2011b). Nearly, 40% of Hispanic males aged 2-5 are obese compared to 34% of non-Hispanic black and 28% of non-Hispanic white males (Ogden et al., 2014). Hispanic and non-Hispanic black female children aged 2-5 also experience greater rates of overweight and obesity compared to non-Hispanic white females. Rates of obesity among Hispanic and non-Hispanic

preschool-aged black females are at 37% and 36% compared to 29% of non-Hispanic white females (Ogden et al., 2014). The racial and ethnic disparity among obesity rates is particularly concerning when combined with the rates of minority children living in poverty: 65% of non-Hispanic Black children, 63% of American Indian children, and 63% of Hispanic children live in low-income households (National Center for Children in Poverty, 2013). With minority low-income children disproportionately affected by obesity, the need for continued examination of the topic for greater understanding and prevention of the early childhood overweight and obesity is clear.

Importance of Early Childhood Obesity

Childhood obesity has been associated with a number of adverse outcomes. Children who are overweight or obese are at greater risk for developing asthma, obstructive sleep apnea (OSA), skin conditions, and type II diabetes (Barlow, S.E, & the Expert Committee, 2007; Ford, 2005). Landau et al. (2012) found that preschool children with OSA experienced greater behavioral problems and significantly decreased executive functions, attention, and receptive vocabulary compared to children without OSA. In addition, children who are overweight or obese in preschool are five times more likely to become overweight or obese as adults compared to children of normal weight (Whitaker et al., 1997; CDC, 2013). The adverse health outcomes associated with childhood obesity may evolve into chronic health problems in adulthood placing children at increased risk for morbidity and early mortality (Must & Strauss, 1999: Neef et al., 2013).

The adverse outcomes associated with childhood obesity are not limited to physical outcomes. Overweight or obesity status in early childhood may also have psychosocial implications. A negative attitude toward overweight and obese children may begin as early as age three and increases with age (Su & Di Santo, 2012; Cramer & Steinwert, 1998). Overweight and obese children are more likely to be perceived by their peers as mean, lazy, stupid, sad, and having few friends (Su & Di Santo, 2012; Brylinsky & Moore, 1994). When shown target figures (thin, average and chubby) and asked which figure looks most like a given characteristic (e.g., nice/mean, smart/stupid, neat/sloppy) preschool children rated the chubby figure significantly lower than the thin and average figures (Musher-Eizenman, Houlb, Miller, Goldstein, & Edwards Leeper, 2004; Cramer & Steinwert, 1998).

Preschool children have also been found to prefer thin and average-sized children as playmates to overweight and obese children (Cramer & Steinwert, 1998; Musher-Eizenman et al., 2004). Furthermore, higher BMI levels have been associated with more externalizing (i.e., aggressive, destructive) behaviors among young children (Suglia, Duarte, Chambers & Boynton-Jarrett, 2013; Anderson, He, Schoppe-Sullivan, Must, 2010). While internalizing (i.e., depressive, anxious, withdrawn) behaviors were not associated with obesity among preschool children (Suglia et al., 2013); a longitudinal study examining the relationship of BMI and behavior in children found an association between higher BMI and internalizing problems beginning in the first grade (Bradley et al., 2008).

Contributing factors of Weight Status in Early Childhood

Parental BMI has been widely documented as a determinant of childhood overweight and obesity (Parikka et al., 2015; Whitaker, Wright, Pepe, Seidel, & Dietz, 1997; Keane, Layte, Harrington, Kearney, & Perry, 2012; Reilly et al., 2005). Children under the age of 10 who have at least one parent who is obese are twice as likely to become obese adults compared to children whose parents are of normal weight status (Whitaker et al., 1997) A combination of shared genetics and environment most likely increases the risk of obesity for children with one or both parents with an obese weight status (Whitakeret al., 1997).

Familial association is not the only contributing factor to early childhood obesity. For example, short sleep duration (<10.9 hours per night), dietary behaviors, and sedentary behavior have been identified as risk factors contributing to early childhood obesity (Guerrero et al., 2015; Reilly et al., 2005). In addition, Guerrero et al., 2015 found significant racial and ethnic differences in BMI trajectories among African American and Latino children, compared to White children. African American and Latino children had higher mean BMI scores, and soda consumption was found to be a particularly significant predictor of BMI trajectories for African American children. However, factors such as feeding practices during infancy have been found to contribute to weight status.

Breastfeeding

The benefits of breastfeeding are well established and breastfeeding has been identified as the cornerstone of child health as it promotes optimal development and

provides protection against disease and illness (Horta & Victora, 2013; Stuebe & Schwarz, 2010; World Health Organization, 2014; Ip et al., 2007). Furthermore, numerous studies have found breastfeeding to reduce the risk of obesity with an inverse dose-response association with obesity (DiSantis, Hodges & Fisher, 2013; Reilly et al., 2005; Ip et al., 2007; Mayer-Davis et al., 2006; Metzger & McDade, 2010; Gillman et al., 2001). Harder, Bergman, Kallischnigg, and Plagemann's (2005) meta-analyses of 17 studies published between 1979 and 2003, examined the relationship between breastfeeding and risk of overweight status and found the greater duration of breastfeeding the lower the likelihood of becoming overweight. The risk of overweight status was reduced by 4% for each month of breastfeeding, up to 9 months of duration. Consequently, a child who was breastfed for 9 months experienced greater than 30% reduction in the odds of becoming overweight compared to a child who was never breastfed. It is important to note that other studies have found no effect or only small effects.

Metzger and McDade (2010) found that among sibling pairs in which only one sibling was breastfed, the breastfed sibling had a BMI 0.39 standard deviations lower than their sibling. Fixed effect logistic regressions predicting overweight and obesity revealed that breastfed siblings were less likely to reach overweight/obesity status BMI levels. This study provides greater evidence of a causal relationship between breastfeeding and childhood obesity.

The World Health Organization (WHO, 2001) and the United Nations Children's Fund (UNICEF, 2014) recommend exclusive breastfeeding (infant receives only

breastmilk—no water, cereal, juice or any other foods) for the first 6 months of life and continued breastfeeding with complementary foods for 2 years or more. Similarly, the American Academy of Pediatrics (APA, 2012) recommends exclusive breastfeeding for the first six months and continued breastfeeding with complementary foods for at least the first year. According to the 2014 Breastfeeding Report Card, 79.2% of infants in the United States were ever breastfed. However, 49.4% of infants were breastfed at 6 months, which fell to 26.7% at twelve months; 18.8% of infants were exclusively breastfed at six months. While the rates of breastfeeding initiation and breastfeeding until 6 months have continued to increase since 1990, there continues to be significant disparities among breastfeeding initiation and continuation rates for African American women, women participating in the Women, Infants, and Children supplemental program, and women younger than 20 years of age (CDC, 2010).

Overall, Hispanic women had higher rates of initiation than non-Hispanic whites and the initiation prevalence between non-Hispanic blacks and non-Hispanic whites were 20 percentage points (CDC, 2010). Grummer-Strawn and Mei's (2004) examination of breastfeeding duration of overweight among low-income 4-year-olds found a dose-response protective relationship against obesity for non-Hispanic white children; however, no significant association was found for non-Hispanic black or Hispanic children.

Even though breastfeeding has been found to reduce the risk of obesity, the exact mechanisms behind how breastfeeding reduces the risk of obesity are still unclear and may be due to a combination of biological and behavioral differences. The composition

of breastmilk varies within feeds and among stages of lactation, mothers and populations, believed to be a natural response to changing needs of infants; whereas formula composition is fairly stable (Koletzko et al., 2009; Ballard & Morrow, 2013). Most infant formulas have higher energy density than breastmilk which results in higher energy intakes and protein supplies in formula fed babies (Heinig, Nommsen, Peerson, Lonnerdal & Dewey, 1993; Alexy, Kersting, Sichertt-Hellert, Manz & Schoch, 1999). Protein content and quality differences between formula and breastmilk composition may contribute to increased weight gain in formula-fed infants (Koletzko et al., 2009). Rapid growth during the first year has been associated with higher BMIs for both boys and girls, and high protein diets have been linked to higher BMIs for boys (Oddy et al., 2014; Gunnarsdottir & Thorsdottir, 2003).

Where the biological mechanisms focus on the composition of breastmilk and physiological responses produced, the behavioral aspect of breastfeeding may influence child eating behaviors and parental feeding practices (Koletzko et al., 2009; Ballard & Morrow, 2013; Fisher, Birch, Smiciklas-Wright & Picciano, 2001; Ruowei, Fein & Grummer-Strawn, 2010). Infants who are breastfed directly from the breast may have greater opportunity to self-regulate their energy needs in response to appetite cues compared to bottle-fed infants which in turn may promote later satiety responsiveness (Brown & Lee, 2012; Birch & Fisher, 1998). Mothers who breastfeed must rely on their infant's cues to gauge interest and satiety during feeding; whereas, mothers who bottle feed infants have a visual indication of infant intake and how much milk or formula

remains to be consumed and are more likely to encourage finishing the entire bottle (Li, Fein, & Grummer-Strawn, 2008).

In addition, as breastmilk changes in composition, babies fed directly from the breast learn to adjust their intake and have been found to consume less milk if the fat content is higher; bottle-fed infants often consume meals at regular times that are similar in volume and energy density which lead them to respond to more external cues of intake rather than internal satiety (Koletzko et al., 2009; Ballard & Morrow, 2013; Brown, Raynor & Lee, 2011).

Brown and Lee (2012) examined the association between infant milk feeding and maternal reported infant satiety and food responsiveness. During the first phase of the study, when their infants were aged between 6-12 months old mothers reported breastfeeding duration, exclusivity, and weaning experiences. In the second phase of the study, when their infants were aged between 18-24 months mothers reported further breastfeeding duration and infant satiety and food responsiveness via questionnaire. Among the 298 mothers in the final analysis, a significant association between breastfeeding duration and child satiety at 18 to 24 months was found. These findings are particularly important as greater satiety responsiveness has been found to lower the risk of overweight and obesity status in later childhood (Webber et al., 2009). However, no significant association between breastfeeding duration and child's weight or eating behaviors were found.

Similarly, Li, Fein and Grummer-Strawn (2010) examined whether infants' self-regulation of milk intake is affected by feeding method and the type of milk in the bottle.

Mothers reported infant feeding practices via monthly questionnaires during their infants first twelve months. Bottle or cup emptying initiated by the infant was used to gauge infant self-regulation of intake. Infants who experienced greater bottle feeding earlier in life were more likely to empty milk bottles or cups later on, regardless of the type of milk in the cup. Interestingly, breastfeeding duration has also been significantly associated with higher fruit and vegetable intake among young children (de Lauzon-Guillian et al. 2013). These findings suggest that feeding practices in infancy have effects lasting well beyond the infant years. However, as children age eating behaviors evolve and it is important to examine the relationship between child eating behaviors and weight status outcomes. It would be of interest to learn whether there is a direct relationship between breastfeeding and later BMI or if such a relationship, if found, is fully or partially mediated by later child eating behaviors such as the ability to experience satiety and end eating accordingly. Child eating behavior literature is further reviewed below.

Child Eating Behaviors

Children's eating behaviors have been found to contribute to weight status and some may also be potential risk factors for childhood obesity. Overweight and obese children tend to demonstrate particular eating behaviors that contribute to higher weight status compared to children of healthy weight status. A variety of eating behaviors have been found to contribute to overweight and obesity status in children. Obese children typically have decreased satiety responsiveness, increased food responsiveness, increased eating speed, and have a tendency to engage in emotional eating more often than children

of healthy weight status (Webber et al., 2009; Llewellyn et al., 2008; Moens & Braet, 2007; Jahnke & Warschburger, 2008; Braet & Van Strien, 1997).

Satiety responsiveness refers to the feeling of fullness and sense of satisfaction after eating. Carnell and Wardle (2008) found that among children aged 8-11 and 3-5 years of age, children in higher weight status categories had lower satiety responsiveness in both age groups. Jansen et al. (2012) found a negative association between satiety responsiveness and BMI among preschool-aged children. Children who were overweight failed to regulate food intake after exposure to smell of appetizing food and after eating a small portion of the food, whereas normal-weight children decreased intake after exposure to both cues.

Correspondingly, food responsiveness describes children's general appetite and desire to eat, as well as children's response to external food cues—sight, smell, taste. Overweight children have been found to be more likely to eat in response to external food cues more often than normal weight children **(**Jansen et al., 2003; Webber et al., 2009). In addition, children of higher weight status were found to have lower satiety responsiveness and higher food responsiveness to external food cues than children of healthy weight status (Carnell & Wardle, 2008). However, the linear effect between satiety responsiveness, food responsiveness and weight was strongest among older children (Carnell & Wardle, 2008). Emotional eating refers to overeating (eating more) or undereating (eating less) in response to negative emotions such as anger, anxiety, and sadness.

Eating speed refers to the rate at which children consume food. Overweight infants and children have been found to eat more rapidly than children of normal weight status (Llewellyn, van Jaarsveld, Boniface, Carnell, &Wardle, 2008; Stunkard, Berkowitz, Schoeller, Maislin, & Stallings, 2004). Llewellyn et al. (2008) found a significant positive linear effect between eating rate and weight status, which indicates that eating rate increased with higher weight status.

Emotional undereating has been found to decrease with age; whereas emotional overeating was not found to vary with age (Wardle et al., 2001). Emotional overeating is common among obese children and has been found to have a linear association with children's BMI (Webber et al., 2009; Wardle et al., 2001; Braet & Van Strien, 1997). Jahnke and Warschburger (2008) examined weight-related differences in eating behaviors and the influence of maternal eating behaviors among children aged 3-6 years and their mothers; children of overweight mothers exhibited greater amounts of emotional eating than children of normal-weight mothers.

In addition, maternal emotional eating ($R^2 = 0.19$, $P < 0.01$) mediated the relationship between maternal BMI and emotional eating of sons. No relationship was found for mother-daughter dyads. While a number of child eating behaviors are associated with weight status in children it is important to consider the influence parental feeding practices have on child eating behaviors and weight status. Parental feeding practice literature is further reviewed below.

Parental Feeding Practices

Parents and caregivers play an integral role in shaping children's early food and eating experiences. Parental feeding practices may influence child eating behaviors and dietary intake which in turn can influence child weight status (Haszard, Skidmore, Williams, & Taylor, 2015). Feeding practices may include the availability of healthy/unhealthy foods available in the home environment and behaviors parents use to determine when and under what circumstances children eat. Behaviors parents may use include: controlling when/what children may eat, pressuring instrumental feeding practices and monitoring children's food intake. Highly controlling parental feeding practices have been negatively associated with children's ability to regulate intake in response to energy content of foods (Johnson & Birch, 1994).

The relationship between parental feeding practices and child weight status is somewhat mixed due to inconsistency and overlap of items and terminology among parental feeding assessment questionnaires which limits the interpretability of comparison between studies. Parental feeding practices in infancy may influence later feeding practices and child eating behaviors. Fisher, Birch, Smicklas-Wright, & Piccano (2000) found mothers who breastfed for at least 12 months were less controlling in feeding which was also found to mediate the relationship between breastfeeding and toddler energy intake at 18 months. These findings suggest that breastfeeding for at least 12 months may shape maternal beliefs around children's eating behaviors that recognize their child's ability to self-regulate intake. In addition, Li et al. (2014) found children whose mothers often encouraged them to finish the milk in their bottles in infancy were

more likely to encourage children to eat all of the food on their plate and ensure their child eats enough later on.

Furthermore, these children were more likely to empty their bottles in infancy and eat all of the food on their plate at age six. Increased parental control and pressure to eat may influence children's dietary intake and disrupt children's self-regulation of food intake (Faith et al., 2004). External cues such as focusing the attention to the amount of food on the plate rather than the internal cue of satiety promotes increased food consumption, and pressure to eat vegetables before leaving the table or as a requirement before receiving dessert may lead to dislike of target foods (Lee & Birch, 2002; Fisher, Mitchell, Smicklas-Wright, & Birch, 2002; Johnson & Birch, 1994).

Moreover, rewarding preschool children with sweets or favorite foods for eating healthy foods has been found to increase preference for those foods and may result in children's dislike and avoidance of the healthier food (Birch, Zimmerman, & Hind, 1980; Birch, Birch, Marlin, & Kramer, 1982). A cross-cultural examination of French and American parental feeding practices, found greater use of food as a reward among American mothers of children with higher BMI levels; the use of food as a reward may negatively impact children's health by increasing intake of unhealthy foods and shape/reinforce unhealthy eating behaviors (Musher-Eizenman, de Lauzon-Guillain, Holub, Leporc, & Charles, 2009; Carnell, Cooke, Cheny, Robbins, & Wardle, 2011).

Current Study

The purpose of this study is to examine child body mass index (BMI) in relation to breastfeeding duration, child eating behaviors and parental feeding practices among low-income preschool children, utilizing parent data from the Educare Evaluation project and nutrition survey data collected as part of a larger cross-cultural study. In addition, potential mediating associations were examined.

The following research questions were posed:

Research Question 1: Is there an association between breastfeeding duration and child eating behaviors (Satiety Responsiveness and Food Responsiveness) and parental feeding practices (Environment and Parental Control over Eating) in preschool-aged children?

Hypothesis 1a: Breastfeeding duration will be positively associated with children's Satiety Responsiveness and negatively associated with children's Food Responsiveness, similar to the findings of Brown & Lee (2013), although that study was conducted with toddlers.

Hypothesis 1b: Breastfeeding duration will be positively associated with Environment and negatively associated with Parental Control over Eating, related to the findings of de Lauzon-Guillian et al. (2013) and Fisher, Birch, Smicklas-Wright, & Piccano (2000), although the latter study was conducted among mothers of infants and toddlers.

Research Question 2: Does breastfeeding duration predict BMI in preschool aged children?

Hypothesis 2: Breastfeeding duration will be associated with lower BMI in study preschool-aged children, consistent with the work of Owen et al. (2005) and

others, although these studies have been conducted across the lifespan, including preschool-aged children. This relationship will remain even after accounting for mediators (See Research Question 4).

Research Question 3: Do child eating behaviors (Satiety Responsiveness and Food Responsiveness) and parental feeding practices (Environment, and Parental Control over Eating) predict BMI in preschool-aged children?

Hypothesis 3a: Preschool-aged children with lower Satiety Responsiveness and higher Food Responsiveness and will have higher BMI, consistent with the literature (Carnell &Wardle, 2007, 2008; Jansen et al., 2012).

Hypothesis 3b: Preschool-aged children who experience households that have healthier foods available and primary caregivers with lower levels of controlling feeding practices will have lower BMI, similar to previous research (Arcan et al., 2013; Musher et al., 2009; Johnson & Birch, 1994).

Research Question 4: Do child eating behaviors (Satiety Responsiveness and Food Responsiveness) and parental feeding practices (Environment and Parental Control over Eating) mediate relations between breastfeeding and BMI in preschool-aged children?

Hypothesis 4: Preschool-aged children who experience longer durations of breastfeeding will have higher Satiety Responsiveness which in turn will be associated with lower child BMI percentile. Preschool-aged children who experience longer durations of breastfeeding will have lower food responsivity and lower BMI percentile. Preschool-aged children who experience greater durations of breastfeeding will have parents who provide greater availability of

healthy food options which will be associated with lower BMI percentiles. Preschool-aged children who experience longer durations of breastfeeding will have parents who implement less controlling feeding practices which will in turn associate with lower child BMI percentile. These relations may partially or fully mediate breastfeeding effects on BMI.

CHAPTER 2

METHODS

Data Collection Procedures

Primary caregivers of preschoolers who had consented to the larger evaluation study were identified to participate in the study. Primary caregivers completed the demographic questionnaire per program requirements with a Family Engagement Specialist from their center. Researchers invited Lincoln Educare primary caregivers who had consented to the larger evaluation study to take part in the nutrition survey. Primary caregivers were asked to complete the survey onsite or at home. The teachers at the Omaha sites distributed the surveys to parents. Questionnaires were provided in English, Spanish, and Arabic. Primary caregivers who completed the survey on site at the Lincoln Educare returned the survey directly to the researchers. Primary caregivers who completed the survey at home at both Lincoln and Omaha Educare locations returned the surveys to teachers who gave them to the researchers.

Participants

Participants were primary caregivers and their preschool-aged children. Data were collected in Educare Centers in Lincoln and Omaha, Nebraska, in the fall of 2014 and were compiled and are now available as secondary data. Participants were asked to complete questionnaires about breastfeeding practices, child eating behaviors and parental feeding practices as part of a larger study. Educare programs assessed each child's height and weight. The participating preschools are full-day, full-year schools which serve low-income, at-risk children and their families.

In total, 296 surveys were distributed and 224 surveys were completed for a response rate of 76%. The final sample included 224 primary caregivers (*M* age = 30.36 years, *SD* = 5.81) of preschoolers (*M* = 4.22 years, *SD* = .55, 55% male). Children ranged in age from 38 to 62 months), averaging 50.7 months and 123 (55%) children were boys. Primary caregiver and child descriptive statistics are presented in Tables 1 and 2. The sample was comprised of primary caregivers whose children were: Hispanic (49%), followed by Black non-Hispanic (27%), and White non-Hispanic (13%). A large number (43%) of primary caregivers immigrated to the United States. The majority of primary caregivers were mothers (90%) who reported two-parent family home structure (54%). Almost all primary caregivers were employed (82%) and nearly one-fourth of primary caregivers reported having an Associate's degree or higher.

Measures

Demographic information. Parents completed a questionnaire with demographic information such as primary caregiver's age, marital status, level of education, and who was considered primary caregiver (mother, father, grandmother, aunt, etc.) as part of the program requirements. Parents were also asked about their height and weight so parental body mass index (BMI) could be calculated. Child's sex, age-in-months, race and ethnicity, and body mass index (BMI) scores and percentiles were obtained directly from the ECE program. Based on CDC (2015) guidelines, a 4-interval weight status categorical variable was created: underweight (BMI < 5^{th} percentile), normal weight (BMI = 5^{th} percentile to <85^{th} percentile), overweight (BMI = 85^{th} percentile to <95^{th} percentile), and obese (BMI ≥ 95^{th} percentile). BMI percentiles were used for analyses as the percentile

score takes into account children's age and sex. BMI-for-age Z-scores were not calculated as child height and weight information was not collected. Age-in-months and child sex were used in analyses as control variables. BMI data were missing for 2 children. Due to missing height and/or weight data for primary caregivers, primary caregiver BMI, asked in the questionnaire, was not used for analysis.

Breastfeeding. Parents completed three questions about infant feeding taken from the Centers for Disease Control (CDC) National Immunization Survey (2006-2012). Questions examined whether the child had ever been breastfed, the duration of breastfeeding, and the age of the child if/when formula was introduced. Breastfeeding duration was measured on a continuous scale (in months) as breastfeeding has been found to have an inverse dose-response association with obesity, and was identified as an independent variable (DiSantis, Hodges & Fisher, 2013; Reilly et al., 2005; Ip et al., 2007; Mayer-Davis et al., 2006; Metzger & McDade, 2010; Gillman et al., 2001).

Child Eating Behaviors. The Child Eating Behavior Questionnaire (CEBQ; Wardle, Guthrie, Sanderson, & Rapoport, 2001; Carnell & Wardle, 2007) was used to measure children's general appetite and satiety. The CEBQ is a parent-completed screening instrument used to examine the eating styles of children aged 3-8. The CEBQ is a 35-item questionnaire with eight scales: Satiety Responsiveness (5 items), Slowness in Eating (4 items), Fussiness (6 items), Food Responsiveness (5 items), Enjoyment of Food (4 items), Desire to Drink (3 items), Emotional Undereating (4 items), and Emotional Overeating (4 items). Participants rated items on a five-point Likert-type scale, responses ranged from never (1 point) to always (5 points).

For the purpose of the present study only the Satiety Responsiveness and Food Responsiveness subscales were used. Mean scores are calculated for each subscale with 80% item completion.

The Satiety Responsiveness subscale indicates the extent to which a child becomes full easily and leaves food when finished eating. Higher scores indicate greater external cues to stop eating while lower scores are indicative of lower satiety responsiveness which has been associated with obesity (Wardle et al., 2001; Carnell & Wardle, 2007). The Food Responsiveness scale addresses children's general appetite for food/desire to eat. The scores are designed to detect levels of appetite that could be considered maladaptive and the tendency to eat when prompted by external cues—finding room for favorite food if full (Wardle et al., 2001; Carnell & Wardle, 2007). Higher scale scores indicate a higher food responsiveness which has been associated with higher adiposity. Wardle et al. (2001) found good reliability for the Satiety Responsiveness scale ($\alpha = 0.83$) and the Food Responsiveness scale ($\alpha = 0.82$). The internal consistency in the present study was good for the Satiety Responsiveness ($\alpha = 0.74$) and Food Responsiveness ($\alpha = 0.81$) scales.

Parental Feeding Practices. Subscales from the Parental Feeding Style Questionnaire (PFSQ; Wardle, Sanderson, Guthrie, Rapoport, & Plomin, 2002) and the Comprehensive Feeding Practices Questionnaire (CFPQ; Musher-Eizenman & Holub, 2007) were used to examine parental feeding practices. Developed by Wardle et al. (2002) the PFSQ was used to assess parents' feeding behaviors and has been validated for

use with preschool children and cross-culturally (Wardle et al., 2002; Tam, Keung, Lee, Lo, & Cheung 2014; Yilmaz, Erkorkmaz, Ozcetin, & Karaaslan, 2013).

The PFSQ includes 27 items over four scales: Control over Eating (10 items), Instrumental Feeding (4 items), Emotional Eating (5 items), and Prompting/Encouragement to Eat (8 items). Five items on the Control over Eating scale were reverse coded. Participants rated items on a five-point Likert-type scale, responses ranged from never (1 point) to always (5 points). The present study used one subscale from the PFSQ—Control over Eating. Mean scores are calculated for each subscale with 80% item completion. Higher mean scores for each scale indicate a higher tendency for parents to implement a particular feeding style. Wardle et al. (2002) found internal consistency for Control over Eating ($\alpha = 0.81$). The internal consistency in the present study Control over Eating was $\alpha = 0.67$.

The CFPQ is a tool designed to measure parental feeding practices of young children aged 2 to 8 years and has been validated cross-culturally (Musher-Eizenman & Holub, 2007; Musher et al., 2009; Haszard et al., 2013). The CFPQ includes 49 items and measures twelve domains: Child Control (5 items), Emotion Regulation (3 items), Encourage Balance and Variety (4 items), Environment (4 items), Food as a Reward (3 items), Involvement (3 items), Modeling (4 items), Monitoring (4 items), Pressure (4 items), Restriction for Health (4 items), Restriction for Weight Control (8 items), and Teaching about Nutrition (3 items). For the purposes of the present study the Environmental subscale was used. Mean scores are calculated for each subscale with 80% item completion. The Environmental subscale examines the provision of healthy

food availability within the home (Musher-Eizenman & Holub, 2007). Musher-Eizenman & Holub (2007) found good reliability of the Environmental subscale (α = .75). The internal consistency of the four items for the present study was α = .47.

CHAPTER 3

RESULTS

Findings are presented as follows: preliminary analyses, including descriptive analyses and bivariate analyses between variables; results from linear regression (preliminarily testing Research Question 1); and results from mediation models (simultaneously testing all research questions one potential mediator at a time, four altogether, as will be explained).

Preliminary Analyses: Descriptive and Bivariate Analyses

Nearly 75% of children had ever been breastfed and were breastfed on average 7.00 months (*SD* = 8.39) (Table 2). The average child BMI percentile was 65.43 (SD = 29.37), with 5.8% of children categorized as underweight (BMI < 5^{th} percentile), 60.3% as normal weight (BMI = 5^{th} percentile to <85^{th} percentile), 15.6% as overweight (BMI = 85^{th} percentile to <95^{th} percentile), and 17.4% as obese (BMI ≥ 95^{th} percentile). Means for the child eating variables and parent feeding variables are in Table 3.

Bivariate correlations of variables were calculated (see Table 4). Breastfeeding duration was significantly and positively correlated with Satiety Responsiveness (r= .16, p<.05) and Environment (r= .22, p<.01). Breastfeeding duration was also significantly and negatively correlated with child BMI percentile (r= -.17, p<.01), Food Responsiveness (r= -.15, p<.05), and Parental Control over Eating (r= -.12, p<.05). Children's BMI percentile was significantly and positively correlated with Food Responsiveness (r= .18, p<.01), Parental Control over Eating (r= .13, p<.05) and Sex with males coded as 1 and females coded as 2 (r= .12, p<.05). Children's BMI

percentile was significantly and negatively correlated with age (r= -.14, p<.01).There were no significant correlations between child BMI and Satiety Responsiveness and Environment. Covariates in further analysis included child age-in-months and sex as associations were found between children's BMI percentile and the variables. Primary caregiver education was not included as a covariate as no association was found between education and child BMI percentile.

Linear Regression

A simple regression was run to predict BMI percentile in preschool-aged children from breastfeeding duration (see Figure 1). A linear regression established that breastfeeding duration could statistically significantly predict child BMI percentile, $F(1, 204) = 4.50$, $p = .03$). Breastfeeding duration accounted for 2% of the explained variability in child BMI percentile (see Figure 1). The regression equation was: predicted BMI percentile = 68.34 – (0.51 x breastfeeding duration).

Simple Mediation Models

A series of simple mediation analyses (see Figures 2-5) were conducted using an ordinary least squares (OLS) regression-based path analysis via the MEDIATE macro developed by Hayes (2013). Bootstrapping confidence intervals based on 5,000 samples yielding 95% confidence intervals was used to test for mediation. In each of the analyses, breastfeeding duration acted as the independent variable (X) and BMI percentile acted as the dependent variable (Y). Separate analyses were conducted for each of the four potential mediators (M)–Satiety Responsiveness, Food Responsiveness, Environment, and Parental Control over Eating. . Child age and sex were covariates in every model.

The MEDIATE macro also tests for the indirect effect of the independent variable on the dependent variable, the effect of the independent variable on the mediator, and the effect of the mediator on the dependent variable. A significant direct effect for breastfeeding duration on the mediator variables was found for child Satiety Responsiveness, Food Responsiveness, and Environment. Food Responsiveness was the only mediator found to have a direct effect on child BMI percentile.

The first analysis examined the relationship between breastfeeding and BMI percentile and whether it was mediated by children's Satiety Responsiveness (see Figure 2). The unstandardized regression coefficient between breastfeeding duration and children's Satiety Responsiveness was statistically significant. However, the unstandardized regression coefficient between children's Satiety Responsiveness and children's BMI percentile was not statistically significant. The bootstrapped unstandardized indirect effect was -.05 and the 95% confidence interval ranged from -.18 to .00. Thus, the indirect effect was not statistically significant.

Second, the relationship between breastfeeding and BMI percentile and whether it was mediated by children's Food Responsiveness was examined (see Figure 3). The unstandardized regression coefficient between breastfeeding duration and children's Food Responsiveness was statistically significant, as was the unstandardized regression coefficient between children's Food Responsiveness and children's BMI percentile. The bootstrapped unstandardized indirect effect was -.08 and the 95% confidence interval ranged from -.24 to -.01. Thus, the indirect effect was statistically significant and the

significant relationship between breastfeeding and BMI percentile was mediated by Food Responsiveness.

The third analysis examined the relationship between breastfeeding and BMI percentile and whether it was mediated by Environment (see Figure 4). The unstandardized regression coefficient between breastfeeding duration and Environment was statistically significant. However, the unstandardized regression coefficient between Environment and children's BMI percentile was not statistically significant. The bootstrapped unstandardized indirect effect was -.03 and the 95% confidence interval ranged from -.14 to .06. Thus, the indirect effect was not statistically significant.

The final analysis examined the relationship between breastfeeding and BMI percentile and whether it was mediated by Parental Control over Eating (see Figure 5). The unstandardized regression coefficient between breastfeeding duration and Parental Control over Eating was statistically significant. However, the unstandardized regression coefficient between children's Parental Control over Eating and children's BMI percentile was not statistically significant. The bootstrapped unstandardized indirect effect was -.04 and the 95% confidence interval ranged from -.19 to .01. Thus, the indirect effect was not statistically significant.

CHAPTER 4

DISCUSSION

While the overall prevalence of childhood obesity in the United States has declined it remains a significant public health concern. This study examined child body mass index (BMI) in relation to breastfeeding duration, child eating behaviors and parental feeding practices among low-income preschool children. In addition, child eating behavior and parental feeding practices were examined as mediators between breastfeeding duration and child BMI percentile. Although, research has investigated breastfeeding duration and child weight status (DiSantis, Hodges & Fisher, 2013; Reilly et al., 2005; Ip et al., 2007; Mayer-Davis et al., 2006; Metzger & McDade, 2010; Gillman et al., 2001), the mediating effect of children's eating behaviors and parental feeding practices on breastfeeding duration in the prediction of child BMI is less known. Examining these direct effects and mediation models was important in order to gain further understanding of how early feeding practices such as breastfeeding influence child eating behaviors and parental feeding practices among preschool-aged children and their primary caregivers and the relation the behaviors and practices to child BMI.

Associations between Breastfeeding, Child Eating Behaviors, Parental Feeding Practices and Child BMI

First, it was hypothesized that breastfeeding duration would be positively associated with children's Satiety Responsiveness and negatively associated with children's Food Responsiveness. Results revealed that there was a significant positive association between breastfeeding duration and children's Satiety Responsiveness and a

significant negative association with children's Food Responsiveness. These results are similar to previous research, although the previous study was conducted with toddlers (Brown & Lee; 2012). While Brown and Lee (2012) found that children who were breastfed during the first year displayed greater satiety responsiveness compared to children who were formula fed, no association was found for food responsiveness. This may be due to the age of the children in their sample as toddlers do not have as much opportunity to seek out food that is not given to them as do older children.

Breastfeeding duration was also hypothesized to be positively associated with Environment and negatively associated with Parental Control over Eating. Results showed that breastfeeding duration was significantly and positively associated with Environment and significantly and negatively associated with Parental Control over Eating. The findings are similar to the results of previous research reporting that longer breastfeeding duration was consistently related to greater fruit and vegetable intake in preschool-aged children and lower levels of parental control in toddler-aged children de Lauzon-Guillian et al., 2013; Fisher, Birch, Smicklas-Wright, & Piccano, 2000). Another interesting significant finding consistent with previous research was the significant negative association between Parental Control over Feeding and child Satiety Responsiveness. Previous research has found that highly controlling feeding practices reduce children's ability to adjust their food intake in response to the energy content of foods (Birch et al., 1987; Johnson & Birch, 1994).

Breastfeeding Duration as a Predictor of Child BMI

The current study also examined whether breastfeeding duration predicted child BMI. It was hypothesized that greater breastfeeding duration would be associated with lower BMIs in preschool-aged children. Results revealed that breastfeeding duration plays a small but detectable role in BMI among preschool-aged children. Parallel to previous findings on breastfeeding duration the current study confirmed relations between breastfeeding duration and later BMI (DiSantis, Hodges & Fisher, 2013; Reilly et al., 2005; Ip et al., 2007; Mayer-Davis et al., 2006; Metzger & McDade, 2010; Gillman et al., 2001). This significant association remained after controlling for child age and sex, as well as, parental feeding practices (see Figures 4-5). However, the significant association between breastfeeding and BMI when controlling for child eating behaviors (Satiety Responsivity and Food Responsivity) failed to reach statistical significance; suggesting mediation could be a possibility, as discussed next.

Child Eating Behaviors as Predictors and Mediators of BMI

Child eating behaviors were examined as predictors of BMI and as potential mediators of the relationship between breastfeeding duration and BMI. Contrary to the hypothesis, child Satiety Responsiveness was not significantly associated with child BMI. Previous research associating Satiety Responsiveness and BMI is inconsistent. Both Carnell & Wardle (2008) and Jansen et al. (2012) found high child Satiety Responsiveness to be associated with lower BMI scores among children. In addition, Frankel et al. (2014) looked at Satiety Responsiveness in low-income children and found a positive significant effect of Satiety Responsiveness on child BMI. However, Hathcock

et al. (2014) examination of Satiety Responsiveness, breastfeeding, and BMI among toddlers of overweight and obese women, found no relationship between satiety responsiveness and child BMI after controlling for maternal BMI and education. Gregory, Paxton, and Brozovic (2010) reported similar findings among preschool-aged children. Consequently, child Satiety Responsiveness was not a significant mediator of the association between breastfeeding duration and child BMI (see Figure 2).

Children with higher Food Responsiveness were hypothesized to have higher BMI percentiles. Results showed that Food Responsiveness was significantly and positively associated with children's BMI. These results are similar to previous research indicating that children who had higher weight status were more responsive to external food cues such as sight, smell, and/or taste (Jansen et al., 2003; Webber et al., 2009). The mediating role of Food Responsiveness on breastfeeding and child BMI was also examined. This conclusion was supported by a bootstrapped mediation analysis (Hayes, 2013) that showed Food Responsiveness was a significant mediator of the association between breastfeeding duration and BMI in preschool-aged children.

Parent Feeding Practices as Predictors and Mediators of Child BMI

This study also examined parental feeding practices as predictors of child BMI and potential mediators of the relationship between breastfeeding duration and child BMI. It was hypothesized that preschool children who experienced households that have healthier food available would have lower BMI. However, results revealed that Environment was not significantly associated with BMI. Arcan et al., 2013 found a marginal association with healthy food availability and weight status of young children.

In the current study because Environment was not found to predict child BMI, it also did not mediate the relationship between breastfeeding duration and child BMI.

Finally, Parental Control over Eating was examined as a predictor of child BMI. It was hypothesized that children whose primary caregivers used less controlling feeding practices would have lower BMI. Contrary to the hypothesis, Parental Control over Eating was not significantly associated with BMI. Prior research on Parental Control over Eating and BMI associations are inconsistent. Johnson and Birch (1994) found that among a preschool-aged sample from a higher socio-economic background, highly controlling parental feeding practices to be associated with higher child body fat stores (Johnson & Birch, 1994). Robinson et al. (2001) found that, among children from diverse ethnic and socioeconomic backgrounds, parental control to be inversely associated with weight status in girls and no association was found for boys.

Faith et al. (2004) examined associations between parent feeding styles, child eating and weight status and found studies that examined particular domains of parental control such as restriction rather than general feeding control were more likely to report positive associations with weight status. These differing outcomes may be due to inconsistencies among definitions of parental control and differences in parental feeding practices among varied ethnic and socioeconomic backgrounds. Parental Control over Eating was not found to mediate the relationship between breastfeeding and child BMI.

Limitations and Future Directions

There were several limitations of this study to consider when planning future research. First, the participants in the study, while ethnically diverse, were limited to

families of lower socio-economic conditions. As a result, the generalizability of this study is limited; however, it does have applicability to Head Start and other programs serving poverty-level families that have emphasized obesity prevention (Gooze, Hughes, Finkelstein, Whitaker, 2010; Lumeng et al., 2015). Also, with the diverse population and large number of immigrant primary caregivers future studies may wish to explore child eating behavior and parental feeding practice differences among these groups (see Appendix A-C). Musher-Eizenman et al. (2009) found significant differences in the way French and American parents fed their children; feeding practices in both cultures were found to be linked to child BMI.

A second limitation is that the study relied on primary caregiver-reported data of early feeding practices, child eating behaviors, and parental feeding practices. Primary caregivers may have intentionally or unintentionally reported inaccurate data. For example, infant feeding practices were provided retrospectively and primary caregivers may not accurately recall or may not know when/if formula was introduced and breastfeeding duration ceased. It is also possible that primary caregivers altered their responses to child eating behaviors or parental feeding practices in order to appear more socially/culturally acceptable, providing a false view of the child eating behaviors and parental feeding practices. Future studies may wish to implement an observational component or prospective approach in the home environment to gain greater understanding of the association between child eating behaviors and parental feeding practices which would aid in overcoming the primary caregiver self-report bias.

Third, this study relied on program-reported child BMI data which did not provide child height and weight at time of measurement. Thus, the lack of available child height and weight prohibited the calculation of child BMIz scores. Fourth, primary caregiver BMI was not included as a covariate in the study due the large number of missing height and/or weight for primary caregivers (who chose not to answer the question on the questionnaire). Research has found parental BMI to be a determinant of childhood weight status and children who have at least one parent who is overweight greatly increases the child's odds of becoming overweight or obese obesity (Parikka et al., 2015; Whitaker et al.,1997; Keane et al., 2012; Reilly et al., 2005). Therefore, a future study with primary caregiver/parent BMI included as a covariate may provide clearer results in terms of predictors of child BMI outcomes.

Contributions

Despite these limitations, this research makes a unique contribution to the literature by providing additional literature examining early feeding practices together with current feeding practices and child eating behaviors and their influence on child BMI. This study provides evidence for the importance of child eating behaviors by highlighting the mediating role of children's Food Responsivity in the association between breastfeeding duration and child BMI. This study brings attention to the influence children's eating behaviors have on BMI at early ages. It suggests that there may be pathways or trajectories of eating and outcomes that are established early. This way of conceptualizing the relationships could be promising for future research.

In the current study and others breastfeeding duration has been found to have an inverse relationship with child BMI (DiSantis, Hodges & Fisher, 2013; Reilly et al., 2005; Ip et al., 2007; Mayer-Davis et al., 2006; Metzger & McDade, 2010; Gillman et al., 2001). Nearly three-fourths of the children in this study had ever been breastfed and 45% were breastfed at least 6 months. According to the CDC Breastfeeding Report Card (2014) the U.S. national average for ever breastfed is 79% and 49% of infants are breastfed until 6 months. Head Start Program Performance Standards indicate that agencies must provide information on the benefits of breastfeeding to all pregnant and nursing mothers, as well as, making arrangements for mothers who choose to breastfeed in center-based programs (United States Department of Health and Human Services-DHHS, 2008). Encouraging breastfeeding by not only providing information and spaces to new and expectant mothers are important, but educating center staff about the benefits of breastfeeding and how to respond to and support nursing mothers may be equally as important.

Gooze et al. (2008) examined obesity interventions in Head Start programs and found that many take a multi-level approach that includes staff, parents, and community partners. However, information about the content and effectiveness of these programs are unclear. Lumeng et al. (2015) found preschool-aged children who entered Head Start as obese exhibited greater declines in BMIz scores during their first year compared to children receiving care from a primary health system. In addition, children who had participated in Head Start had significantly healthier BMIs at kindergarten than the comparison group.

While Lumeng et al.(2015), provides insight into the effectiveness of the programs the exact content of the obesity intervention approaches is not clear as many of the federal interventions available are piecemeal at the state level (Banghart, 2012). Head Start guidelines promote healthy eating habits such as providing sufficient time for children to eat their meals, a variety of foods at mealtimes, encouraging—not forcing children to eat or taste their food, and providing meals/snacks that conform to recommended serving sizes and standards (US DHHS, 2008). Family-style eating is also part of program requirements and children and staff are required to eat together and share the same menu—as much as possible (US DHHS, 2008).

Whereas healthy eating habits are encouraged within the center it may be more difficult to fully implement healthy eating behaviors within the program and home when food insecurity is present. Approximately, two-thirds of children in Head Start are living in families who are at or below the federal poverty level and nearly half of such homes experience food insecurity (Hulsey et al., 2011; Nord et al., 2010). Furthermore, Gooze et al. (2012), examined how Head Start programs responded to food insecurity, portion sizes and child BMI in programs and found almost half of all programs surveyed (N = 1, 583) provided more food to children and families who were perceived to be food insecure. During family-style mealtimes, in 39% of programs surveyed staff decided children's portion sizes and in 55% of programs the children mainly decided on their portion sizes.

Fulkerson et al. (2013), found underweight and overweight young Native American children to have higher food responsiveness scores compared to children of the

same age. These findings are contrary to Webber et al. (2009), who found a positive linear trend for Food Responsiveness and weight status. However, nearly 40% of families in Fulkerson et al.'s study reported food insecurity and the Parental Control scores were lower compared to those found in Wardle et al.'s (2002) validation study. The increased Food Responsiveness scores for underweight children may be in response to the lack of food or fears of inadequate food supply and the feeling of necessity to eat when food is available. Also, the lower Parental Control scores may be as a result of more encouragement to eat rather restriction in response to food security. While this study did not examine the Food Responsiveness scores among the various weight classifications it may be beneficial in future research to examine the differences, especially with groups who are more likely to experience food insecurity.

Although the linear effect between food responsiveness and child weight status is strongest among older children (Carnell & Wardle, 2008) the evidence provided in this study shows the early presence of the effect. Using the information found in this study to support and encourage healthy eating behaviors and parental feeding practices early on may help decrease children's external food cue responsiveness which may aid in children maintaining healthy weight status. However, unless food security issues are addressed within programs it may be difficult to gain ground with decreasing Food Responsiveness in relation to BMI.

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Table 1

Family Descriptive Characteristics

Variable	n (%)	Missing	M	SD	Range
Primary Caregiver	224				
Mother	203(90.6)				
Father	17(7.6)				
Grandmother	2(0.9)				
Aunt	2(0.9)				
Primary Caregiver Age	214	10	30.36	5.81	18.59–47.81
Ethnicity	222	2			
White	30(13.4)				
Black	60(26.8)				
Hispanic	110(49.1)				
Other	22(9.8)				
Language	223	1			
English	129(57.6)				
Spanish	74(33.0)				
Other	20(8.9)				
Primary Caregiver Education	223	1			
Less than high school	50(22.3)				
High school diploma or GED	66(29.5)				
Some college	53(23.7)				
College degree	54(24.1)				

Table 2

Child Descriptive Characteristics

Variable	n (%)	Missing	M	SD	Range
Sex	224				
Boy	123(54.9)				
Girl	101(45.1)				
Age (months)	224		50.70	6.63	38–62
Breastfed Ever	214	10			
Yes	166(74.1)				
No	48(21.4)				
Breastfeeding duration (months)	208	16	7.00	8.39	0-48
Body Mass Index Percentile	222	2	65.43	29.37	1-100
Body Mass Category	222	2			
Underweight	13(5.8)				
Normal weight	135(60.3)				
Overweight	35(15.6)				
Obese	39(17.4)	1			

Table 3

Descriptive Statistics of Variables

Variable	Mean	SD	Range	α
Child Eating Behaviors-CEBQ				
Satiety Responsiveness[b]	3.02	.67	1.00-4.80	.737
Food Responsiveness[a]	2.43	.82	1.00-5.00	.816
Parental Feeding Practices-CFPQ				
Environment[c]	3.80	.47	2.33-5.00	.473
Parental Feeding Practices-PFSQ				
Control Over Eating[d]	3.93	.49	2.40-5.00	.673

Note. CFPQ=Child Feeding Practices Questionnaire; PFSQ=Parental Feeding Style Questionnaire CEBQ=Child Eating Behavior Questionnaire. [a]Data missing for 1 participant. [b]Data missing for 1 participant.[c]Data missing for 1 participant. [d]Data missing for 4 participants. [e]Data missing for 2 participants.

Table 4

Correlations among breastfeeding duration, child BMI, Food Responsivity, Satiety Responsivity, Environment, Control over Eating, age-in-months, sex, and primary caregiver education.

	Variables	1	2	3	4	5	6	7	8	9
1.	Breastfeeding Duration	_								
2.	Child BMI Percentile	-.17**	_							
3.	Food Responsivity	-.15*	.18**	_						
4.	Satiety Responsivity	.16*	-.11	-.35**	_					
5.	Environment	.22**	-.07	-.23**	-.02	_				
6.	Control Over Eating	-.12*	.13*	-.08	-.12*	.17**	_			
7.	Age in Months	.02	-.14*	.05	-.04	.05	-.06	_		
8.	Sex	.03	.12*	.07	.07	.03	-.00	-.02	_	
9.	Primary Caregiver Education	-.03	-.05	.10	.04	.05	.13*	-.06	.08	_

Note. *p< .05, one-tailed. **p< .01,one-tailed*. Listwise N=203

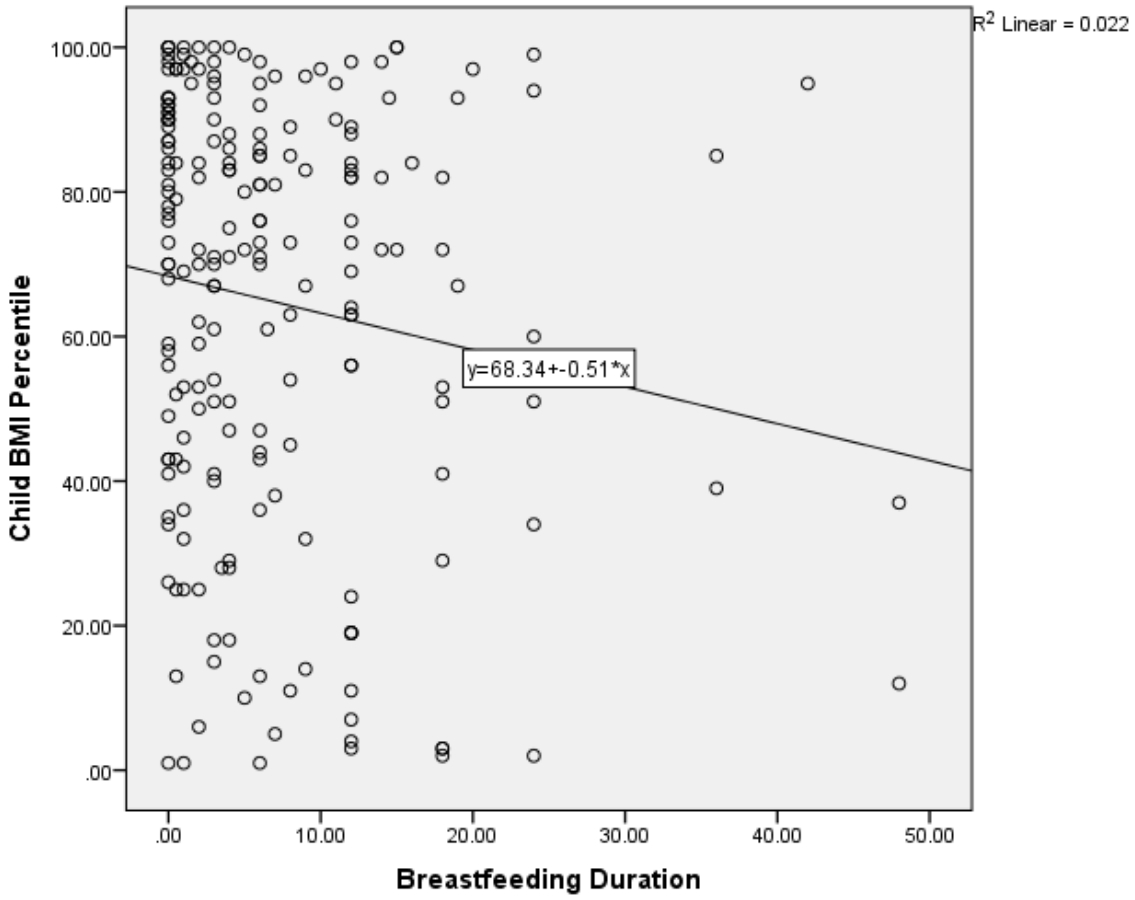

Figure 1. Relation between breastfeeding duration and child BMI percentile. There is a significant negative association between breastfeeding duration and BMI percentile (b = -.51, p = .03). Greater duration of breastfeeding is associated with lower child BMI percentiles.

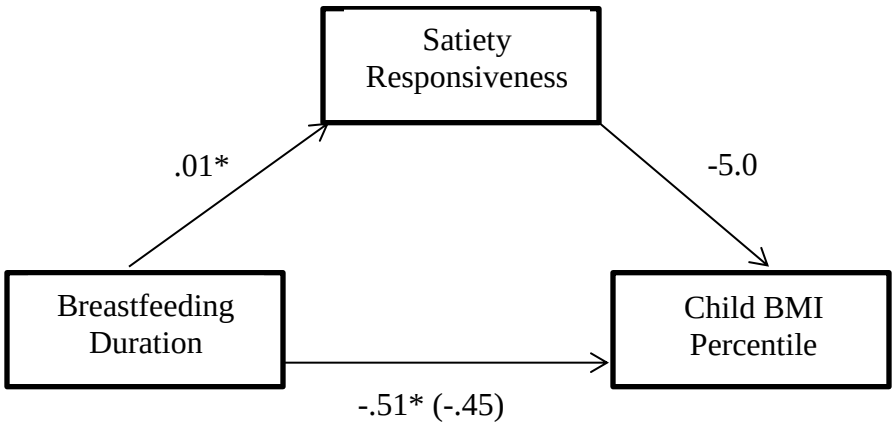

Figure 2. Unstandardized regression coefficients for the relationship between breastfeeding duration and child BMI percentile as mediated by Satiety Responsiveness. The unstandardized regression coefficient between breastfeeding duration and child BMI percentile, controlling for Satiety Responsiveness, is in parentheses.

Note. *$p < .05$. Listwise N= 205.

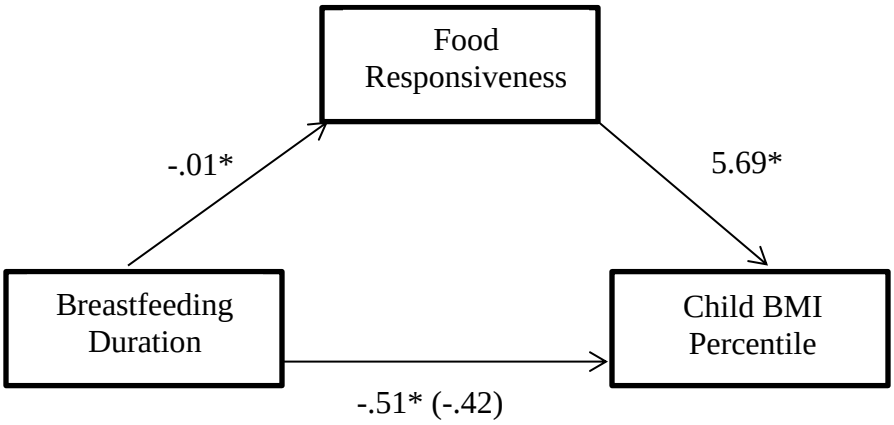

Figure 3. Unstandardized regression coefficients for the relationship between breastfeeding duration and child BMI percentile as mediated by Food Responsiveness. The unstandardized regression coefficient between breastfeeding duration and child BMI percentile, controlling for Food Responsiveness, is in parentheses.

Note. $*p < .05$. Listwise N= 205.

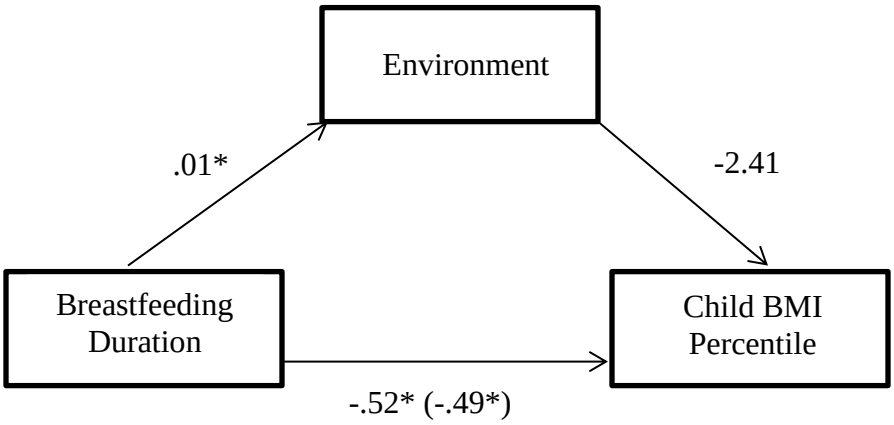

Figure 4. Unstandardized regression coefficients for the relationship between breastfeeding duration and child BMI percentile as mediated by Environment. The unstandardized regression coefficient between breastfeeding duration and child BMI percentile, controlling for Environment, is in parentheses.

Note. *$p < .05$. Listwise N= 204.

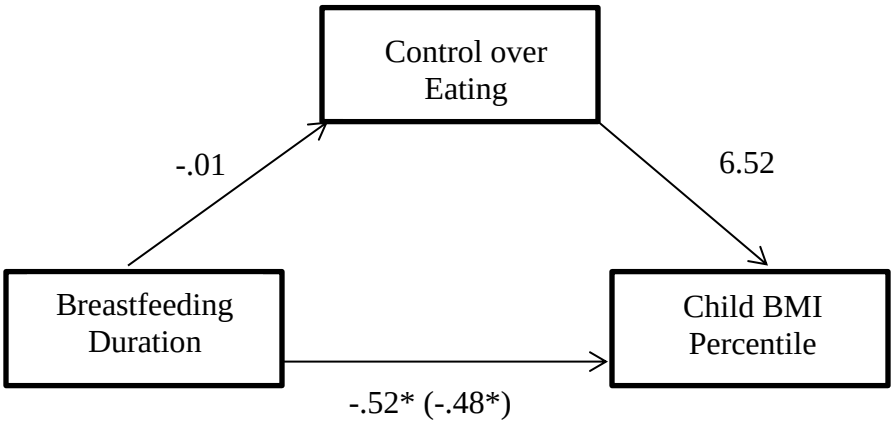

Figure 5. Unstandardized regression coefficients for the relationship between breastfeeding duration and child BMI percentile as mediated by parent Control over Eating. The unstandardized regression coefficient between breastfeeding duration and child BMI percentile, controlling for parent Control over Eating, is in parentheses.
Note. *$p < .05$. Listwise N= 204.

Appendix A: Primary Caregiver Immigrant Status— Differences on BMI and Breastfeeding

Variable	n	Missing	M	SD	Range
BMI %	222	2			
Non-Immigrant	123	2	69.80	27.48	1-100
Immigrant	97		59.93	31.14	1-100
Unknown Status	2		64.00	16.00	56-72
Breastfeeding Duration (in months)	208	16			
Non-Immigrant	118	7	4.82	6.44	0-42
Immigrant	88	9	9.94	9.89	0-48
Unknown Status	2		7.00	7.07	2-12

Appendix B: Primary Caregiver Immigrant Status— Differences on Child Eating Behaviors

Variable	n	Missing	M	SD	Range
Satiety Responsiveness	223	1			
Non-Immigrant	125		2.91	.70	1.20-4.80
Immigrant	96	1	3.15	.62	1.00-4.75
Unknown Status	2		3.30	.14	3.20-3.40
Food Responsiveness	223	1			
Non-Immigrant	125		2.60	.81	1.20-4.80
Immigrant	96	1	2.24	.82	1.00-5.00
Unknown Status	2		2.40	.28	2.20-2.60

Appendix C: Primary Caregiver Immigrant Status— Differences on Parental Feeding Practices

Variable	n	Missing	M	SD	Range
Environment	223	1			
Non-Immigrant	125	0	3.70	.44	2.33-4.75
Immigrant	96	1	3.96	.48	2.50-5.00
Unknown Status	2		3.50	.71	3.00-4.00
Parental Control over Eating	220	4			
Non-Immigrant	125		4.04	.48	2.40-5.00
Immigrant	93	4	3.80	.48	2.44-2.56
Unknown Status	2		4.15	.35	3.90-4.40