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Examining how Parent Child Interaction Therapy (PCIT) Skills influence childrens eating during a structured eating task

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EXAMINING HOW PARENT CHILD INTERACTION THERAPY (PCIT) SKILLS INFLUENCE CHILDREN'S EATING DURING A STRUCTURED EATING TASK

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Abstract

Early childhood is a critical period for the development of healthy eating behavior. This study aimed to examine how mothers' behaviors during an eating scenario align with evidence-based parenting skills (e.g., Parent-Child Interaction Therapy (PCIT) skills) and to determine how these skills influence children's eating. This study observationally coded videos of dyadic parent-child interactions for 50 mothers and 50 children (ages 4 to 7 years old) from a primarily low-income population using Noldus Observer XT software. It examined interactions during a structured eating task (e.g., taste testing of foods) by first, applying and modifying the PCIT coding scheme to determine if these skills are applicable during an eating situation; and by second, using lag sequential analysis to assess how use of "Do" and "Don't" skills [associated with two phases of PCIT: 1) Child-Directed Interaction (CDI) skills, and 2) Describe, Approach, Direct command, and Selective attention (DADS) skills], related to the child's eating behavior. This study established the feasibility of applying and coding PCIT skills in an eating scenario with a few modifications. When examining all antecedent-consequences of interest, a CDI and DADS "Do" skill was more likely to be followed by child eating. Looking at just bites of food, children were more likely to eat in response to a CDI and DADS "Do" skill rather than a "Don't" skill. Lastly, when examining how children respond to "Do" skills, children were more likely to eat following a DADS "Do" skill, rather than engage in "other" behavior; however, this was not significant for the CDI model, suggesting that the unique features of DADS skills are more effective at encouraging eating relative to other behavior when compared to CDI skills. This study used novel methodology and expands prior work around dyadic interactions during eating scenarios. Our findings demonstrate that PCIT "Do" skills encourage eating and may help children overcome food neophobia and increase consumption of a variety of healthy foods.

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Introduction

Early childhood is a critical period for the development of healthy eating behaviors and the prevention of pediatric obesity, especially when considering that children's eating behavior traits (e.g., satiety responsiveness, food responsiveness, enjoyment of food, emotional overeating, and food fussiness) are established within the first 5 years of life and remain relatively stable thereafter (Ashcroft, Semmler, Carnell, Van Jaarsveld, & Wardle, 2008). Although recent prevalence rates suggest that obesity is stabilizing or decreasing, 13.9% of preschool-age children are obese (Hales, Carroll, Fryar, & Ogden, 2017; Ogden, Carroll, Kit, & Flegal, 2014). Pediatric obesity during early childhood is concerning due to the likelihood that obesity will persist into later childhood and adulthood. Notably, children who are overweight or obese at age 5 are greater than 6 times more likely to be obese in adolescence and adulthood, relative to children at the 50^{th} Body Mass Index (BMI) percentile (Nader et al., 2006). Understanding modifiable factors that have a strong influence over the development of eating behaviors is critical for developing interventions aimed at enhancing healthy eating behaviors and promoting healthy weight trajectories.

One such factor that has been implicated is parent and family characteristics in relation to the food environment and eating contexts (Faith et al., 2003; Webber, Cooke, Hill, & Wardle, 2010). Specifically, researchers have posited that parents shape children's dietary patterns as a result of interactions that take place during mealtimes (Faith, Scanlon, Birch, Francis, & Sherry, 2004). Parent-child interactions in relation to eating behaviors and pediatric obesity have been measured in the literature in various ways, including parenting styles (i.e., general behavioral constructs which sets the emotional context which parents and children interact), feeding styles (i.e., a subcategory of parenting styles that are specific to mealtimes and apply the same dimensions of demandingness or responsiveness in the feeding context), or parent feeding practices (i.e., specific goal-directed behaviors used by parents to directly influence their child's eating). However, these global concepts and practices do not necessarily translate to skills that parents can readily understand and utilize during a mealtime to promote healthy eating. The purpose of the present study is to better understand how a parent's behaviors during a structured eating task map onto evidence-based parenting skills aimed at modifying young children's behavior, as well as determine how they influence children's eating behavior.

Parenting styles in relation to eating behavior and weight

Parenting styles are characterized as having two dimensions: demandingness (i.e., how much control parent's exercise) and responsiveness (i.e., warmth and acceptance in response to their children's needs; (Baumrind, 1971, 1978, 1989; Darling & Steinberg, 1993). Four types of general parenting styles have been offered: (1) authoritative parenting, linked with higher levels of demandingness and higher responsiveness to the child; (2) authoritarian parenting, associated with higher demandingness but lower responsiveness to the child's needs; (3) indulgent parenting, which is associated with lower demandingness and higher responsiveness; and finally (4) uninvolved parenting which corresponds to both lower demandingness and lower responsiveness (Baumrind, 1971; Hughes, Power, Fisher, Mueller, & Nicklas, 2005; Wardle, Sanderson, Guthrie, Rapoport, & Plomin, 2002).

Multiple studies have examined general parenting styles in relation to children's weight status. In particular, some studies have found that children of authoritarian mothers had the highest risk of overweight among young children (Rhee, Lumeng, Appugliese, Kaciroti, & Bradley, 2006; Sleddens, Gerards, Thijs, De Vries, & Kremers, 2011). However, children with parents who displayed indulgent or uninvolved parenting styles also had increased risk for becoming overweight relative to children of authoritative mothers (Sleddens et al., 2011). When controlling for weight status at baseline, Olvera and Power (2009) found that indulgent or uninvolved general parenting styles at baseline were associated with children being overweight at follow-up a year later. Another study found that general parenting styles may moderate the relation between children's food approach traits (e.g., food responsiveness and enjoyment of food) and higher zBMI; specifically, an uninvolved parenting style was found to amplify this relation (Rodenburg, Kremers, Oenema, & van de Mheen, 2012).

Feeding styles in relation to eating behaviors and weight

Level of demandingness and responsiveness can be related to the context of eating. For instance, a parent with an authoritative feeding style encourages eating using supportive and non-directive behaviors, is nurturing and high in structure, and demanding, but responsive to child's needs, whereas a parent with an authoritarian feeding style, encourages eating with directive, rule-based demands regardless of child preferences (Hughes et al., 2005). Parents with indulgent feeding styles encourage eating with few requests, in a non-directive manner, and are supportive, whereas a parent with an uninvolved feeding style makes very few demands on the child to eat, and when demands are made they are unsupportive (Hughes et al., 2005). Researchers who have examined feeding styles have found that indulgent feeding styles were associated with higher weight or BMI z-scores compared to other feeding styles (Frankel et al., 2014; Hennessy, Hughes, Goldberg, Hyatt, & Economos, 2010; Tovar et al., 2012). Furthermore, one study found that authoritative feeding was positively associated with child's increased consumption of dairy and vegetables, whereas authoritarian feeding was negatively associated with vegetable consumption (Patrick, Nicklas, Hughes, & Morales, 2005). Among 3- to 5-year olds from low-income racial/ethnic minority families, one study's finding suggests that an authoritarian feeding style was associated with significantly lower zBMIs compared to an indulgent feeding style (Hughes et al., 2005).

Feeding practices in relation to eating behaviors and weight

Different from feeding styles which are characterized by dimensions of demandingness and responsiveness in the eating context, feeding practices refer to parents' behaviors that are specific and goal-directed and used to directly influence their children's eating. For example, attempts to increase (e.g., prompts to eat) or decrease intake of certain foods (e.g., restrict food) are types of feeding practice because it is specific parent behavior and goal-directed and aims to influence children's eating. There are many feeding practices, but the most commonly studied include: modeling eating behaviors, restricting certain types of food, pressuring children to eat, rewarding positive behaviors with food, and availability of food at home (Shloim, Edelson, Martin, & Hetherington, 2015). Cross-sectional studies have found an association between restrictive/controlling feeding and high child BMI; these findings sometimes varied depending on sex, age, and race/ethnicity (Cardel et al., 2012; Dev, McBride, Fiese, Jones, & Cho, 2013; Haycraft & Blissett, 2008; Rhee et al., 2009; Rollins, Loken, Savage, & Birch, 2014). For example, one study found that between the ages of 4-7, mothers became more controlling and restrictive for both girls and boys who had greater zBMIs; however, for children 7-9 years of age, there was only an association of restrictive feeding practices and greater zBMI for girls (Rhee et al., 2009). In a separate study, parental restriction was a significant predictor of child adiposity and Hispanic American parents reported significantly higher levels of restriction relative to African Americans and European Americans (Cardel et al., 2012). Longitudinal studies found that restriction/controlling feeding practices can have protective effects such that parents of young children (5-6 years) who restricted foods at baseline had children who gained less weight over 3 years' time, whereas there was no association between restrictive feeding practices and weight gain among older children (Campbell et al., 2010).

Feeding practices and child characteristics also likely interact. For instance, one study found that children with low inhibitory control whose mothers restricted all snacks gained the most weight and increased their eating in the absence of hunger (Rollins et al., 2014). Alternatively, pressure to eat (i.e., a parental controlling feeding practice aimed at encouraging a child to eat more) was associated with lower child BMI in a number of studies (Hennessy et al., 2010; Jansen et al., 2012; Tschann et al., 2013; Webber et al., 2010). One study in particular investigated pressure to eat in regards to "stimulation of healthy intake" and found that this variable was significantly and concurrently associated with greater child BMI z-score (zBMI) at age 5 and predicted a healthy BMI at age 7 (Gubbels et al., 2011). Similarly, this longitudinal study also found that parental monitoring of food intake was associated with lower child zBMI at age 7 (Gubbels et al., 2011). However, most studies have found no association between parental monitoring and child BMI (Hennessy et al., 2010; Jansen et al., 2012; Rodenburg, Kremers, Oenema, & MHEEN, 2011; Rollins et al., 2014; Webber et al., 2010).

Eating behaviors, obesity, and parental feeding practices in relation to family income

Income level, a proxy for socioeconomic status (SES), has been used in various studies and examined in relation to eating behaviors, parenting behaviors during mealtimes, and overweight/obesity. Studies have found that children from low-income families are at greater risk for obesity compared to children from middle- and high-income families (Murasko, 2011; Wang, 2011; Wang & Lim, 2012). In a qualitative study examining barriers to healthy eating, low-income rural parents indicated children's behavior as a primary barrier to healthy eating. With regard to parenting behaviors during mealtimes, one study found that parents of higher SES families were more likely to use reasoning, praise, and rewards to encourage positive eating behaviors relative to parents of lower SES families (Orrell-Valente et al., 2007). Among low-income African American families, Powers and colleagues (2006) found that pressure to eat by parents was positively associated with greater zBMI in children. However, greater control and restriction were positively associated with child zBMI, only if mothers' were obese; this was not the case for non-obese mothers (Powers, Chamberlin, Van Schaick, Sherman, & Whitaker, 2006).

In relation to eating behaviors, Lumeng and colleagues sought to understand the mechanisms behind the relation of children from low-income households and risk for overweight by examining cortisol levels, eating behaviors, and zBMI. Among children living in low-income families, children with more chaotic homes were more likely to experience hypocortisolism, or lower levels of cortisol in the morning, which was consistent with individuals who have experienced significant allosteric load as a result of early life chronic stress (Lumeng et al., 2014). Girls experiencing hypotcortisolism were found to have a greater likelihood of being overweight, which was mediated through reduced satiety responsiveness (Lumeng et al., 2014). Whereas with boys, the association of the hypocortisol pattern with being overweight was mediated entirely through emotional overeating (Lumeng et al., 2014). Given these findings, it may be particularly important to better understand how parents can influence and promote healthy eating behaviors among children who live in low-income families and experience greater levels of chaos.

Observational studies on parent-child interactions during mealtimes

Parenting styles, feeding styles, and feeding practices have largely been studied using self-report data, but these studies are limited by potential biases and may be more reflective of idealized or intended behaviors rather than actual behaviors during mealtimes (Farrow, Blissett, & Haycraft, 2011; Haycraft & Blissett, 2008). In fact, three studies comparing self-report mealtime behaviors and observed mealtime behaviors found no correlation (Farrow et al., 2011; Haycraft & Blissett, 2008; Lewis & Worobey, 2011). Observational approaches offer an opportunity to capture real-time overt behaviors that occur during parent-child mealtime interactions. Findings from studies examining observable mealtime behaviors and weight status are mixed. For instance, two studies have found that more maternal prompts to eat were positively associated with weight (Klesges, Malott, Boschee, & Weber, 1986; Lumeng & Burke, 2006). Klesges and colleagues (1986) found that parents of children who were overweight gave significantly more encouragements to eat, offers of food, and prompts to eat than did parents of average weight children. Similarly, a study by Lumeng and Burke (2006) found that more prompts to eat novel foods was positively associated with child zBMI scores, however this was only true for children with mothers who were obese. Conversely, Drucker and colleagues (1999) found that maternal discouragements to eat per minute were significantly related to child BMI (Drucker, Hammer, Agras, & Bryson, 1999). Children who were overweight were more likely to receive negative statements about food from parents, whereas children of average weight received more neutral statements about food from parents (Koivisto, Fellenius, & Sjoden, 1994). Studies have also found a significant correlation between parental feeding practices and total energy intake and eating time (Koivisto et al., 1994). Two studies found that greater parental prompts to eat was significantly related to longer eating time, which differed from the duration of the mealtime. Additionally, Drucker and colleagues (1999) found that more maternal prompts to eat was associated with significantly greater total energy intake by the child. Lumeng and Burke (2006) found that children complied with maternal prompts to eat on average 63.5% of the time.

Interestingly, the study found no statistically significant difference between how many prompts mothers gave based on their weight status; however, children of mothers who were obese were more likely to comply to prompts to eat (70% compared to 59%; (Lumeng & Burke, 2006). A study by Orrell-Valente et al. (2007) evaluated children from a diverse range of socioeconomic backgrounds in the United States, with results that showed 85% of parents tried to encourage their child to eat more, and in turn, 83% of children ate more than they would have eaten if unprompted (Orrell-Valente et al., 2007).

Early Childhood Considerations

Although parenting styles, feeding styles, and feeding practices have been studied extensively in relation to eating behavior and children's weight, specific targeted recommendations for parent-child interactions during mealtimes are not clear. Whereas general constructs are helpful in characterizing parents' behavior during mealtimes, observable and coachable behavior are important for making more targeted intervention recommendations. Early childhood poses unique considerations for promoting healthy eating behavior. Diet preferences and mealtime behaviors are qualitatively different among children ages 4-7 compared to older youth. Moreover, many developmental barriers challenge caregiver efforts to modify their child's diet (Kuhl, Clifford, & Stark, 2012). With regard to diet, food neophobia, or unwillingness to try new foods peaks during the preschool age (Addessi, Galloway, Visalberghi, & Birch, 2005). Parents offer new foods to children on average of 3 to 5 times, however, acceptance of a novel food among preschool age children requires 14 food offers on average (Birch, 1979a, 1979b, 1987; Birch & Marlin, 1982). Of concern, food neophobia has been associated with an increased intake of energy-dense foods, such as savory snacks and sweets (Tharner et al., 2014), and a decreased intake of fruits and vegetables (Dubois, Farmer, Girard, &

Peterson, 2007; Haszard, Skidmore, Williams, & Taylor, 2015; Jacobi, Agras, Bryson, & Hammer, 2003).

Additionally, mealtime tantrums are a frequent occurrence among young children (Agras, Hammer, McNicholas, & Kraemer, 2004; Berlin et al., 2010; Potegal & Davidson, 2003) and are a common parent-reported barrier to meeting American Medical Association (AMA) guidelines for obesity prevention and management, regarding limit-setting related to diet (e.g., limiting sugar-sweetened beverages and snacks; (Agras et al., 2004; Bolling, Crosby, Boles, & Stark, 2009; Rao, 2008). Persistent tantrums over food in early childhood are a risk factor for later obesity (Agras et al., 2004). Specifically, noncompliance and tantrum behavior often serve one of two purposes: 1) to obtain attention and stimulation from a caregiver and/or 2) to escape parent demands (McNeil & Hembree-Kigin, 2010a). As such, early childhood pediatric obesity treatments may be more successful if they target parent-child interactions to model, shape, and reinforce healthy lifestyle behaviors (i.e., eating vegetables, etc.) and better support parents' effective management of tantrums.

PCIT as a mechanism for modifying children's behavior during mealtimes

Parent Child Interaction Therapy (PCIT) is an evidenced-based treatment that has been successfully applied to preschool age children across different presenting problems (Carpenter, Puliafico, Kurtz, Pincus, & Comer, 2014; Eyberg, Nelson, & Boggs, 2008; Silverman et al., 2013). PCIT focuses on the parent-child relationship to increase adaptive functioning and decrease maladaptive behaviors linked to important outcomes. PCIT may pose three advantages when extended to early childhood obesity treatment. First, PCIT is formatted to improve child functioning by reshaping parent behavior and dyadic interactions between parent and child, rather than engaging directly with the child, thereby avoiding the common pitfall of utilizing treatments that may be beyond the cognitive capacity of young children (Feinfield, Lee, Flavell, Green, & Flavell, 1999; Flavell, 2004). Distinctly, PCIT teaches efficacious parenting skills utilizing a training format (i.e., in-vivo coaching) that is evidence-based for preschool age children across various presenting problems (Carpenter et al., 2014; Cooley, Veldorale-Griffin, Petren, & Mullis, 2014; Hood & Eyberg, 2003; Lenze, Pautsch, & Luby, 2011). Second, parents of children with obesity are often inadvertently involved in the maintenance of children's unhealthy behavior habits. That is, parents' attention or concession to children's food demands or tantrum behavior can inadvertently reinforce such behaviors (Kuhl et al., 2012). PCIT targets the negative reinforcement cycles in the parent-child relationship and teaches parents to selectively ignore unwanted child behavior so as to extinguish maladaptive patterns and positively attend to desired child behavior so as to increase their frequency (McNeil & Hembree-Kigin, 2010b). Finally, PCIT is sensitive to development and applies reinforcers and motivators unique to early childhood (i.e., social rewards such as special play time with a parent, praise, and attention; (McNeil & Hembree-Kigin, 2010a).

If PCIT is to be an effective intervention for promoting healthy eating and preventing early childhood obesity, researchers must first examine how the different phases of PCIT may or may not be applicable during mealtimes. There are typically two phases of PCIT treatment: Child Directed Interaction (CDI) and Parent-Directed Interaction (PDI); however, additional phases have been added based on presenting problem, such as the DADS phase (Puliafico, Comer, & Albano, 2013). In CDI, parents learn skills to enhance the parent-child relationship by using warmth and responsiveness to develop a stronger relationship and more effective emotional and behavioral regulation. The skills of CDI are referred to as PRIDE skills and consist of providing specific labeled **P**raises, **R**eflecting, **I**mitating, behaviorally **D**escribing, expressing **E**njoyment and providing contingent attention (McNeil & Hembree-Kigin, 2010b). In CDI, parents are explicitly instructed to avoid commands, negative talk (i.e., criticism), and questions, often referred to as the "Don't Skills" (McNeil & Hembree-Kigin, 2010b). In PDI, parents learn skills for improving child compliance and decreasing disruptive behaviors. PDI skills include giving clear commands, praising compliance, using time-out procedures for non-compliance, and establishing standing house rules (McNeil & Hembree-Kigin, 2010c). The DADS skills (**D**escribe situation, **A**pproach situation, give **D**irect Command to join situation, and provide **S**elective attention based on child's performance) were added for the treatment of anxiety disorders in preschool-age children (Puliafico et al., 2013; Puliafico, Comer, & Pincus, 2012). Specifically, DADS skills work by teaching parents to model approach behaviors, effectively communicate in anxious situations, provide clear and direct expectations about child approach behaviors, praise brave child behaviors, and selectively ignore anxious, avoidant, or whining behaviors. These skills may be particularly relevant for children who are reluctant to try new foods or eat healthy foods (e.g., vegetables; (Puliafico et al., 2013). To modify these skills for mealtimes, the term "situation" could be substituted to fit with whatever food the child is reluctant to eat, such as a novel/avoided vegetable. Parents own eating of novel foods would serve as modeling (i.e. Approach Situation). A similar approach has been found to be effective in increasing non-preferred food in children with feeding disorders (Bachmeyer, 2009; Kerwin, 1999; Linscheid, 2006; Lukens & Silverman, 2014; Sharp, Jaquess, Morton, & Herzinger, 2010).

Child-Directed Interaction (CDI) skills may be useful for mealtimes because they allow the child to take the lead, are non-directive parent skills, and use selective attention. For instance, parents may describe the child's behavior as he or she picks up a new food to try, praise his or her behavior for sitting calmly at the table, or reflect the child's statements about the food. The

PRIDE skills are consistent with the warmth and responsive parenting and feeding styles and may encourage more of the positive behavior that is being attended to by parents (Shloim et al., 2015). CDI skills would presumably allow children to direct their mealtime behaviors and choices. These skills may be particularly helpful when children are served familiar foods, so that they are not encouraged to eat more than is desired, as seen in other mealtime studies (Orrell-Valente et al., 2007). However, given that the level of demandingness is low in the CDI phase, using only the CDI skills may result in indulgent feeding styles, which is associated with greater obesity (Hughes, Shewchuck, Baskin, Nicklas, & Qu, 2008). Additionally, mealtime behavior and trying novel and nutritious foods (e.g., fruits and vegetables) may not improve if parents are unable to use commands.

Parent Child Interaction (PDI) skills may prove useful when direct commands are given to try novel and nutritious foods or engage in appropriate mealtime behavior (e.g., staying seated at the table). However, if a parent provides direct commands and follows-through with consequences and time-out procedures, mealtimes may become more demanding and restrictive, which is associated with greater BMIs in the literature (Birch, Fisher, & Davison, 2003; Campbell et al., 2010).

Fortunately, the DADS skills offer an ideal alternative. If a child's mealtime problems are related to reluctance to try novel or healthy foods, the DADS skills may prove more beneficial. To apply the DADS skills during a mealtime, a parent would first describe the food, model tasting the food (approach), provide a direct command to the child to taste the food, and provide selective attention to only the behavior that is desired (e.g., trying the food). Given that the PCIT skills have been primarily used with disruptive behaviors and the DADS skills have been used for anxious and avoidant behaviors, further examination is needed to determine how these skills may increase desired behaviors and decrease undesired behaviors at mealtimes. Therefore, examining how parents generally use these skills during mealtimes is needed to determine whether these skills are applicable to mealtime settings and eating behavior.

Purpose of the present study

Parenting behaviors in the context of eating and mealtimes have been previously defined by global constructs, making specific recommendations for modifying children's eating behavior challenging. Defining parent's behaviors during eating situations by evidence-based behavior modification strategies may be more tenable, but to our knowledge this has not been examined yet. Additionally, understanding parent-child interactions in low-income households is imperative given children's increased susceptibility to obesity. The present research examined mothers' naturally-occurring use of PCIT skills during an eating context to first determine if PCIT skill sets are applicable to describe parent-child interactions during an eating situation; and second, to examine how mother's natural use of PCIT skills relate to children's eating behavior. For the purpose of this study, a structured laboratory eating task (e.g., taste testing of four different foods) with low-income mother-child dyads was used to compare mother's natural use the "Do" and "Don't" skills associated with two phases of PCIT (e.g., CDI and DADS; see Table 1) and assessed whether using a particular set of skills increased the likelihood of taking a bite of food. PDI was not included in this study because follow-through of commands (i.e., time out procedures) were not used during the structured eating task.

The first model of "Do" and "Don't" skills are related to the CDI phase and include the following "Do" skills: Praise (labeled and unlabeled), Reflections, and Behavioral Descriptions, Neutral Talk; and the following "Don't" skills: Questions, Criticisms, and Commands. The second model of "Do" and "Don't" Skills correspond to the DADS phase and include the following “Do” Skills: Praise (labeled and unlabeled), Reflections, Behavioral Descriptions, Neutral Talk, Direct Commands, Description of Foods, Parent Bites (i.e., modeling eating the food); and the following “Don’t” skills: Questions and Criticisms. Three general hypotheses related to these two models (henceforth referred to as the CDI and DADS models) were generated. First, when looking at all parent-child antecedent and consequence pairings (e.g., “Do” with eat, “Don’t” with eat, “Do” with “other,” and “Don’t” with “other”), it was hypothesized that children would more likely respond to a “Do” with a bite of food, than any other parent-antecedent/child-consequence pairings for both the CDI and DADS model. Secondly, it was hypothesized that a child would be more likely to take a bite of food when a parent uses a “Do” skill, rather than a “Don’t” skill in this model. Lastly, it was hypothesized that a child would more likely respond to a “Do” skill with a bite of food, rather than an “other” behavior in both models. These hypotheses can also be articulated using the sets of contrast codes presented in Table 2. In the final model for the structured eating task, relevant moderators, such as child weight (i.e., child zBMI), maternal BMI, and child sex were accounted for. Significant moderators were included in the final models and examined in relation to child eating vs. non-eating behaviors.

Methods

Participants and Recruitment

Mothers and their 4- to 7-year-old children were recruited via participation in Head Start programs in South Central Michigan and enrolled in *ABC Preschool*, a longitudinal study conducted between 2009 and 2011. Approximately two years after participation in *ABC Preschool*, mothers were invited to participate in a follow-up study on child feeding, *ABC Feeding.* All mothers enrolled were fluent in English and had less than a 4-year college degree.

Of the 380 caregivers invited, a total of 296 caregiver-child dyads agreed to participate in this follow-up study. Forty-nine dyads were excluded from the structured eating protocol (SEP) for child or parent food allergies. An additional 3 dyads were not able to complete the SEP due to scheduling. Of the 244 who completed SEPs, 7 were excluded for the following reasons: the child becoming ill during the protocol, the mother speaking a language other than English during the SEP, or for the video being uncodeable (due to noise or video recording malfunction). Therefore the final sample size was 239 dyads in the ABC Feeding Study. Children in this sample were on average 5.9 years old (SD = 0.70, 89% were between 5 and 7), male (50.7%), and of average weight classifications (average = 58.1%, overweight = 20.3%, and obese = 21.6%). The average BMI-for-age z-score was 0.85 (*SD* = 1.04) and the average BMI percentile was 72.87% (*SD* = 25.41). The sample of children were the following race and ethnicity: 61.17% White, 17.7% Multiracial, 16.3% Black, 11.3% Latino, and 1% Other. Parents participating were predominantly mothers (*n* = 296 of 301), non-Hispanic ethnicity (91.3%) and reported race as White (73.4%) followed by Black (16.6%), Multiracial (8.9%), or Other (1%). Notably this particular sample of low-income families differs from the national sample of families living in poverty on key demographics (e.g., race, ethnicity, education level, occupation) due to the region of the country where this sample was collected.

Given the complexity and time intensity of the analysis, the decision was made to code and analyze an established subset of 50 dyads based on prior analysis of these data (Pesch et al. 2018). Purposive sampling was used to obtain a sample of 50 dyads evenly distributed based on child weight status (e.g., 25 children with lean weight, BMI $>5^{th}$ percentile and $<85^{th}$ percentile for age and sex according to Center for Disease Control, and 25 children with overweight/obese weight status $\geq 85^{th}$ percentile for age and sex according to CDC growth charts). The study protocol was approved by the University of Memphis Institutional Review Board as well as the University of Michigan Institutional Review Board.

Measures

Observed Mother and Child Interactions During a Structured Eating Task as Assessed at Baseline. Mother and child pairs were video-recorded eating in a structured, laboratory observation at baseline. During this standardized laboratory videotaped eating interaction, the mother and child were seated at a table next to each other in a quiet room and video-recorded while sampling four foods presented individually and sequentially in random order. Children and mothers were encouraged to try the food and eat as much as or little as they liked, but they were not required to eat it if they did not want to. Each food was presented for 5 minutes and collected at the end of 5 minutes by the researchers. The foods were chosen based on two factors: vegetable vs. sweets and novel vs. familiar. The four foods in these categories were: quartered artichoke hearts (novel vegetable), green beans (familiar vegetable), Halva, a Mediterranean dessert made from sesame seeds (unfamiliar sweet), and a chocolate cupcake (familiar sweet). Existing recordings of mother-child dyads in structured eating laboratory interactions were coded by independent undergraduate research assistants who were blind to study hypotheses and trained to reliability (see below for details).

Dyadic Parent Child Interaction Coding System, Fourth Edition (DPICS-IV). The DPICS-IV is a standardized observational coding system developed by Eyberg and colleagues (2013) used to assess parent-child interactions of 2- to 7-year-old children (Eyberg, Nelson, Ginn, Bhuiyan, & Boggs, 2013). The parent behaviors of interest were those that express reciprocity, nurturance, and parental control, which are the antecedent and consequent behaviors that serve to increase or decrease child reciprocity and cooperative social behaviors (Eyberg et al., 2013). Codeable parent behaviors correspond to skills in the CDI and PDI phases and fall into the following priority order: negative talk (i.e., criticism), direct command, indirect command, labeled praise, unlabeled praise, information question, descriptive question, reflection, behavioral description, and neutral talk (Eyberg et al., 2013). Two additional parent codes, "describe food" and "parent bite," will be added to the DPICS-IV coding scheme to include the DADs skills. Child behaviors included were: bite and other (i.e., all other miscellaneous behavior). All structured eating task videos were coded using observational coding software (e.g., Noldus Observer XT, which is a software package used for the collection, analysis, and presentation of observational data). Each structured eating protocol recording was divided and coded in four segments corresponding to the different foods provided: a) novel vegetable, familiar vegetable, novel sweet, familiar sweet. Inter-rater reliability was established prior to analyzing data.

Training of undergraduate students using the DPICS-IV was broken into 6 training sessions. Undergraduate students were instructed to read the DPICS-IV manual and complete worksheets testing their knowledge of the relevant skills prior to each training session. During the training sessions, worksheets were reviewed and any errors were corrected and discussed. Then undergraduates completed a written test related to the skills reviewed in each training session. Training sessions reviewed basic coding rules such as the complete thought rule, priority order rules, and decision rules. Finally, we watched recordings of the structured eating tasks from participants who were not included in the subset in this present study and discussed how to code parent and child behaviors. In between training sessions, coders practiced coding on their own time of videotapes of participants not included in the current sample. Questions about unusual situations were reviewed and discussed at follow-up training sessions.

Coding Procedures

Observational codes were recorded using the Noldus Observer XT, a software package that allows researchers to code and describe behavior in an accurate and quantitative way, calculate statistics, and assess reliability. Trained observers entered codes separately for mothers and children, yielding two synchronized streams of continuous data. A modified version of the DPICS-IV coding system was used. The modified DPICS-IV coding system consisted of 9 mutually exclusive parent behavior codes: praise, reflection, behavior description, commands, questions, food description (added for this study), parent bite (added for this study), and other behavior (added for this study), and are also presented in Table 1. It also included 2 mutually exclusive child behavior codes: child bite and other behavior, both of which were added for this study. All parent and child codes were coded as state event codes that captured frequency, duration, and sequence of behavior, with the exception of parent and child bite codes, which were coded as point codes, and defined as any food that passed the lips and also included licking (Chorney, McMurtry, Chambers, & Bakeman, 2014). Point codes capture frequency and sequence information, but do not capture duration information. This was chosen for bite codes because duration of eating each bite was not relevant to our hypotheses.

Prior to initiating coding of the video interactions, trained observers (i.e., undergraduate students) were intensively trained to a minimum criterion of 75% agreement and 0.65 kappa using a frequency/sequence-based and a criterion of 80% agreement and 0.70 kappa using a duration/sequence based comparison on a “test video” (Noldus Observer XT). Coding of video interactions of participant data used for this study did not occur until inter-rater reliability was achieved. Once coding began, approximately 16% of the sample was double coded by the graduate student (e.g., 2 tapes per each undergraduate) and coded at random for reliability to assess for coder drift. Coders were blind to which sessions were used to assess observer agreement after the initial "test video." If percent of agreement and kappa did not achieve our standards, the graduate student reviewed discrepancies with the coder and coders corrected their coding of that video with the graduate student. The average coder agreement was 83% and 0.77 kappa for the frequency/sequence-based method and was 96% and 0.96 for the duration/sequence-based method.

Coders were blind to study hypotheses and were only told that we were interested in better understanding parent-child interactions during a structured eating task. During coding of video interactions, observers first watched the video in its entirety (i.e., 20 minutes) before beginning coding. Coders began coding parent streams of behaviors first. They were able to pause, rewind, delete or replace elements, and review the coding manual throughout coding to ensure most accurate coding of data. Coders were instructed to review their coding by watching the video at least once in its entirety after all codes had been entered. They could make changes or adjustments as needed to their coding during that final review. After coders completed coding parent streams of behaviors for all of their assigned videos, they began coding child streams of behavior. It was determined that they would code the same videos for child streams of behavior as they did for parent streams of behavior so that another observer would not interfere with another observer's coding of parent behavior. The same procedures for coding parent streams of behavior were applied for coding child streams of behavior.

Data Analyses

Data were extracted from Noldus Observer where individual DPICS-IV codes were collapsed across parent-antecedent behaviors that fit into either category (i.e., "Do" or "Don't" skills) of each coding type (e.g., CDI and DADS) in relation to "bite of food" or "other child behavior." A bite of food was defined as coded when a child took a bite in the 5s following a maternal "Do" or "Don't" behavior. Following the recommendations of Howe and colleagues, a multilevel (log-linear) statistical approach was used to examine observed sequences of parent-child mealtime interactions (Dagne, Howe, Brown, & Muthén, 2002; Howe, Dagne, & Brown, 2005). Specific cross tabulation or parent/child antecedent-consequences across the two models of "Do" and "Don't" Skills were incorporated into the statistical models using a contingency table presented in Table 2 (Wickens, 1989). A contingency table represents the relation between states in one time series (e.g., the parent) and states in another time series (e.g., the child) at a given lag (e.g., specified interval of time). Numbers in the cells represent the frequencies that one state (e.g. child behavior: Bite vs. No Bite) follows another state (e.g., parent behavior: "Do" skill vs. "Don't" skill) in a given lag (i.e., specified time). The specified time window chosen was 5 seconds based on statistical guidance, the nature of our data, and prior studies (Pesch et al., 2018; Yoder & Tapp, 2004). Specifically, hypotheses related to "Do" and "Don't" skills were modeled in the contingency table and analyzed in comparison to a series of row and column effects using Mplus 8.3. These row (antecedent) effects, R1-R3 (reflecting Do vs. Don't, Eat vs. Other, and Don't vs. Other as antecedents respectively) and column (consequence) effects C1-C3 (reflecting Do vs. Don't, Eat vs. Other, and Don't vs. Other as consequences respectively), control for behavioral tendencies (e.g. amounts of behaviors as antecedents and consequences) and permit the modeling of specific antecedent-consequence associations. Incorporating this vector in the linear model, allows for the estimated coefficient to index the size and direction of the difference between behaviors (Howe et al., 2005).

If the mother's actions influenced the behavior of her child, then cell counts would differ from those predicted by the row and column totals. The difference between the logs of the two row marginal totals was reflected in the value of the coefficient (Howe et al., 2005). Contrast codes were used to determine differences in pairs of antecedent statements ("Do" or "Don't" skills) as antecedents of a child's bite response or "other" behavior (see Table 2). For example, when comparing a bite of food following CDI "Do" skill (coded as 1) vs. a bite of food following a CDI "Don't" skill (coded as -1), estimates could range from 1 to -1. An estimate of zero reflects an equal ratio of bites following both "Do" and "Don't" skills, whereas positive estimates reflect proportionally more bites following a CDI "Do" skill compared to a CDI "Don't" skill. When there was significant variability within our modeled hypotheses, child zBMI, maternal BMI, and sex were examined as predictors of our modeled hypotheses.

Results

Bivariate comparisons of characteristics of the groups of children with overweight or obese weight status vs. children with lean weight are shown in Table 3. The two groups did vary significantly by maternal demographics, specifically maternal age and maternal BMI. Mothers of children with lean weight were older in age relative to mothers of children with overweight or obese status. With regard to maternal BMI, mothers of children with overweight or obese status had a greater BMI compared to the children with lean weight group. Number of bites of food following a "Do" skill or a "Don't" skill did not significantly vary by child weight status. Additionally, average total number of "Do" skills and "Don't" skills as antecedents did not vary significantly by child weight status. Finally, average total bites of food as consequences did not vary significantly by child weight status.

Results of the multilevel (log-linear) sequential analysis hypothesis testing are shown in Table 4 and point estimates with 95% confidence intervals are depicted in Figure 1. When examining all possible parent-child antecedent-consequences of interest, a bite of food was more likely following a parent "Do" skill, versus a bite of food following a "Don't" skill, or an other behavior following a "Do" skill or a "Don't" skill in both the CDI and DADS models (Hypothesis 1: estimate = 0.09, $p = .03$; estimate = 0.22, $p < .01$, respectively). There was significant variability in these models (CDI estimate = 0.08, $p < .01$; DADs estimate = 0.05, $p < .01$) allowing the examining of whether child zBMI, sex, or maternal BMI were differentially related, but these predictors were not significant. The second hypothesis examined whether a child bite of food was more likely following a "Do" skill or a "Don't" skill and this was significant for both the CDI and DADs models (Hypothesis 2: estimate = 0.08, $p < .01$; estimate = 0.15, $p < .01$, respectively). Significant variability in these models (CDI estimate = 0.03, $p < .01$; DADS estimate = 0.20, $p < .01$) was not predicted by child zBMI, sex, or maternal BMI. Lastly, which child behavior (e.g., a bite of food or "other") was more likely to occur following a "Do" skill was examined, and this was not significant for the CDI model suggesting that the proportions were relatively equal (Hypothesis 3: estimate = -0.01, $p = .87$). However, it was significant in the DADS model, suggesting that following a DADS "Do" skill, a bite of food was more likely to occur than an "other" behavior (Hypothesis 3: estimate = 0.06, $p = .02$). Significant Variability in these models (CDI estimate = 0.04, $p < .01$; DADS estimate = 0.03, $p < .01$) were not related to child zBMI, sex, or maternal BMI.

Discussion

In order to develop efficacious interventions aimed at enhancing healthy eating behaviors and promoting healthy weight trajectories among children, it is critical to understand modifiable factors that have a strong influence over the development of eating behaviors, such as parent-child interactions during eating. The primary aims of this study were first to explore whether PCIT is a feasible framework for describing parent-child interactions during a structured eating task among a primarily low-income sample; and second, to examine if mother's natural use of PCIT skills were related to children's eating behavior. This study adds several new findings to the literature using novel methodology and expands prior work around dyadic feeding interactions. First, this study examined the association of parent's PCIT "Do" and "Don't" skills with the likelihood of a child taking a bite of food or engaging in an "other" behavior during a structured eating task. No known studies have examined PCIT skills during an eating scenario as they correspond to eating behavior. Notably, this study examined mothers' general use of PCIT skills without any prior coaching or modeling. Using observational coding to capture moment-to-moment parent-child interactions, this study found that when compared to all parent-child antecedent-consequent pairings, a CDI and DADS "Do" skill was more likely to be followed by a bite of food. This means that children proportionally took more bites of food in response to a "Do" skill when compared to a "Don't" skill, and also in comparison to doing an "other" behavior in response to a "Do" skill" or a "Don't" skill. Given that the structured eating task was designed to encourage children to taste test each food, it is not surprising that "Do" skills were more proportionally related to child eating than all other pairings. However, these results highlight that children responded to non-directive PCIT skills (e.g., CDI "Do" skills) and more directive (e.g., DADS "Do" skills) similarly overall. It is notable that both CDI "Do" skills, which do not include maternal prompts or "commands" to eat, and DADS "Do" skills, which could include maternal prompts or commands to eat), were both significantly related to bites of food, relative to all other parent-child antecedent-consequent pairings. However, it is also worth noting that in all analyses, the effects of using DADS skills are more strongly associated with children's eating when compared to using CDI skills. Therefore, the directness that DADS skills afford may be more effective than non-directive CDI skills at encouraging children's eating.

Looking more closely at just bites of food, we found that children were more likely to take a bite of food in response to a CDI and DADS "Do" skill rather than a "Don't" skill, which confirmed our second hypothesis. In other words, children are more likely to take a bite of food in response to "Do" skills, such as praise, behavioral descriptions, reflections, descriptions of food, modeling of eating, and commands, rather than in response to questions or criticisms. These findings from the DADS model align with several prior studies that demonstrated maternal prompts (i.e., a "Do" skill in the DADS model) to eat are positively associated with child total energy intake (Drucker et al., 1999) and greater bites of food, (Lumeng & Burke, 2006), whereas parental negative statements (i.e., a "Don't" skill) were correlated negatively with child energy intake (Koivisto et al., 1994). However, it also expands the literature beyond just looking at maternal prompts to eat and negative statements and suggests that non-directive skills such as praise, reflection, behavioral description (CDI "Do" skills), as well as describing food and modeling eating (DADS "Do" skills) are also associated with more bites of food, relative to "Don't" skills (e.g., criticisms or questions). Therefore, these findings support a larger variety of skills that parents can utilize to encourage eating than has been studied in the literature before.

Lastly, when examining how children respond to "Do" skills, we found that children were more likely to follow a DADS "Do" skill with a bite of food rather than an "other" behavior. However, this was not significant for the CDI model. This result suggests that the unique features of DADS skills (e.g., modeling eating, describing food, or giving a command) may be more effective at encouraging bites of food relative to "other behavior," when compared to CDI skills alone. CDI "Do" skills are non-directive in nature and rely on the use of selective attention to increase the occurrence of behaviors. Since we captured all CDI skills (eating related and otherwise) in our analyses, it is not surprising that other behaviors would occur just as frequently as eating. DADS "Do" skills are inherently more directive by allowing commands and explicit modeling of eating behavior by the parent. As such, this finding suggests that DADs skills may be more applicable when wanting to encourage bites of food during a mealtime setting, as opposed to other positive mealtime behaviors (e.g., sitting properly at the table). This is in alignment with previous research that has found that children comply with maternal prompts to eat on average 63.5% of the time (Lumeng & Burke, 2006), but again, it also expands the research by incorporating other directive behaviors, including parent's modeling of eating behavior and describing of the food.

Surprisingly, child zBMI, sex, and maternal zBMI were not significantly related to these results, suggesting that these "Do" skills are associated with children's eating similarly across children with lean weight and overweight/obese status, and despite whether a child is male or female, or mother's weight status. These findings are somewhat contrary to what has been previously found in the literature and may be a result of our smaller sample size. Prior observational studies have found that parental prompts to eat were positively associated with child's weight (Klesges et al., 1986). Moreover, parents of overweight children were found to give significantly more encouragement to eat and prompts to eat, relative to parents of lean weight children (Klesges et al., 1986). Lumeng and Burke (2006) found that children of mothers who were obese were more likely to comply with maternal prompts to eat novel foods compared to children of mothers who were not obese. Unfortunately, low base rates of bites of food did not allow for us to look at specific types of food (e.g., novel vs. familiar or vegetable vs. sweet) as a moderator for these relations.

Clinical Implications

There may be important clinical implications of these results with regard to future interventions related to parent feeding practices and children's eating behavior. First, this study established the feasibility of coding and applying PCIT skills in a new context (e.g., eating scenarios). Our findings are particularly applicable, because prior studies have shown that food neophobia or picky eating peaks during early childhood and as a result of food neophobia children are more likely to consume greater amounts of low nutrient energy-dense foods (i.e., savory snacks and sweets) as well as a decreased intake of fruits and vegetables (Dubois et al., 2007; Haszard et al., 2015; Jacobi et al., 2003; Tharner et al., 2014). Our findings demonstrate that PCIT "Do" skills encourage bites of food and as such may help children overcome food neophobia and increase consumption of fruits and vegetables. For example, parents could take a less directive approach and use CDI "Do" skills by praising a child for interacting with or eating the food (e.g., "I like how you're exploring the texture of the broccoli"), behaviorally describing the child interacting with the food (e.g., "You're picking up the asparagus and tasting it with your tongue"), or reflecting child's statements about the food, (e.g., "You're right, the green beans are smooth on the outside"), thereby providing selective attention to the child's engagement with the novel food. Taking a less-directive approach to responding to children's mealtime eating behavior actually aligns with current guidelines (Daniels & Hassink, 2015; Gidding et al. 2006) that recommend parents refrain from being overly controlling during mealtimes due to concern that excessive or inappropriate parental control may lead to poorer child self-regulation of consumption by focusing the child's attention on external cues to eat, rather than internal cues of satiety (Birch & Fisher, 1998).

Alternatively, parents can use DADS "Do" skills to take a slightly more directive approach to encourage eating of novel foods. For instance, parents may describe the food for the child, model eating the food (i.e., also known as, approach behavior), give a direct command to try a bite of the food, and then provide selective attention only when the child interacts with the food in the desired way. Additionally DADS skills may be particularly helpful at managing mealtime tantrums, which are a frequent occurrence among young children (Agras et al., 2004; Potegal & Davidson, 2003) and are a common parent-reported barrier to meeting American Medical Association (AMA) guidelines for obesity prevention and management, regarding limit-setting related to diet (Agras et al., 2004; Bolling et al., 2009; Rao, 2008). Moreover, persistent tantrums over food in early childhood are a risk factor for later obesity (Agras et al., 2004). Therefore, by using PCIT skills to not only increase children's willingness to eat a variety of foods, but also reinforce other positive mealtime behaviors, we may be able to prevent tantrums during mealtimes and reduce parents' reluctance to set limits around low-nutrient, energy dense foods, and hopefully decrease the risk for obesity development.

It is notable that this study was conducted with primarily low-income families and as such help to characterize how these mothers, in particular, naturally use CDI and DADS skills to influence eating behavior. Given that these skills are already in their toolbox, parents only need refinement of these skills to better learn how to use CDI and DADS skills more effectively during mealtimes. In light of the growing integrated primary care model, psychologists working in primary care settings have more opportunities to engage low-income families. If parents are reporting picky eating or mealtime difficulties to their children's pediatrician, this might be an ideal time to consult with the psychologist who can empower families by helping them to refine their use of behavior management strategies (i.e., CDI and DADS skills) during mealtime settings through the use of coaching in the moment. More specifically, parents can be taught how to encourage eating of novel healthy foods by applying specific “Do” skills. They can also be taught how to avoid using “Don’t” skills, such as critical statements aimed at restricting child’s intake, and replace them with “Do” skills that provide selective attention for behaviors they want to see more of (e.g., trying new foods or eating slowly and paying attention to satiety cues).

Limitations

This study is not without limitations and given the structure of the eating task, results may not be generalizable to typical mealtimes. Additionally, our findings might not extend to other populations, including interactions with other caregivers and fathers. Of note, these rates of PCIT skills reflect mothers’ use of them naturally without prior teaching or coaching. We expected the rates of individual CDI and DADS skills to be low and therefore planned to group across these codes to create “Do” and “Don’t” skills. However, because codes were grouped together, we do not have data about how individual codes, such as praise or modeling, for instance, relate to children’s eating. Additionally, due to the low base rates of bites of food for certain types of food (e.g., novel foods and vegetables), we did not have enough power to examine how these skills differentially relate to eating of novel foods versus familiar foods, or sweet foods versus familiar foods. Collapsing across these conditions may have masked important differences. For instance, we might have seen that DADs skills were more likely to influence eating of novel vegetables, because parents can describe the taste and texture, model eating, and give a command for the child to try a bite. Given that DADS skills were positively associated with bites of food in comparison to other behaviors, one might speculate that DADS skills may be more likely to increase bites of novel foods or foods more commonly avoided, such as vegetables, relative to CDI skills. Additionally, we did not examine these skills in relation to promoting other positive mealtime behaviors, such as staying seated at the table, or decreasing negative mealtime behaviors, such as whining or tantrum behavior.

Future Directions

Future studies should replicate this study using a larger sample size, which would allow for more narrowed analysis of individual PCIT skills as they relate to eating behavior. Additionally, replicating this study in a sample that incorporates a wider array of caregivers (e.g., fathers, grandmothers, child care workers) and more socioeconomic status and racial/ethnic diversity would allow for greater generalizability of findings. Further, examining how PCIT skills relate to intake of novel foods and vegetables may be important to understand how parents can apply these skills with children who are picky eaters or resistant to eating more nutrient rich foods. More narrowed analysis of specific PCIT skills in relation to eating behavior and type of food would allow for more targeted interventions to be created to determine how best to encourage healthy eating or more sensitively moderate food consumption when warranted. Additionally, future studies would benefit from exploring parent's use of PCIT skills during a home-based mealtime observation to improve generalizability of findings. Lastly, targeted interventions could be designed to test whether CDI or DADS skills are effective at reducing food neophobia and increasing consumption of fruits and vegetables, as well as improving other mealtime behaviors (e.g., reducing tantrums), and modifying children's weight over time.

Table 1

Parent Behaviors Coded for Each PCIT Phase

Parent Behavior	**CDI "Do" Skill**	**CDI "Don't" Skill**	**DADS "Do" Skill**	**DADS "Don't" Skill**
Praise	✓		✓	
Behavioral Description of child behavior	✓		✓	
Reflection	✓		✓	
Commands		✓	✓	
Describe Food			✓	
Parent Bite (i.e. modeling approach)			✓	
Questions		✓		✓
Negative Talk about child behavior		✓		✓

Table 2

Contrast Coding for Antecedent Consequence Contingency Tables

Hypothesis 1: Children are more likely to respond to a "Do" with a bite of food, than any other parent-antecedent/child-consequence pairings

	Consequent			
Antecedent	Do Skill	Don't Skill	Eat	Other
Do Skill	0	0	1	-1/3
Don't Skill	0	0	-1/3	-1/3
Eat	0	0	0	0
Other	0	0	0	0

Hypothesis 2: A child will be more likely to take a bite of food when a parent uses a "Do" skill, rather than a "Don't" skill

	Consequent			
Antecedent	Do Skill	Don't Skill	Eat	Other
Do Skill	0	0	1	0
Don't Skill	0	0	-1	0
Eat	0	0	0	0
Other	0	0	0	0

Hypothesis 3: A child will more likely respond to a "Do" skill with a bite of food, rather than engage in an "other" behavior

	Consequent			
Antecedent	Do Skill	Don't Skill	Eat	Other
Do Skill	0	0	1	-1
Don't Skill	0	0	0	0
Eat	0	0	0	0
Other	0	0	0	0

Table 3

Participant characteristics and differences by child weight status

	Entire Sample (N = 50)	**Child with lean weight (N=25)**	**Child with overweight or obesity (N=25)**	***p*-value**	**Effect Size (*d*)**
	N (%) or mean (± SD)	*N* (%) or mean (± SD)	*N* (%) or mean (± SD)		
Child Characteristics					
Sex (child is male)	26 (52)	13 (52)	13 (52)	1.00	.00
Age (months)	71.82 (7.47)	71.42 (7.10)	72.23 (7.95)	.71	-.10
Child Weight Status				<.01	4.99
Obese	17 (34)	0 (0.00)	17 (68.00)		
Overweight	8 (16.00)	0 (0.00)	8 (32.00)		
Lean weight	25 (50.00	25 (100.00)	0 (0.00)		
Mother Characteristics					
Age (years)	31.82 (7.59)	34.24 (8.63)	29.4 (5.55)	.02	.67
White non-Hispanic race/ethnicity vs. Other	39 (78.00)	20 (80.00)	19 (76.00)	.73	.14
Highest level of education > HS diploma	25 (50.00)	10 (40.00)	15 (60.00)	.16	-.51
BMI	32.97 (10.92)	29.07 (6.19)	36.86 (13.19)	.01	-.74
Maternal Antecedents & Child Target Behaviors					
Average Number of Bites Followed by Maternal CDI "Do Skills"	4.26 (3.63)	3.84 (3.10)	4.68 (4.05)	.42	-.23
Average Number of Bites Followed by Maternal CDI "Don't Skills"	3.30 (2.50)	3.20 (2.55)	3.40 (2.45)	.78	-.08
Average Number of Bites Followed by Maternal DADS "Do Skills"	3.52 (3.28)	3.72 (3.85)	3.32 (2.56)	.67	.12
Average Number of Bites Followed by Maternal DADS "Don't Skills"	2.62 (2.22)	2.48 (2.19)	2.76 (2.23)	.66	-.13
Maternal Antecedents					
Average CDI "Do" Skills	32.18 (18.50)	35.16 (22.10)	29.2 (13.83)	.26	.32
Average DADS "Do" Skills	17.58 (11.31)	18.80 (13.33)	16.36 (8.96)	.45	.21
Average CDI "Don't" Skills	45.82 (23.67)	49.56 (26.86)	42.08 (19.83)	.27	.32
Average DADS "Don't" Skills	34.46 (15.53)	35.72 (18.43)	33.2 (12.22)	.57	.16
Child Target Behaviors					
Average Bites in CDI	16.28 (15.05)	15.32 (12.30)	17.24 (17.57)	.66	-.13
Average Bites in DADS	15.56 (14.39)	13.24 (10.88)	17.88 (17.11)	.26	-.32
Average Other Behaviors in CDI	35.22 (29.58)	30.00 (28.29)	40.44 (30.50)	.22	-.73
Average Other Behaviors in DADS	23.04 (25.94)	18.32 (23.14)	27.76 (28.13)	.20	-.37

Table 4

Results from Multi-Level Sequential Analysis Model

	Estimate	S.E.	*p*-value
CDI Model			
Hypothesis 1: "Do": Eat vs. "Do": Other, "Don't: Eat, "Don't": Other	0.09	0.04	.03
Child zBMI	-0.02	0.05	.74
Maternal BMI	<0.01	<0.01	.57
Sex	0.01	0.08	.94
Hypothesis 2: "Do": Eat vs. "Don't": Eat	0.08	0.03	<.01
Child zBMI	0.03	0.03	.28
Maternal BMI	<0.01	<0.01	.87
Sex	0.05	0.05	.35
Hypothesis 3: "Do": Eat vs. "Do": Other	-0.01	0.03	.87
Child zBMI	-0.03	0.03	.32
Maternal BMI	<0.01	<0.01	.36
Sex	-0.01	0.05	.89
DADS model			
Hypothesis 1: "Do": Eat vs. "Do": Other, "Don't: Eat, "Don't": Other	0.22	0.03	<.01
Child zBMI	-0.02	0.04	.69
Maternal BMI	<0.01	<0.01	.47
Sex	0.08	0.06	.20
Hypothesis 2: "Do": Eat vs. "Don't": Eat	0.15	0.02	<.01
Child zBMI	0.01	0.03	.82
Maternal BMI	<0.01	<0.01	.35
Sex	0.05	0.04	.19
Hypothesis 3: "Do": Eat vs. "Do": Other	0.06	0.03	.02
Child zBMI	-0.05	0.03	.14
Maternal BMI	<0.01	<0.01	.06
Sex	0.05	0.05	.35

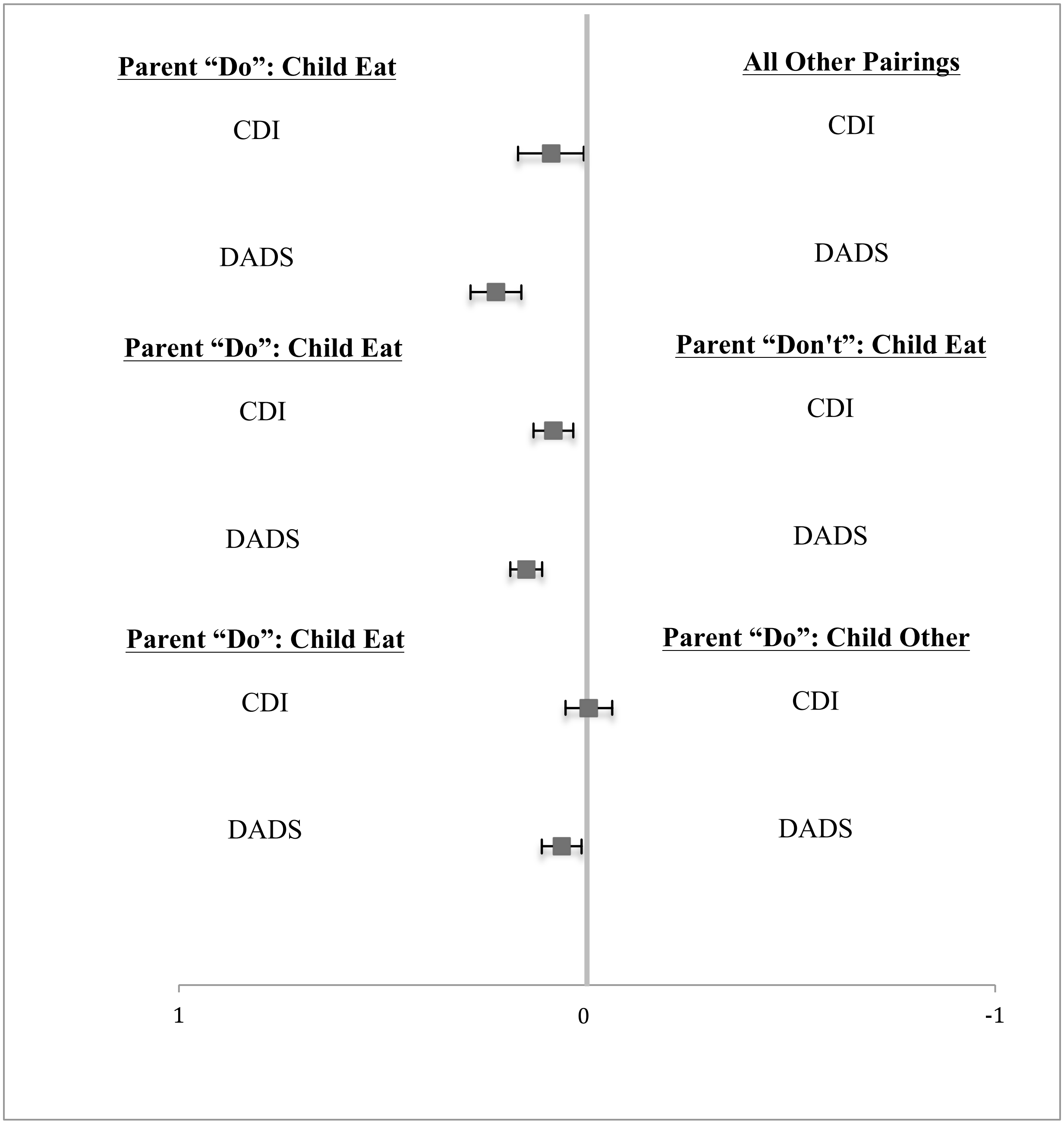

Figure 1. Point Estimates and 95% Confidence Intervals of Hypotheses. The point estimate depicts the estimation from the lag sequential analysis for each of the tested hypotheses and can range from 1 to -1. The 95% confidence interval reflects the upper or lower bounds for each point estimate. Significant findings are those in which the 95% confidence intervals do not include 0.

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