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THE RELATIONSHIP OF PARENTAL FEEDING CONTROL PRACTICES TO FOOD INTAKE OF 3-5YR CHILDREN IN FAMILIES WITH LIMITED INCOMES

By

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ABSTRACT

THE RELATIONSHIP OF PARENTAL FEEDING CONTROL PRACTICES TO FOOD INTAKE OF 3-5YR CHILDREN IN FAMILIES WITH LIMITED INCOMES

BY

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Background. The poor diet quality of young children can lead to increased risk of overweight and obesity, especially for children from families with limited incomes. One important role of parents is to guide the development of healthy dietary habits contributing to a healthy weight status in their children via mealtime interactions. Parental *control* over child feeding, the most studied parental feeding behavior, is believed to negatively influence the child's food intakes and weight status, but there is some confusion in how "control" in child feeding situations is defined. Some types of control might actually be necessary and beneficial to promoting children's development of good food habits.

Aims. 1) To clarify different types of control practices in child feeding situations by developing an instrument; and 2) to examine if and how the different types of parental control over child feeding relate to children's food intakes and weight status.

Methods. Twenty-nine items measuring parental feeding practices were generated from the literature to measure three different types of control in child feeding situations: directive, non-directive and food environmental control. Cross-sectional data collection was conducted with 330 mothers and their children participating in the Head Start program in central Michigan. The mothers completed a 29-item instrument and a food frequency questionnaire reflecting the children's food intakes during the past week.

Height and weight of both mothers and children were measured. Confirmatory factor analysis tested the factorial validity of the instrument, and multiple regression analysis tested whether maternal control feeding practices predicted children's intakes of nutrient-dense or energy-dense foods and the child's weight status.

Results. The three-factor measurement model did not provide an acceptable fit to the data, but an alternative seven-factor model did. The factors confirmed were high control (pressure to eat), high contingency (food rewards/threats), child-centered feeding (praise and encouragement), encouraging nutrient-dense foods (modeling nutritious eating), discouraging energy-dense foods (not modeling eating of energy-dense foods and limiting accessibility of these foods at home), mealtime behaviors (setting rules for family meals without television) and timing of meals (setting regular mealtimes). Child-centered feeding practices and encouraging nutrient-dense foods positively predicted the children's intake of nutrient-dense foods, whereas encouraging nutrient-dense foods and discouraging energy-dense foods negatively predicted the children's intake of energy-dense foods. None of the feeding practices were associated with the children's weight status.

Conclusions. The instrument developed in this study will permit researchers to quantitatively measure a set of controlling feeding practices and to relate these with children's food intakes. In this low-income sample, healthier dietary intakes in children were associated with mothers' feeding practices that motivated and environmentally supported the children to eat nutritious foods. This knowledge can be used to develop educational interventions for parents emphasizing strategies to improve child feeding practices in particular target groups.

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CHAPTER 1

INTRODUCTION

I. Background

The poor diet quality of young children can lead to overweight and obesity (Nicklas et al., 2001), especially for children from families with limited incomes (US Department of Agriculture et al., 2008). Low intake of nutrient-dense foods (e.g., fruits and vegetables), and high intake of energy-dense foods (e.g., sweets, snack chips and sweetened beverages) are special dietary concerns (Nicklas and Hayes, 2008; NCHS, 2008). It is the parent's role to guide the child's development of good dietary practices to acquire adequate nutrient-dense foods, and to protect the child from food environments with excess access to energy-dense foods. However, most parents, especially those with limited income, struggle with child feeding issues (Evans et al., 2009; Sherry et al., 2004). The interaction of human genetic predispositions and the food environment contribute to many parental struggles to feed children (Savage et al., 2007). Children are predisposed to accept and prefer sugar and fat in energy-dense foods, and reject sour and bitter tastes found in some fruit and many vegetables--nutrient-rich foods (Savage et al., 2007). Surrounded by an environment filled with high fat and high sugar food without adult guidance, children are likely to eat large amounts of these foods, but little or no fruit and vegetables (Spurrier et al., 2008). Furthermore, marketing strategies to promote consumption of high-fat and high-sugar foods, such as television commercials and children's menus at fast food restaurants, strongly impact children's intake and preference for such foods (Grier et al., 2007; O'Donnell et al., 2008). Within the current

food environment, mothers of young children feel pressured to give their children treats that are seen as part of current social norms (Pagnini et al., 2007).

Despite food struggles with young children, guidance for parents is not well developed for how to interact with children in difficult feeding situations. This is because the knowledge base from scientific studies is currently limited due to the paucity of high quality evidence supporting clear relationships between parental feeding practices and child outcomes (American Dietetic Association, 2010). Several limitations in previous research are: 1) the child's weight status has been studied more often than child's dietary intakes as the outcome of parental feeding; 2) parental control in child feeding is defined inconsistently across studies leading to confusion in understanding the roles of control in child nutrition; and 3) research on feeding practices in samples with low income is limited despite higher risk of nutritional problems in this population. Therefore, this study was designed to explore parental control of the child's food behaviors and routines in relation to food intakes as well as the child's weight status in children from limited income families. Three essential concepts (types) of control feeding were defined (**directive control, non-directive control, and food environmental control)** and their relationship to children's intake of key foods as indicated by **nutrient-dense foods** and **energy-dense foods** was tested.

II. Specific aims and hypotheses

Aim 1: Develop an instrument that measures three different types of feeding control, and test the factorial validity of the measurement model.

Hypothesis 1: A three-factor structure with directive control, non-directive control and food environmental control will be confirmed.

Aim2[1]**:** Examine the associations of different types of control in child feeding with children's food intakes and with children's weight status.

Hypothesis 2: Mothers' use of directive control will be negatively related to the children's intakes of nutrient-dense foods, but positively related to intake of energy-dense foods. For non-directive and food environmental control, the directions of the relationships will be opposite. Children's weight status will be negatively associated with mothers' use of directive control, but no associations with non-directive and food environmental control.

III. Significance

The long-term health outcomes of obesity and other chronic diseases, stemming from poor diet quality (Kant et al., 2000) and beginning in early childhood, contribute to the massive costs of health care. Furthermore, the issue of poor diet quality and obesity impacts families with limited incomes to a greater extent than those with more resources (Gibson et al., 1998; 2008). In the U.S. in 2007, 5.7 million of children 3-5yr (approximately 43% of all 3-5yr children in the U.S.) lived in low-income families, <200% of the net Poverty Index (Douglas-Hall and Chau, 2008). Parents with limited income often report that fast foods cost less than more nutritious foods like fruits and

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[1] In middle-income families, parental concern about child's weight status is known to affect parental control feeding practices. Such a relation has not been found in low-income families possibly because in general, low-income parents do not demonstrate concern about their child's weight status (Hughes et al., 2010). Therefore, parental concern about child's weight status was not an aim for this study. However, if a significant portion of parents in our sample demonstrates concern about their child's weight status, this factor will be included in the main analysis as an influential factor.

vegetables (Drewnowski and Darmon, 2005). Indeed, greater numbers of fast food restaurants can be found in limited income neighborhoods than in higher-income neighborhoods (Block et al., 2004). Focus groups with parents found that those with low socioeconomic status (SES) reported setting fewer limits for their children's intake of energy-dense foods and purchasing more energy-dense foods compared to parents of higher SES (Haerens et al., 2008).

The problem is that inappropriate parental feeding practices relate to poor diet quality in children and perhaps to their weight status (Clark et al., 2007a; Faith et al., 2004b; Scaglioni et al., 2008; Ventura and Birch, 2008). **Therefore, the child's diet quality is not likely to improve unless parents know how to use feeding strategies that will help children achieve this goal.** A strategic sticking point to the solution seems to be that control in parental feeding can both negatively and positively affect the child's food intake depending upon how researchers and educators conceptualize feeding practices and how child perceive them (Hughes et al., 2008a). As an outcome of this research, the concept of parental feeding control was clarified as relating not only to directive control, as in pressure to eat, but also to ways that parents can indirectly control the child's food intake via modeling and the food environment. The outcome was a comprehensive path model or step-wise regression model to explain the relationship between these multiple feeding control concepts and the child's dietary intake to provide evidence on which to base educational interventions for low-income parents. This study is an important step for evidence-based feeding guidelines and recommendations that health and nutrition professionals can use, especially for those working with limited income parents of preschoolers. The direct benefits from later

evidence-based interventions would be improved diet quality in children from low-income families.

CHPTER 2

REVIEW OF LITERATURE

This chapter reviews evidence for the significance and rationale described in Chapter 1. Chapter 2 includes issues regarding diet quality and weight status in children and influences of feeding practices. Finally, issues with the dietary assessment of young children and factors that influence are discussed.

I. Dietary issues in children

Poor diet quality in young children

The poor diet quality in young children, specifically ages between three to five years, is a serious public health issue, because rapid physical growth and development occur during the first five years of life and the foundation of future eating patterns are acquired between three to five years of age (Savage et al., 2007). Data from the National Health and Nutrition Examination Survey (NHANES 1999-2004) revealed that the diets of most children 2-5 years old were far below what is recommended (USDA, 2008). For example, the average score for children this age on the Healthy Eating Index (HEI-2005) assessing overall diet quality was only 60 out of a possible 100 points (USDA, 2008). Most children did not meet recommendations for fruit, vegetable and dairy groups (Nicklas and Hayes, 2008). Also, intakes of fiber and micronutrients (i.e. calcium, vitamin E, folate, iron, magnesium and potassium) were inadequate for children 2-5 years old (NCHS, 2008).

The diet quality of children from families with limited incomes was lower than that of the overall average. National survey data from 1999-2004 showed that children

from families with incomes <185% gross federal poverty level had significantly lower HEI-2005 scores than those from families with higher incomes. Children from families with limited incomes were more likely than those from higher income families to consume higher intakes of regular soft drinks, and less likely to eat whole grains, fruit, fruit juice, yogurt, sweets, and reduced-fat milk (Gibson et al., 1998; USDA, 2008).

It has been hypothesized that poor diet quality is linked to overweight and an increase in adiposity among children (Nicklas et al., 2001). However, studies have been unable to show the causal relations (Alexy et al., 2004; Sugimori et al., 2004; US Department of Health and Human Services). Analysis of the Continuing Survey of food Intakes by Individuals (CSFII), a cross-sectional nationally representative survey, indicated that higher consumption of fruit including fruit juice was linked with a lower body mass index (BMI) in both adults and children (Lin and Morrison, 2002b). However, consumption of vegetables including deep-fried vegetables and vegetable juice had only a weak correlation to healthier body weight (Lin and Morrison, 2002a). Analysis of 21-year longitudinal data from the Bogalusa Heart Study showed no causal associations between changes in meal patterns and overweight status in children (Nicklas et al., 2004). Such findings support that there is no single factor responsible overall for obesity, but rather that there are multiple contributing factors in the etiology of child obesity, such as physical activity, the food environment and genetics (Faith et al., 2004a). Parental feeding practices during childhood might be one of the several factors of the etiology of child obesity.

Key dietary needs of young children

Considering the dietary issues in young children, two key dietary needs of young children this dissertation addressed were to:

1) Increase consumption of nutrient-dense foods to the recommended levels; and

2) Reduce consumption of energy-dense foods to the recommended levels.

Nutrient-dense food refers to food and beverages that contain substantial amounts of vitamins and minerals with relatively few calories as defined by the US Dietary Guidelines 2005 (USDHHS/USDA, 2005) and MyPyramid (USDA, 2009). Fruits, vegetables, low-fat milk, lean meat, poultry, and whole grains fall into the nutrient-dense food and beverage category. In children from low-income families, because intakes of fruits, vegetables and low-fat dairy have been found to be low (Hoerr et al., 2008; Patrick et al., 2005), foods that fall into these three food groups are proposed to be defined as nutrient-dense foods in this study. However, because so few young children consume low-fat milk (US Department of Agriculture et al., 2008), and because milk is a food source of calcium, vitamin D and potassium, milk with any fat content was categorized as a nutrient-dense food for this study.

Energy-dense food refers to food and beverages that are relatively high in energy with substantial amounts from solid fats and added sugars. This definition is the same as that proposed in the Dietary Guidelines for Americans 2005 as Solid Fat, Alcohol, and Added Sugar (SoFAAS), but excludes Alcohol (USDA, 2009; USDHHS/USDA, 2005). In children from families of all income levels high fat and sugar foods and sweetened beverages are the major food sources in the SoFAAS category (USDA, 2008).

II. Weight issues in young children

Definition of overweight and obesity in children

For children 2-19 years of age, the Centers for Disease Control and Prevention (CDC) and the American Academy of Pediatrics define four weight status categories using BMI-for-age (**Table 1).** BMI-for-age is not a diagnostic tool, but it is useful to screen for overweight and obesity in children. In recent years, because of increased prevalence of childhood obesity, researchers started using the 97th percentile as the cut-off point for severe obesity in children (Dietz et al., 2009). However, BMI-for-age is not an indicator of body composition. Other indicators, such as triceps skinfold measurements, can help to distinguish overweight and over fat in those with BMI-for-age the 85th percentile and above (Dietz et al., 2009).

Table 1. Weight status categories for children 2-19 years old.

Weight Status Category	BMI-for-age percentile range
Underweight	Less than the 5th percentile
Healthy weight	5th percentile to less than the 85th percentile
Overweight	85th to less than the 95th percentile
Obese	Equal to or greater than the 95th percentile

(Kuczmarski et al., 2002)

Prevalence of overweight and obesity in children.

The prevalence of childhood obesity has increased since the 1970s with the greatest increase late in that decade (Troiano et al., 1995). In 2-5 year old children, prevalence of obesity was 5% in the 1970-80s, and 10-12% in recent years. The prevalence increased during the 1970s until late 1990s, and has not changed statistically since survey year 1999-2000 (Ogden et al., 2010). In 2-5 year old children, the ratio of overweight and obesity has been approximately 1:1 since 1999 (**Figure 1**). A significant portion of obese children aged 2-5 years has been recognized as extremely obese since

2005 when the 97th percentile criteria were applied to the trend analysis. Similarly, findings from CDC's Pediatric Nutrition Surveillance System (PedNSS) indicated that obesity prevalence among low-income, preschool-aged children increased from 1998 (12.4%) to 2003 (14.5%), but remained the same in 2008 (14.6%) (Centers for Disease Control and Prevention, 2009b). Unlike for children older than 5 years of age, Healthy People 2010 did not have an objective to reduce prevalence of overweight and obesity in 2-5 year old children (U.S. Department of Health and Human Services), and pediatric health professionals see this as a serious public problem (Ogden et al., 2010).

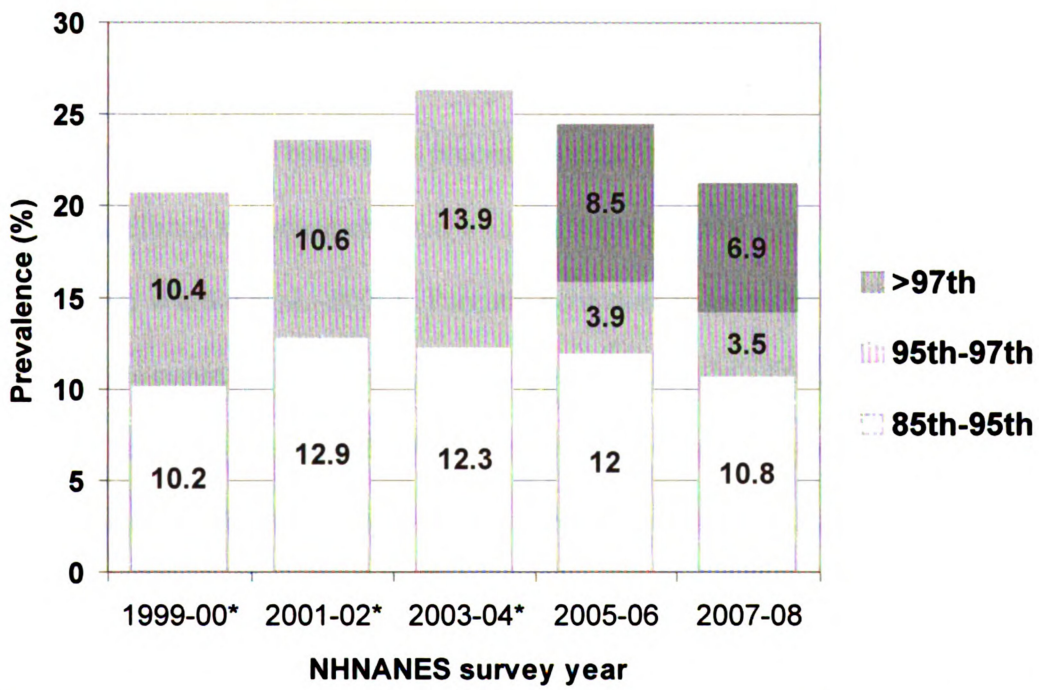

Figure 1. Prevalence of 2-5yr children with BMI-for-age percentiles at the 85th and above for 1999-2008*.

Consequences of child obesity

Obese children are at risk of immediate and later physical and mental health problems. Such children have increased risks for cardiovascular disease, like high

* Data for % children with BMI-for-age 97th percentile or greater was not available.

cholesterol levels, high blood pressure, and abnormal glucose tolerance (Dietz, 1998; Freedman et al., 2007). In those genetically pre-disposed, type 2 diabetes is another consequence of childhood obesity, and its prevalence has been increasing (Fagot-Campagna et al., 2001; Must and Anderson, 2003). Although less common, asthma, hepatic steatosis, and sleep apnea have also been shown to be related to child overweight (Luder et al., 1998; Mallory et al., 1989; Rodriguez et al., 2002). Obese children are more likely to become obese as adults (Serdula et al., 1993; Whitaker et al., 1997), especially when the onset of is before eight years of age (Serdula et al., 1993).

III. Role of parental feeding in child health and nutrition

The interactive behavioral processes occurring between parents and children during mealtimes influence children's eating behaviors and weight status (Orrell-Valente et al., 2007; Wardle et al., 2005). Parental behaviors in feeding situations are one of the most critical parental factors in the development of a child's food preference and eating patterns (Scaglioni et al., 2008). Children's weight status as an outcome of parental feeding behaviors has been the main interest of many studies (Clark et al., 2007a; Ventura and Birch, 2008).

In the current literature, one research path linking parenting behaviors to child eating and weight status involves studies on a set of directive feeding practices (i.e. restriction, monitoring, and pressure to eat) that are conceptualized as "control" in the Child Feeding Questionnaire developed by Birch and colleagues (Birch et al., 2001). Laboratory studies have demonstrated negative effects of high levels of restriction and pressure to eat (Fisher and Birch, 1999a; 1999b; Fisher et al., 2002). The researchers

suggested that the findings were due to the absence of self-regulation of energy intake and satiety in the children. Such controlling feeding practices have been used as indicators of the broader concept of controlling feeding practiced, though control is only a narrow aspect of parental feeding. Moreover, review articles on child feeding have stated that food restriction, in particular, a highly controlling feeding practice, has also been consistently associated with overweight and heavier weight status in children (Clark et al., 2007a; Faith et al., 2004b; Ventura and Birch, 2008). It should be noted that these reviews did not consider family income levels as a contributor. For these reasons, parental control in child feeding as currently defined is believed to lead to negative outcomes in children in general.

Another research path linking parenting behaviors to child eating and weight status includes studies based on the concept of feeding styles, which embeds how parents interact with children around eating within a general parenting style framework.[2] In the studies using this new conceptualization, general parenting styles are characterized within the context of child feeding (Hughes et al., 2005), and racial differences have been reported in low-income populations (Hughes et al., 2005; Ventura et al., 2010). Hughes found that the child's weight status was associated positively with permissive feeding styles (low demandingness and high responsiveness) and negatively with authoritarian feeding style (high demandingness and high responsiveness) in low-income groups (Hoerr et al., 2009; Hughes et al., 2005; Hughes et al., 2008b). Though only a limited number of studies are available for review, such findings might be interpreted that too

[2] General parenting style is a global and stable characteristic of parenting reflecting both the degree of demands/control on the child as well as the parental responsiveness to the child (Baumrind, 1966). Authoritarian, authoritative, indulgent and neglectful styles are the classification of parenting styles most often been used in research (Maccoby and Martin, 1983).

little demandingness in feeding is not adaptive for children's good health in the current dietary climate that is flooded with cheap, readily available energy dense foods. Some level of parental demandingness might be necessary to promote optimal weight outcomes in young children, at least in low-income parents (Hughes et al., 2008a; Vereecken et al., 2004; Wardle et al., 2005). It must be noted that *feeding styles* are distinct from *feeding practices* as general *parenting styles* are considered distinct from *parenting practices* (Ventura and Birch, 2008). Because feeding practices (behaviors) are changeable whereas feeding style is trait-like and are less likely to change, feeding practices, rather than feeding styles, are assumed to be more informative indicators of parental feeding and more meaningful to investigate in nutrition education.

IV. Confusion in defining "control" in feeding

It can be argued that the confusion in conceptualizing parental feeding control that has led to some of the confusion in the literature and even for parents. As mentioned in the previous section, parental "control" in child feeding is believed to lead to negative outcomes in children (Ventura and Birch, 2008). Therefore, experts often suggest that caregivers exert little control over child feeding. However, providing a choice of nutritious foods and eating nutritious foods in front of the child (modeling) can be interpreted as psychologically positive and "indirect control" that motivates the child to eat those foods (Cullen et al., 2001; Hughes et al., 2008a; Reinaerts et al., 2007). Similarly, making nutritious foods readily available and setting regular meal and snack times can be a type of positive control over the food environment (Bere and Klepp, 2004;

2005; Cullen et al., 2001; De Bourdeaudhuij et al., 2005; Downs et al., 2009; Hang et al., 2007; Hanson et al., 2005; Hendy et al., 2009; Koui and Jago, 2008; Wind et al., 2006).

If researchers conceptualize parental "control" over child feeding differently, it should not be surprising that parents do as well. This confusion leads to serious problems when experts and the media make nonscientific statements about the effects of parental control on child eating and weight status. If any parental control of feeding is viewed as contributing to childhood obesity, then parents might assume that permissive feeding practices are good. This is a problem when the research on child feeding contradicts this to the extent that indulgent feeding styles are associated with the highest body weights of children (Hughes et al., 2005). As nutritionists join developmental psychologists in recognizing the importance of parent-child feeding interactions to the quality of children's diets, researchers need to study not only directive types of feeding control such as restriction and pressure to eat but also other types of feeding control such as psychologically motivating children to eat and structuring the child's food environment.

V. Clarifying types of parental feeding control

Clarification of the types of parental feeding control will permit researchers to evaluate the true effects of feeding control on children's food intake (Clark et al., 2007b; Faith et al., 2004b). The present study defines control in child feeding as practices that parents perform for the child to achieve the food intake for optimal health (consuming recommended amount of nutrient-dense foods and energy-dense foods). As shown in **Table 1,** feeding practices, where parents force children to eat a healthy diet **(directive control)** can be differentiated from practices, where parents psychologically motivate

children to eat healthy diet **(non-directive control).** In addition, feeding practices where parents control the food environment to support children in eating a healthy diet **(food environmental control)** should also be differentiated from the other two types of control. Thus, one cannot view all types of parental control in the feeding situations as negative. Parental use of directive control over child feeding is hypothesized to have negative outcomes on the child's dietary and anthropometric measures. Use of the latter two types of feeding control is hypothesized to have positive child outcomes.

Table 2. Definitions of parental control practices of child feeding.

Construct	Definition	Example
Directive control	Practices where parents put external pressure on the child to eat a healthy diet.	• Pressure to eat • Rewards/threats • Restriction
Non-directive control	Practices where parents interact with the child to motivate him/her eat a healthy diet by internalizing the goal.	• Encouraging • Complement • Modeling • Reasoning
Food environmental control	Practices where parents provide a healthy and organized home food environment and family rules around eating to help the child eat a healthy diet.	• Make food available at home • Setting rules for mealtime behaviors • Setting regular mealtime

VI. Associations between feeding control and child food intakes

This section reviews current research in parental child feeding in relation to the child's food intake. Also, the need for clarifying and measuring different types of feeding control is justified for the purpose of improving the child's diet quality.

1) Directive control and child food intake. Types of directive control found in the literature include pressuring to eat certain foods, food rewards and threats (contingency feeding and guilt induction), and food restriction, and all relate to the food intake of children. The aspect of parental control termed "pressure to eat" that has been most widely reported in the literature used a well-validated instrument for predominantly

middle-income white children by Birch, the Child Feeding Questionnaire (CFQ) (Birch et al., 2001). Using the CFQ, greater use of "pressuring child to eat" has been associated with negative child food intake outcomes. Cross-sectional studies in middle-income groups showed that parental pressure to eat related to low intake of fruit and vegetables in 5-year-old girls (Fisher et al., 2002), high intake of high-fat/sugar foods in 4-7-year-old children (Brown et al., 2008), and picky eating in 3-5-year-old children, characterized as lower consumption of fruits and vegetables (Galloway et al., 2006). A longitudinal study supports these findings by showing that the middle-income mother's use of pressure to eat when the child was five related to the child's picky eating and to low intake of fruit and vegetables at age seven (Galloway et al., 2005). However, the effects of parental "pressure to eat" on the children's food intake in low-income groups are unclear.

"Rewarding" in child feeding situation is another type of directive control that parents of young children often use (Moore et al., 2007). Experimental studies have shown that parental use of food rewards for eating a "desirable" food or behavior (e.g., responding to verbal request) increased the child's preference for the rewarded foods, which are usually attractive to children, such as sweets and snacks (Birch et al., 1980; Newman and Taylor, 1992). A few European studies have found positive associations between rewards and intake of sweets (Vereecken et al., 2004) and with high fat and high sugar foods and beverages (Kroller and Warschburger, 2009; Sleddens et al., 2009). Such findings suggest that rewarding a child with sweets and snacks for eating "desirable" or nutritious foods might increase the child's preference for the rewarded food (sweets and snacks). Birch reported that the child's preference of desirable foods (nutritious foods) was decreased when non-food rewards (i.e., praise) were used (Birch et

al., 1984). Bante and colleague (2008) also demonstrated negative association between parental use of rewards and children's preference for fruit and vegetables, but parental use of rewards increased children's intakes of these foods. A few studies have also explored the influences of use of food rewards on the child's weight status, and found a positive association in U.S. white children from middle-income families, but inverse associations in French and German children (Kroller and Warschburger, 2009; Musher-Eizenman et al., 2009). In England, Carnell found no association between parental uses of rewards and the child's adiposity (Carnell and Wardle, 2007).

Although parental food restriction of children has been extensively studied for its negative impact on the children's food preferences and food intakes, restrictive practices studied in laboratory settings might not be used in practical situations (Birch et al., 2003; Fisher and Birch, 1999b). As Moore and colleagues found that mothers "indirectly" restricted foods by not purchasing undesirable foods, avoiding fast food outlets, and serving some energy-dense foods only for special occasions (Moore et al., 2007), these types of indirect food restrictions might be used by parents in more moderate and appropriate ways in practical situations. Therefore, this review section includes research that conceptualized parental food restriction in indirectly or non-directly, but not directly.

2) Nondirective control and child food intake. In the literature, encouragement, praising, talking about food and nutrition, and modeling are practices that can be conceptualized as "non-directive control" as defined in **Table 2.** These techniques are subtler than directive control, and permit some child autonomy. Studies on non-directive feeding control have shown associations with children's diet quality, although few have been done with young children or with low-income samples. For parental food modeling

to occur, the child must see the parent eat the food. Studies with school-aged children have shown that parents' fruit and vegetable eating behaviors positively related to the intake of fruit and vegetables in children from multi-ethnic groups in the U.S. (Cullen et al., 2001), and in different European countries (Bere and Klepp, 2005; De Bourdeaudhuij and Brug, 2000; De Bourdeaudhuij et al., 2005; Matheson et al., 2006; Wind et al., 2006). Likewise, parental modeling of undesirable eating behaviors was shown to negatively influence child food intakes in school-aged children. In a mixed ethnic sample, parent's snack modeling predicted the child's snack frequency (Hendy et al., 2009). Among Belgian parents and their 12-18 year old adolescents, the children of parents who modeled a dislike for certain foods (e.g., leaving the food untouched and taking something else to eat), tended to report reduced consumption of vegetables (De Bourdeaudhuij and Brug, 2000).

Increasingly, researchers are testing the impact of other non-directive control practices, like parental use of encouragement, praise, and motivational food conversation, but these other types of non-directive parental control over child feeding have not yet been extensively studied. Hughes and colleagues (2006) conceptualized these as child-centered feeding practices and found positive associations between caregivers (92% were mothers) use of child-centered feeding practices and children's intakes of fruit and vegetables in low-income groups. In a Belgian sample, parental encouragement with negotiation was related to increased intakes of vegetables in school-aged children. In addition, children of parents who encouraged variety and balance in their children's diet had children with lower BMIs (Musher-Eizenman et al., 2009). Parental use of praising also related to increased intake of nutrient-dense foods and decreased intakes of energy-

dense foods by children (Arredondo et al., 2006). Regarding motivational food conversation, Hendy and colleagues found that "positive persuasion" about nutrient-dense foods (e.g., telling the child how much the parents like the food, or how good the food is for the child) was associated with increased intake of those foods in US school children (Hendy et al., 2009). Importantly, positive persuasion about energy-dense foods was also related to increased intake of energy-dense foods in the children (Hendy et al., 2009).

3) Food environmental control and child food intake. The food environment, as an aspect of parental control of feeding, has been variably and inconsistently measured as food availability either in the home or while eating out. As indicators of feeding practices relating to mealtime routine and rules, the physical contexts of mealtimes and plans for regularity of mealtimes have also been investigated in relation to children's diet quality. This aspect of feeding control is especially important to assess in parents with limited incomes, because such parents often perceive lack of time and financial resources as barriers to provide their children organized and planned meals (Hoerr et al., 2005).

Feeding practices related to home food availability and accessibility have been studied the most in parents of school-aged children and a few with parents of preschoolers. Consistently strong associations between home food availability and accessibility have been found with children's intakes of those foods, both nutrient-dense foods (Bere and Klepp, 2004; 2005; Cullen et al., 2001; De Bourdeaudhuij et al., 2005; Downs et al., 2009; Hang et al., 2007; Hanson et al., 2005; Hendy et al., 2009; Koui and Jago, 2008; Reinaerts et al., 2007; Spurrier et al., 2008; Wind et al., 2006) and energy-dense foods (Brown et al., 2008; Hang et al., 2007; Ogden et al., 2006; Spurrier et al.,

2008). Home availability of energy-dense foods (e.g., sweetened beverages) generally related to low intake of nutrient-dense foods (e.g., milk) in children from preschoolers to adolescents (Brown et al., 2008; Hang et al., 2007; Hanson et al., 2005). However, the number of studies in preschoolers is limited (Brown et al., 2008; Hoerr et al., 2006; Ogden et al., 2006).

One of the mealtime physical contexts, "eating with family members," has been related to decreased energy-dense food intake in preschoolers (Spurrier et al., 2008) and in school-aged children (Coon et al., 2001; Hendy et al., 2009). Some studies also suggested that "TV viewing during mealtime" was a problematic physical distracter for school-aged children when associated with decreased intake of fruit and vegetables, and increased intake of high-fat foods and sweetened beverages (Coon et al., 2001; Spurrier et al., 2008). One study showed that preschool children who were "not seated during mealtimes" related negatively to the children's diet quality in Early Head Start families (Hoerr et al., 2005; Horodynski et al., 2009). "Planning for regularity of mealtimes" has not yet been tested in relation to the child's diet quality, but it is part of many recommendations for feeding young children (Barlow, 2007; US Department of Agriculture and Food and Nutrition Service, 2008). Items to measure this concept have been developed and hypothesized as an important feeding concept to improve children's dietary intake (Baughcum et al., 2001).

VII. Parental concern about child weight status

Research has found that parental concern about their child's weight status is associated with parental feeding practices. With middle-income parents, greater concern

about their child's weight has been reflected in greater use of directive feeding control practices like food restriction and monitoring (Birch and Fisher, 2000; Francis et al., 2001). In general the degree of parental concern about the child's weight status tends to vary by income level. Compared to middle-income predominantly white parents, those with limited income have expressed lower levels of concern about their child becoming overweight (Anderson et al., 2005; Hughes et al., 2010). In a sample of 231 Head Start parents, 78% of the parents of overweight children viewed their children as of average weight status (Anderson et al., 2005). In a focus group with limited income parents, researchers found that most parents did not use the child's actual weight as an indicator of overweight, but rather considered whether their child's weight interfered with physical activity, or whether their child had a good appetite or was teased about his or her weight (Jain et al., 2001). In Black and Hispanic parents of Head Start preschoolers, the child's actual weight status correlated positively with the parent's "perceptions" of their child's weight, but not with parental "concern" about the child's weight (Anderson et al., 2005). These studies showed that low-income parents are not concerned about their child's weight status suggesting that such concern might not influence their feeding practices as in middle-income parents (Francis et al., 2001; Webber et al., 2010). Therefore, the conceptual framework of this study did not include parental concern about child weight status.

VIII. Dietary assessment in children

Obtaining dietary information

It is challenging to measure food intakes of preschool-aged children by any means. Caregiver-reports of children's diets using a Food Frequency Questionnaire (FFQ), 24-hour recalls, and food records have been used in research settings, but no single approach captures usual dietary intake perfectly. In feeding studies in the current literature, FFQ is used most commonly with preschoolers (Arredondo et al., 2006; Brown and Ogden, 2004; Ogden et al., 2006; Patrick et al., 2005; Reinaerts et al., 2007; Spurrier et al., 2008; Wardle et al., 2005). Although some feeding studies in school-aged children used semi-quantitative FFQs, studies with preschool children generally use non-quantitative FFQs, which might limit the findings (Hang et al., 2007; Hanson et al., 2005; Koui and Jago, 2008). A short FFQ is preferentially used in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) (IOM, 2002b). The strengths that justify the use of a FFQ screener in the proposed study are: 1) it can assess usual food intake, 2) the food lists reduce the under- and misreporting of food items of key interest, and 3) it is more practical with a limited income population than other methods, and 4) the data are more suitable for use with path analysis than are 24 hour food recalls or records. These points are expanded below.

1) Usual intake. Day-to-day validity of intake varies with multiple influences such as appetite, physical activity, illness, season of the year, and holidays (IOM, 2002b). Especially in limited income samples with economic constraints, an individual's intake may become either more erratic or more monotonous. A large body of literature indicates that one or two diet recalls or food records cannot provide accurate information on usual food intake for an individual (Serdula et al., 2001). Such recalls have a high respondent burden and are expensive in terms of time and training necessary to analyze

them (Boyle and Holben, 2005). By assessing food eaten during a certain period of time (e.g., last week, last month), FFQs can assess the typical food intake over a period of time, more easily than completing multiple days of food recalls.

2) Listed food items. In general, respondents have been more likely to omit than to add food items (Briefel et al., 1997). Snack foods and desserts are less likely to be recalled than are main meal items. Unlike diet recalls and food records, which rely on respondents for the food information, FFQs list foods that are typically eaten by the target population.

3) Practicability. To obtain a high response rate, the assessment method should have low respondent-burden and not be too time consuming (National Cancer Institute). Compared to other dietary methods, FFQs have many positive features in terms of time and effort that are required for the respondents. Although lengthy FFQs require respondents to engage in a variety of cognitive processes, short-form FFQs with elementary-level language have been shown to reduce the burden (National Cancer Institute, year not specified). Self-administered, scannable FFQs do not require highly-trained personnel to collect and analyze the data as do 24-hr recalls and food records. Furthermore, the data output in terms of frequency per month from a FFQ results in fewer zero scores per participant that make path analysis so difficult or impossible when using only a few days of dietary recalls or records.

A limitation of using FFQs in preschool children is the tendency of caregivers to overestimate their food intakes (Institute of Medicine and Food and Nutrition Board, 2002b). This could occur because studies often use adult portion sizes scales (25-33% higher than sizes typical for preschoolers) to assess preschoolers' food intakes (Serdula et

al., 2001). Generally, semi-quantitative FFQs are considered to be more accurate than nonquantitave ones, but being used with preschool children, appropriate portion size scales should be used. Another limitation is that cultural food items can be omitted from the food list. Limited income samples typically include a higher than average percentage of multiethnic, multicultural, heterogeneous groups. Diversity in heritage, geography, food consumed and culture all translate into diversity in dietary patterns and practices (National Cancer Institute). Language translation alone will not provide an acceptable instrument for dietary assessment for a different culture, because the types of foods consumed, the portion sizes, food combinations and the way foods and eating are conceptualized are likely to differ (Teufel, 1997). Such differences can be addressed by pilot testing the questionnaire with a few people from different ethnic groups found in the target population. Because for the most part, the limitations are addressable and because of the advantages of using a FFQ, a semi-quantitative FFQ developed for children will be used along with visual portion guides for this study (See details in Methods).

Assessing diet quality – food-based vs. nutrient-based approaches

Diet quality is assessed, in part, from a measure of the character of overall diet or dietary patterns (Kant, 1996; Kerver et al., 2003). Evaluation of individual's or group's intake of food groups (food-based approach) or intake of nutrients (nutrient-based approach) or a combination of both are often used to help indicate diet quality (Waijers et al., 2007). Because human diets consist of complex food matrixes of multiple nutrients (Kant et al., 2000), intake patterns of food groups (e.g., fruits, vegetables, dairy, sweets, high-fat foods) can be useful to help assess diet quality and easier for people to understand and apply to their meal planning. A food-based approach generally shows

relationships to some biomarkers of dietary exposure and disease risk in the expected directions (Kant, 2004). Specifically, higher levels of green leafy, yellow/orange and cruciferous vegetables and citrus fruits are most strongly correlated with decreased risk for multiple chronic diseases in adults (Bueno de Mesquita et al., 1991; Jain et al., 1999; Kerver et al., 2003; McNaughton et al., 2008a; Nanney et al., 2004; Steinmetz et al., 1993; Verhoeven et al., 1996; Witte et al., 1996) and in adolescents (McNaughton et al., 2008b). Thus, intakes of higher levels of fruits and vegetables would indicate better quality, than lower levels. Likewise intakes of fruits, vegetables, and other nutrient-dense foods like milk that meet or approached governmental recommendations (US Department of Health and Human Services and US Department of Agriculture, 2005) would indicate a good quality diet. Considering the scientific evidence on the usefulness of food-based approach, this study selected a food-based approach as the most appropriate means to evaluate diet quality in young children.

IX. Summary and implication to the research design and methods

This chapter reviewed that a children's poor diet quality is a serious public issue in low-income groups and in relation to childhood obesity, and that parents play important roles in children's dietary intake via their feeding practices. However, there are research gaps in the relationship between parental feeding practices and children's diet quality that few studies have been done with limited income families. The review of feeding studies in this chapter described the confusion in defining "control" in feeding situations and distinguished three distinct constructs of feeding control practices. Because no single instrument measures all three constructs, a new instrument needs to be

developed. This is one focus of this dissertation. A large number of studies were identified that could be used to draft the new instrument to test with the target population of this study.

Although many studies have investigated child's weight status as the outcome of parental feeding practices, children's food intake is a more meaningful child outcome to study. Child's weight status, however, should be assessed, because it has been shown to be related to parental concern about children's weight status in middle income samples (Faith et al., 2004a; Spruijt-Metz et al., 2002). It is not clear if and how low-income parents are concerned about their child's' weight status. Because this research with the three constructs of parental control over child feeding is in its beginning stage, this research was planned to be exploratory and the data were collected in a cross-sectional setting.

CHAPTER 3

METHODS

I. Conceptual framework

The central hypothesis of this study was that three distinct types of parental control in child feeding would relate to the children's dietary intake as well as their weight status as shown in **Figure 2**. Including children's food intakes as well as weight status would explain the impacts of parental feeding on children's outcomes more thoroughly than would using food intake alone. Although parental concern about a child's weight status has been shown to influence parental feeding behaviors in previous studies of middle income families (Galloway et al., 2005), parental concern about the child's weight status was not included in the model in this study. Parents in families with limited income exhibit little, or any, such concern about their child's weight status (Anderson et al., 2005; Hughes et al., 2010). Parental concern about their child's weight status was still assessed, however, to confirm its absence in the sample.

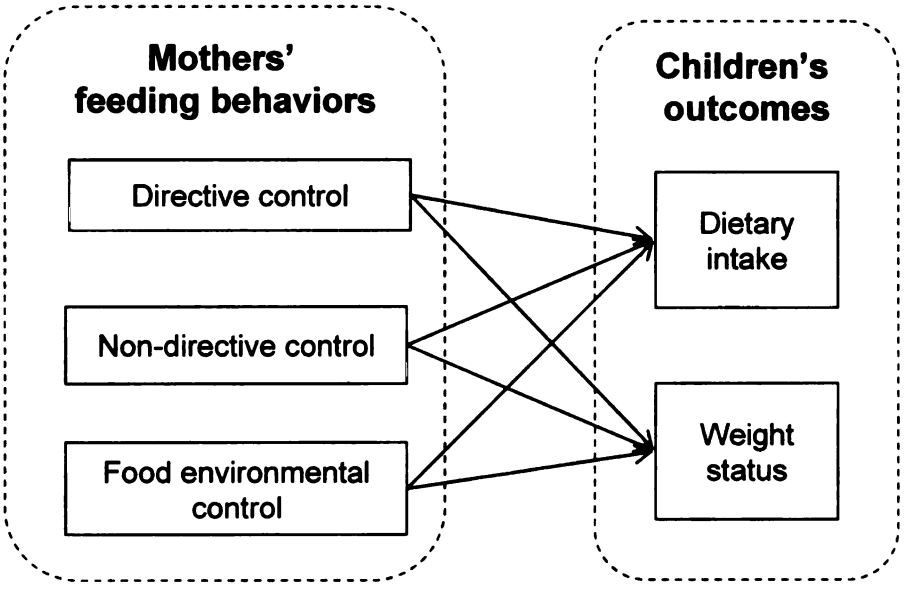

Figure 2. Conceptual model of the present study.

II. Research design

A cross-sectional research design was used in this exploratory study. Before the data collection, an instrument to be used was developed. Therefore, the methods section includes a description of instrument development before the actual data collection.

III. Target population of the research

The target population was families with 3-5 year old children participating in the Head Start program encompassed within the Capital Area Community Services (CACS) in four counties of central Michigan. Head Start is a national program for children 3-5 years old from families with an income less than 130% of the gross poverty guideline at the CACS Head Start program (http://www.cacsheadstart.org/20092010_income_guidelines.html). Ten percent of the children must be those with special needs, and such children need not meet the income criteria. Nationally, one million children participate in the Head Start program (National Head Start Association, 2010). For CACS Head Start in 2009-10, 1457 children were enrolled including 65 children from families with income over 130% of the gross poverty guideline. Most of the children (58.5%) were white, 27.7% were black, 11.8% were biracial and 0.2% were Asian, Native American or Pacific Islander. Of all the children, 19.1% were of Hispanic or Latino origin. According to the federal required nutrition monitoring of 1099 children in spring, 2010, 18.9% of the children were obese (BMI-for-age equal to or greater than 95th percentile), and 1.1% were underweight (BMI-for-age less than the 5th percentile) (Data from Health Services Advisory Committee Meeting, 4/20/10, Lansing).

IV. Overall study procedures

Before data collection, the Michigan State University's Institutional Review Board (IRB) approved the study design, the procedures (**Appendix 1**) and the instruments (**Appendix 2**) for each step of the study. The first step was item generation for the parental feeding control instrument and then cognitive interviews with parents in Head Start for item understanding and feasibility. After revisions, the procedures were pilot tested with nine mother-child dyads and revised as needed. Finally, the actual data collection for hypothesis testing occurred using the revised instrument. The data needed to test Hypotheses 1 and 2 were collected at the same time point. For the actual data collection, seven research staff members collected the data during individual appointments or at family social nights at local Head Start sites. All seven research staff completed the human subject research training provided by the university's IRB and attended two training sessions on survey data collection and anthropometric measurements. The training was repeated until all staff obtained an acceptable inter-observer reliability (the extent to how close the measurement values are to those of an expert. Following informed consent, the staff assisted mothers to complete feeding control, dietary and demographic questionnaires and obtained anthropometric measurements of both the mothers and their children. Mothers received $25 grocery gift cards upon completion. For test-retest reliability, the same survey packet and enclosed return envelope (addressed and stamped) were sent to 60 mothers three days after their first data collection. The mothers who returned the survey within 10 days received an additional $10 grocery gift card.

V. Instrument development

Because no single instrument existed to measure all three concepts of caregivers' feeding, a new instrument was developed for this study. The process included item generation from existing instruments and the literature, and feasibility testing with mothers from the target population. Then, cognitive interviews were conducted with mothers of Head Start children to test the feasibility of the instrument.

Item Generation

Research articles describing existing instruments for assessing parental feeding behaviors were reviewed to list items that fit to the three-tiered definition of feeding control proposed in this study (**Table 2** in the literature review). After developing the item pool, the researchers reviewed all items and findings from studies that used the instruments and selected individual items or a set of items as a construct that demonstrated expected associations with children's dietary intakes. As the result, a 28-item instrument was generated to measure the three control constructs as described below.

Directive control. Seven items were selected from the Caregiver's Feeding Styles Questionnaire (CFSQ) (Hughes et al., 2006). The CFSQ was developed to assess feeding practices of African-American and Hispanic caregivers of Head Start children. The seven items were categorized as either high control or contingency control sub-constructs within the questionnaire. The CFSQ demonstrated convergent validity with other parenting instruments, acceptable test-retest and internal consistency reliability and factorial invariance across ethnic groups. Confirmatory factor analyses have confirmed the factor structure of the three factors included in the CFSQ. Each item was measured

using a 5-point scale, (1=Never, 2=Rarely, 3=Sometimes, 4=Most of the time, 5=Always), where high scores indicated greater use of the given type of control. The seven items are shown in **Table 3**.

Table 3. Draft items for directive control.

Item ID	Item description	Sub-construct	Reference
D_DC_1	I beg my child to eat dinner	High control	(Hughes et al., 2006)
D_DC_2	I spoon-feed my child to get him or her to eat dinner	High control	(Hughes et al., 2006)
D_DC_3	I physically struggle with my child to get him or her to eat (for example, putting my child in the chair so he or she will eat)	High control	(Hughes et al., 2006)
D_DC_4	I warn my child that I will take away something other than food if he or she doesn't eat (for example, "If you don't finish your meal, there will be no TV tonight after dinner")	High contingency	(Hughes et al., 2006)
D_DC_5	I promise my child something other than food if he or she eats (for example, "If you eat your beans, we can play ball after dinner")	High contingency	(Hughes et al., 2006)
D_DC_6	I encourage my child to eat something by using food as a reward (for example, "If you finish your vegetables, I'll get you some ice cream")	High contingency	(Hughes et al., 2006)
D_DC_7	I warn my child that I will take a food away if the child doesn't eat (for example, "If you don't finish your vegetables, you won't get dessert")	High contingency	(Hughes et al., 2006)

D_DC: Draft Directive control

Non-directive control. In total 10 items were selected to assess this control (**Table 4**). Six items from the CFSQ were categorized as child-centered feeding. As described previously, the validity and reliability of the CFSQ as a whole was confirmed in caregivers of Head Start children (Hughes et al., 2006). Items addressing feeding practices to model eating nutrient-dense foods (two items) and energy-dense foods (two items) were generated based on items developed for parents of elementary school children and adolescents, respectively (Reinaerts et al., 2007; van der Horst et al., 2007), because few instruments existed that measured food modeling by caregivers of preschoolers. Each item had a 5-point Likert response scale, (1=Never, 2=Rarely,

3=Sometimes, 4=Most of the time, 5=Always), where high score indicated greater use of the given type of control. The 10 items for non-directive control are listed in **Table 4**, with items 9 and 10 reverse scored.

Table 4. Draft items for non-directive control.

Item ID	Item description	Sub-construct	Reference
D_NDC_1	I say something positive about the food my child is eating during dinner	Child-centered feeding	(Hughes et al., 2006)
D_NDC_2	I reason with my child to get him or her to eat (for example, "Milk is good for your health because it will make you strong")	Child-centered feeding	(Hughes et al., 2006)
D_NDC_3	I help my child to eat dinner (for example, cutting the food into smaller pieces)	Child-centered feeding	(Hughes et al., 2006)
D_NDC_4	I compliment the child for eating food (for example, "What a good boy! You're eating your beans")	Child-centered feeding	(Hughes et al., 2006)
D_NDC_5	I encourage my child to eat by arranging the food to make it more interesting (for example, making smiley faces on the pancakes)	Child-centered feeding	(Hughes et al., 2006)
D_NDC_6	I ask my child questions about the food during dinner	Child-centered feeding	(Hughes et al., 2006)
D_NDC_7	I eat fruits and vegetables in front of my child	Modeling	(Reinaerts et al., 2007)
D_NDC_8	I drink milk in front of my child	Modeling	(Reinaerts et al., 2007)
D_NDC_9*	I eat sweets, candy or salty snacks in front of my child	Modeling	(van der Horst et al., 2007)
D_NDC_10*	I drink sweetened beverages** in front of my child. **Drinks like Coke, 7-Up, Sunny Delight, Hawaiian Punch, or agues frescas (DO NOT include 100% fruit juice and diet soda)	Modeling	(van der Horst et al., 2007)

D_NDC: Draft Non-Directive control

Food environmental control. Eleven items were generated for this construct based on four important concepts emerging from previous studies: home food availability/accessibility; structuring physical contexts during mealtime; setting regular eating times; and having the child sit while eating. These concepts have all been found to significantly impact children's intake of nutrient-dense foods (Reinaerts et al., 2007) and/or energy-dense foods (Ogden et al., 2006). Each item was measured using a 5-point scale, (1=Never, 2=Rarely, 3=Sometimes, 4=Most of the time, 5=Always), where high

scores indicated greater use of the given type of control. The 11 items follow in **Table 5**, with items 2, 3, 5, 8 and 11 reverse scored.

Table 5. Draft items for food environmental control.

Item ID	Item description	Sub-construct	Reference
D_FE_1	I keep fruits and vegetables available that my child can eat	Food availability	(Reinaerts et al., 2007)
D_FE_2*	I keep sweets, candy or salty snacks where my child can reach them	Food availability	(Brown et al., 2008; Ogden et al., 2006)
D_FE_3*	I keep sugar-sweetened beverages* where my child can reach them. *Drinks like Coke, 7-Up, Sunny Delight, Hawaiian Punch, or agues frescas (DO NOT include 100% fruit juice and diet soda)	Food availability	(Brown et al., 2008; Ogden et al., 2006)
D_FE_4	I limit my child's access to sweets, candy, salty snacks or sweetened beverages by not having them readily available	Food availability	(Arredondo et al., 2006)
D_FE_5*	I allow my child to play and watch TV during meals	Mealtime behaviors	(Spurrier et al., 2008)
D_FE_6	We eat dinner together as a family	Mealtime behaviors	(Spurrier et al., 2008)
D_FE_7	If my child doesn't like a food served, I make him/her wait until the next meal or snack to eat.	Timing of meals	(Baughcum et al., 2001)
D_FE_8*	I allow my child to eat an hour before meals	Timing of meals	(Baughcum et al., 2001)
D_FE_9	I set regular meal times for my child	Timing of meals	(Baughcum et al., 2001)
D_FE_10	I have my child sit down at home while eating	Mealtime behaviors	(Hoerr et al., 2005)
D_FE_11*	I allow my child to eat while standing or walking	Mealtime behaviors	(Hoerr et al., 2005)

*Reversed scored, D_FE: Draft Food Environmental control

Feasibility test

Design and participants. Cognitive interviews were conducted to test the feasibility of the 28 items developed to measure parental feeding control as described and to establish face validity with the intended sample population. Researchers and Head Start staff recruited nine parents in July 2009. The sample size was based on data saturation. Two researchers visited two local Head Start sites (Maplehill and Holy Cross) to distribute the study flyer and several mothers of 3-5 year old Head Start participating

children signed up for the cognitive interviews. The Head Start staff also provided a list of mothers who were interested in the study. The researchers called each parent to schedule a one-hour appointment to complete the instruments and then be interviewed. The interview was done at the most convenient local Head Start site for the parent. All participants were mothers.

Procedures. After obtaining IRB approval, two researchers trained in qualitative research data collection conducted individual appointments with each mother participant at three of the local Head Start sites (Willow, Maplehill and Holy Cross). After obtaining the informed consent, researchers asked the parent to complete the feeding practice questionnaire and the food frequency questionnaire. Because the participant often brought their child to the appointment, one of the researchers tended to the child as needed, while the other assisted the mother in completing the questionnaires. After completing both questionnaires, the researcher interviewed the participant asking open-ended questions to assess her understanding of 10-15 selected items (**Appendix 1**). The interviews took 45-60 minutes and were audio-taped to be transcribed. The participants received a $10 grocery gift upon completion of the interview.

Findings. Participants understood all items in the manner anticipated. The quotes are presented in the **Appendix 3.** One mother mentioned that item D_FE_7 (**Table 5)** was neither practical nor realistic. Therefore, this item was replaced with item FE_7 and FE_8 (**Table 6**).

Table 6. Items included in the revised 29-item instrument by the three sub-constructs.

Item ID	Item description	Sub-construct	Reference
DC_1	I beg my child to eat dinner	High control	(Hughes et al., 2006)
DC_2	I spoon-feed my child to get him or her to eat dinner	High control	(Hughes et al., 2006)
DC_3	I physically struggle with my child to get him or her to eat (for example, putting my child in the chair so he or she will eat)	High control	(Hughes et al., 2006)
DC_4	I warn my child that I will take away something other than food if he or she doesn't eat (for example, "If you don't finish your meal, there will be no TV tonight after dinner")	High contingency	(Hughes et al., 2006)
DC_5	I promise my child something other than food if he or she eats (for example, "If you eat your beans, we can play ball after dinner")	High contingency	(Hughes et al., 2006)
DC_6	I encourage my child to eat something by using food as a reward (for example, "If you finish your vegetables, I'll get you some ice cream")	High contingency	(Hughes et al., 2006)
DC_7	I warn my child that I will take a food away if the child doesn't eat (for example, "If you don't finish your vegetables, you won't get dessert")	High contingency	(Hughes et al., 2006)
NDC_1	I say something positive about the food my child is eating during dinner	Child-centered feeding	(Hughes et al., 2006)
NDC_2	I reason with my child to get him or her to eat (for example, "Milk is good for your health because it will make you strong")	Child-centered feeding	(Hughes et al., 2006)
NDC_3	I help my child to eat dinner (for example, cutting the food into smaller pieces)	Child-centered feeding	(Hughes et al., 2006)
NDC_4	I compliment the child for eating food (for example, "What a good boy! You're eating your beans")	Child-centered feeding	(Hughes et al., 2006)
NDC_5	I encourage my child to eat by arranging the food to make it more interesting (for example, making smiley faces on the pancakes)	Child-centered feeding	(Hughes et al., 2006)
NDC_6	I ask my child questions about the food during dinner	Child-centered feeding	(Hughes et al., 2006)
NDC_7	I eat fruits and vegetables in front of my child	Modeling	(Reinaerts et al., 2007)
NDC_8	I drink milk in front of my child	Modeling	(Reinaerts et al., 2007)
NDC_9*	I eat sweets, candy or salty snacks in front of my child	Modeling	(van der Horst et al., 2007)
NDC_10*	I drink sweetened beverages** in front of my child. **Drinks like Coke, 7-Up, Sunny Delight, Hawaiian Punch, or agues frescas (DO NOT include 100% fruit juice and diet soda)	Modeling	(van der Horst et al., 2007)
FE_1	I keep fruits and vegetables available that my child can eat	Food availability	(Reinaerts et al., 2007)

Table 6 continued. Items included in the revised 29-item instrument by the three sub-constructs.

Item ID	Item description	Sub-construct	Reference
FE_2*	I keep sweets, candy or salty snacks where my child can reach them	Food availability	(Brown et al., 2008; Ogden et al., 2006)
FE_3*	I keep sugar-sweetened beverages* where my child can reach them. *Drinks like Coke, 7-Up, Sunny Delight, Hawaiian Punch, or aguas frescas (DO NOT include 100% fruit juice and diet soda)	Food availability	(Brown et al., 2008; Ogden et al., 2006)
FE_4	I limit my child's access to sweets, candy, salty snacks or sweetened beverages by not having them readily available	Food availability	(Arredondo et al., 2006)
FE_5*	I allow my child to play and watch TV during meals	Mealtime behaviors	(Spurrier et al., 2008)
FE_6	We eat dinner together as a family	Mealtime behaviors	(Spurrier et al., 2008)
FE_7*	I allow my child to eat whenever he/she is hungry during a day	Mealtime behaviors	(Baughcum et al., 2001)
FE_8*	I allow my child to decide when to eat meals and snacks	Timing of meals	(Baughcum et al., 2001)
FE_9*	I allow my child to eat an hour before meals	Timing of meals	(Baughcum et al., 2001)
FE_10	I set regular meal times for my child	Timing of meals	(Baughcum et al., 2001)
FE_11	I have my child sit down at home while eating	Mealtime behaviors	(Hoerr et al., 2005)
FE_12*	I allow my child to eat while standing or walking	Mealtime behaviors	(Hoerr et al., 2005)

*Reversed scored. DC: Directive control, NDC: non-directive control, FE: Food environmental control

Data collection for hypothesis testing

Participants and recruitment. Three-hundred-thirty dyads of female primary food caregivers and their children were recruited through Head Start staff, teachers and researchers from 30 Head Start sites within CACS in September 2009 through February 2010. Excluded were primary food caregivers younger than 18 years of age, and children with special needs that might interfere with normal feeding (such as a physical, mental or emotional disability) and their caregivers. Caregivers of children with special needs often use different feeding techniques (Powers et al., 2005; Stark et al., 2000). Researchers attended a Head Start teacher training seminar held in August before the

2009-10 school year and distributed the study flyers and sign-up sheets for teachers to post in the classrooms and announce to mothers. The teachers later returned the sign-up sheets to the research office with the names and phone numbers of interested primary food caregivers. The researchers called interested mothers to schedule an appointment at the closest Head Start site. The researchers also attended Head Start monthly social events to recruit additional parents and conduct data collection. The sample size for the actual study was driven by the number of participants required for the confirmatory factor analysis (CFA) for the validation of the instrument on feeding control practices.

Repeated data collection for establishing test-retest reliability. The researchers randomly selected 60 actual study participants and mailed them the same survey packet with an enclosed return envelope (addressed and stamped). Thirty-five participants completed and returned the survey within 2 weeks from the actual data collection. Thirty was the minimum sample size required for the correlational analysis.

Power analysis for testing Hypothesis 1. Hypothesis 1 was planned to be analyzed using (CFA). Two categories of general recommendations for estimating sample size for CFA are: 1) subject-to-item ratio, and 2) absolute number of subjects. That is: 1) at least five subjects (Bryant and Yarnold, 1995; Gorsuch, 1983; Gurson, 2008) or 10 subjects (Everitt, 1975; Gurson, 2008) should be contained for each item in the instrument: and 2) a sample size 100 = poor, 200 = fair, 300 = good, 500 = very good (Comrey and Lee, 1992). Based on Recommendation #1, our 29-item instrument required (5-10 subjects) x (29 items in the instrument) = 140 to 290 subjects. Considering Recommendation #2, 300 subjects were determined to be sufficient for the CFA.

VI. Measurements and variables

Children's food intakes. Frequency and amount of foods and beverages that the child ate were measured by using the Block Food Screeners for Ages 2-17 2007 (Block FFA-39, here below). This food frequency questionnaire is a 39-food item questionnaire developed for children 2-17 years old (**Appendix 2**). The Block FFQ-39 is a version modified from an 80-item questionnaire originally developed for young children and adolescents (Block et al., 1995; Cullen et al., 2008; Marshall et al., 2008). Several modified versions of the Block Kids FFQ exist and have been validated in different population groups including 757 WIC mothers (n=-~250 for each of White, Black and Hispanic, from Hempstead NY, Oakland CA, Houston TX, and Cincinnati OH) compared to three nonconsecutive day 24 hour recalls and food records of their children (US Department of Agriculture, 1994). A validity study for the Block FFQ-39 was underway at the time of data collection (personal communication, NutritionQuest). The Block FFQ-39 measures the frequency that children ate each food item over the past week using a six-point scale (i.e., none, 1 day, 2 days, 3-4 days, 5-6 days, and everyday), and the amount that children ate each food item one day in the past week using three-point scales (**Table 7-9**). The researchers assisted mothers in determining the portion sizes by using cups, bowls and photographs of each food item depicting the three different portion sizes of each food (**Appendix 4**).

Of the 39 items, 14 nutrient-dense and 16 energy-dense food items were selected for data analysis (**Table 7-9**). Nutrient-dense foods as defined in the Dietary Guidelines for Americans were those that provided substantial amounts of vitamins and minerals and relatively few calories, i.e., fruits, 100% fruit juice, vegetables and milk with any fat

content (US Department of Health and Human Services & US Department of Agriculture,2005). Although the Dietary Guidelines recommends low-fat milk, this study included all milk within the nutrient-dense definition for several reasons. Few children in the sample consumed low-fat milk. Also, milk is a rich source of key shortfall minerals such as calcium, potassium and vitamin D. Energy-dense foods were those that contained greater than 25% energy from added sugars, and/or greater than 35% energy from fat per serving based on USDA's food and nutrient database, i.e. sweets, high fat meats, salty snacks and sweetened beverages, (US Department of Agriculture, 2008).

As the variables for child's food intake, amount of nutrient-dense foods and energy-dense foods eaten last week was calculated summing the grams/day of food items within each of the food groups consumed. There were two food amount variables--amount of the nutrient-dense foods and the amount of energy-dense foods. These were defined as the total grams of the 14 nutrient-dense foods or the 16 energy-dense foods the child ate in on one day last week. Fruit juice up to 6 fl oz was considered as a nutrient-dense food, but not when intakes exceeded 6 fl oz per day (American Academy of Pediatrics, 2001).

Table 7. Food items included in the nutrient-dense food categories from the 39-item Block Kids Food Screener.

Nutrient-dense food	Portion size		
	1 serving	2 servings	3 servings
Real fruit juice	1 glass	2 glasses	3+glasses
Apples, bananas or oranges	1/2	1	2
Applesauce, fruit cocktail	A little	Some	A lot
Any other fruit	A little	Some	A lot
Other potatoes	A little	Some	A lot
Lettuce salad	A little	Some	A lot
Tomatoes	1/4 tomato	1/2 tomato	1 tomato
Green beans, peas	A little	Some	A lot
Other vegetables	A little	Some	A lot
Vegetable soup	A little	Some	A lot
Pinto beans, etc	A little	Some	A lot
Glasses of milk	1 glass	2 glasses	3+ glasses
Whole wheat bread	1 slice	2 slices	3 slices
Low-sugar whole wheat cereal	1 bowl	2 bowls	3 bowls

Table 8. Food items included in the energy-dense food categories from the 39-item Block Kids Food Screener.

Energy-dense food	Portion size		
	1 serving	2 servings	3 servings
Ice cream	1 scoop	2 scoops	3 scoops
Candy	Mini	Small	Large
Cookies, cakes	A little	Some	A lot
Granola bars	1/2	1	2
Cold cereal*	1 bowl	2 bowls	3 bowls
French fries, tater tots	A little	Some	A lot
Hamburgers	1 small	1 large	2 large
Hot dogs	1	2	3
Lunch meats	1 slice	2 slices	3+slices
Pizza	A little	Some	A lot
Macaroni & cheese	A little	Some	A lot
Buttered Popcorn	A little	Some	A lot
Snack chips	A few	Small bag	Large bag
Cheese	1 slice	2 slices	3+slices
Sodas, soft drinks, fruit drinks	1 glass	2 glasses	3+glasses
*Only when high-sugar cereal was reported as the cold cereal that the child regularly ate.			

Table 9. Food items excluded for the analysis from the 39-item Block Kids Food Screener.

Food item excluded from analysis	Portion size		
	1 serving	2 servings	3 servings
Cooked cereal	A little	Some	A lot
Whole wheat bread	1 slice	2 slices	3 slices
Ketchup or salsa	A little	Some	A lot
Refried beans	A little	Some	A lot
Eggs	1 egg	2 eggs	3 eggs
Chicken	A little	Some	A lot
Fish	A little	Some	A lot
Burritos, tacos	1/2	1	2
Beef, like roast	A little	Some	A lot
Other meat in a meal	A little	Some	A lot
Pork	A little	Some	A lot

Height and weight of mothers and children. Trained staff measured participants' height and weight twice each =following standard procedures (Lohman et al., 1988). Height was measured to the closest 0.1 cm using a portable stadiometer (SECA 214, Seca Corp., Hanover, MD). Weight was measured to the closest 0.2 kg on a digital platform scale accurate to 200 kg (BWB800AS, Tanita, Tokyo, Japan). The body mass index (BMI) was calculated for both children and mothers using the equation, weight (kg)/height $(m)^2$. For children, percentile by age and gender specific BMI (BMI-for-age) was obtained from the 2000 CDC Growth Chart (Kuczmarski et al., 2002).

Parents' concern about child weight status. A two-item subscale on parents' concerns about their child's weight status and written at a third grade reading level was derived from a questionnaire developed for use with WIC parents of 2-5 year old children (Baughcum et al., 2000). The items were, "I worry that my child is overweight right now," and "I am worried that my child will become overweight." The items have a 5-point Likert scale (1=Never, 2=Rarely, 3=Sometimes, 4=Most of the time, 5=Always),

where high scores indicate a higher level of concern about the child being or becoming overweight. Although the internal reliability has not been reported previously, this two-item construct has been pilot-tested with two samples of limited income mothers of young children (Baughcum et al., 2000). In the present sample, the Cronbach's alpha for the construct was .790. As explained earlier, this variable was not included within the conceptual framework, but still assessed to verify that maternal concern about the child's weight was low in this limited income sample. Results showed that 309 out of 330 mothers were unconcerned about their child being overweight. Because of this highly skewed distribution (only 21 mothers reported concerned about their child's weight status), it was not appropriate to include this variable in the conceptual model or in regression statistics.

In regards to the two feeding practices shown to be affected in middle income samples by parental concern about their child's weight status, t-tests were run comparing the scores for two feeding practices between concerned mothers and unconcerned. For high control the scores were 1.6±0.7 vs. 1.4±0.7 (NS) for mothers unconcerned vs concerned about child weight status, respectively. Similarly, for high contingency feeding practices the scores of were 2.1±0.8 vs. 1.8±0.9 ($p<0.05$) for mothers unconcerned vs. concerned about child weight status, respectively. The differences in the child's BMI-for-age percentiles were 71.3±24.3 vs. 98.2±3.6 for mothers unconcerned vs concerned about child weight status, respectively.

Demographic information included the child's and mother's age, gender and race-ethnicity. Also, queried were the mother's educational attainment, current relationship, living arrangement, employment, pregnancy, breastfeeding, frequency and transportation

for grocery shopping, participation in Supplemental Nutrition Assistance Program (SNAP) and SNAP-Education (SNAP-Ed). Mothers responded using multiple-choice scales appropriate for each item.

VII. Analysis

The methods for data analysis are described in the manuscripts in the next chapter. One pertains to the instrument development and one, to the relationships.

CHAPTER 4

RESULTS

This chapter includes two manuscripts prepared to submit to scientific journals. The results for the instrument feasibility test are presented in **Appendix 3**.

I. Manuscript for Aim 1:

TITLE: Confirmatory factor analysis of a questionnaire measuring control in parental feeding practices in mothers of Head Start children

ABSTRACT

Parental control in child feeding has focused primarily on directive types of control, such as pressure to eat and food restriction. This study aimed to develop an instrument to assess directive control and two additional aspects of parental child feeding, non-directive and food environmental control. Mothers of Head Start children (n=330) completed a 29-item instrument designed to assess these three constructs. Children's food intakes and height and weight of both mothers and children were measured. Confirmatory factor analysis revealed that the model with three constructs did not provide an acceptable fit to the data, but an alternative model with seven subconstructs did (Chi-square=330, df=228 $p<0.05$, CFI=.942, TLI=.930, RMSEA =.037). The latter model included 24 items loading onto one of the following seven factors: high control, high contingency, child-centered feeding, Encouraging nutrient-dense foods, discouraging energy-dense foods, mealtime behaviors and timing of meals. By allowing

researchers to quantitatively measure feeding practices in low-income parents, this instrument will contribute to improve an understanding of how parental child feeding behaviors can impact children's weight status and food intakes.

KEY WORDS

Child, Preschool, Parents, Poverty, Parenting, Feeding behavior, Diet, Body weight, Factor analysis.

INTRODUCTION

The poor diet quality of young children is one factor that can lead to overweight and obesity (Nicklas et al., 2001). Low intake of nutrient-dense foods (e.g., fruits, vegetables) and high intake of energy-dense foods (e.g., high fat and sweetened foods and beverages) are of special concerns, especially for children from families with limited incomes (Gibson et al., 1998; US Department of Agriculture, 2008). An important role for parents and others with a role in feeding young children is to guide the development of healthy dietary practices through interactions with their children, which help the children consume adequate nutrient-dense foods, and protect children from food environments with high access to energy-dense foods.

Many parents struggle with child feeding issues and guidance on how to interact with children in feeding situations is still being investigated (American Dietetic Association, 2010). It can be argued that conceptualization of control in child feeding (i.e., restrictive and authoritarian feeding practices) has led to some of the confusion in

the literature and consequently, in communications to parents. In general, parental control in child feeding is believed to lead to negative dietary outcomes and overweight in children (Birch and Fisher, 1995; 2000; Birch et al., 2003; Ventura and Birch, 2008). Control practices found in the literature are "pressure to eat certain foods," "food rewards and threats," and "food restriction" and all can relate to the food intake of children. Laboratory studies have demonstrated negative effects of these practices on children's food preferences, self-regulation of energy intake and dietary intakes (Birch et al., 1980; Fisher and Birch, 1999a; 1999b; Fisher et al., 2002; Galloway et al., 2005; Galloway et al., 2006; Newman and Taylor, 1992). Restriction, in particular, a highly controlling feeding practice, has also been consistently associated with overweight and heavier weight status in children across multiple studies with predominantly middle-income children (Clark et al., 2007a; Faith et al., 2004b; Ventura and Birch, 2008).

However, some types of less direct or less overt control such as "food modeling", "encouragement to eat," and "meal timing and structure" might psychologically and environmentally lead children to consume healthier diets and, further, lead to healthier weight status. For instance, when a parent provides the child with a choice of nutritious foods, this can be interpreted as a type of control by behaviorally and indirectly motivating the child to eat (Hughes et al., 2008a). Similarly, the concept of a parent's setting a regular mealtime and behavioral rules during meals (Baughcum et al., 2001) and making fruits and vegetables readily available can be viewed as a type of control over the food environment (Spurrier et al., 2008). Some studies suggest that these non-directive types of control practices relate to preferable weight outcomes in children. Arredondo and colleagues (2006) reported that parental reinforcement to eat a "healthy" diet--

defined as fruits, vegetables and low–fat and sugar foods--positively related to the children's intakes of these foods. Hendy and colleagues (2009) assessed parental positive persuasion, where the parents told the children how much the parents liked the foods that they wanted the children to eat, and found positive associations with the children's intake of fruits and vegetables. A recent literature review concluded that fruit and vegetable intakes in children were positively associated with parental encouragement, modeling, and fruit and vegetable availability at home (Pearson et al., 2009a). Thus, clarifying these different types of feeding control practices might help to clarify some confusion in the literature and help guide parents in the use of various types of parental control in child feeding.

Because no one instrument exists to assess parental feeding control from this broad of a perspective, this study aimed to develop a factor model of different types of parental control of child feeding, based on an instrument developed for families with limited resources. First, we defined control in child feeding as "practices that parents perform for the child to achieve healthy eating, or consume the recommended amounts of nutrient-dense foods and limited amounts of energy-dense foods." The three different types of control proposed for the measurement model were **directive control, non-directive control** and **food environmental control.** Seven sub-constructs were defined under these three constructs. "Directive control" refers to practices where parents put external pressure on the child to eat a healthy diet. This category was further divided into two sub-constructs: **high control**, where parents verbally, psychologically and physically pressure the child to eat, and **high contingency**, such as rewarding or threatening the child to eat (Hughes et al., 2006). "Non-directive control" refers to practices where

parents interact with the child to help him or her to eat a healthy diet by internalizing the goal. These techniques are subtler than directive control and permit some child autonomy within the limits that parents set. Two sub-constructs are included under this construct: **child-centered feeding**, such as arranging foods to make them interesting, and complimenting the child when he/she eats (Hughes et al., 2006); and **modeling**, where parents demonstrate the preferred eating practices in front of the child (eating fruit and vegetables and not eating high fat/sugar foods) (Reinaerts et al., 2007; van der Horst et al., 2007). "Food environmental control" refers to practices where parents provide a healthy and organized home food environment and family rules around eating to help the child consume a healthy diet. Three subconstructs are **food availability,** where parents keep or do not keep certain types of foods in house (Brown et al., 2008; Spurrier et al., 2008), rules for **mealtime behavior,** where parents set rules during meals such as sitting at a table, eating together, and not viewing television during meals (Baughcum et al., 2001; Hoerr et al., 2005), and **timing of meals,** where parents set regular mealtimes for the child and family (Baughcum et al., 2001).

By conceptualizing this variety of feeding practices as "control," this study addresses a limitation in the literature in which the main focus has been limited to those feeding practices defined here as directive control. These directive control practices, like pressure to eat and food restriction, should be differentiated from other controlling feeding practices that can have positive outcomes, such as encouraging children to eat a healthy diet via modeling and verbal communications (non-directive control) and keeping nutrient-dense foods available at home (food environmental control). By distinguishing among these types of feeding control, researchers should be better able to assess the

effects of various types of feeding control on the children's food intake and communicate findings in a clear, constructive manner to parents and caregivers. This study specifically aimed to establish the factorial validity of the three-factor measurement model of feeding control using confirmatory factor analysis (CFA). CFA is increasingly being used in parental feeding research to empirically test complex theories of parental feeding behaviors when developing an instrument or testing factorial validity in different groups (Anderson et al., 2005; Birch et al., 2001; Geng et al., 2009; Hughes et al., 2006; Kaur et al., 2006; Larios et al., 2009). The convergent validity of the constructs was also tested using children's food intake and weight status as criterion measures.

METHODS

Sample recruitment and size

Data were collected from 330 dyads of female primary feeding caregivers (hereafter called mothers) and their children participating in Head Start programs in central Michigan from October 2009 through February 2010. For the recruitment, researchers attended summer Head Start teacher trainings to distribute study flyers and sign-up sheets for teachers to post in classrooms. The researchers also attended monthly Head Start parent night social activities to recruit mothers. Excluded were mothers younger than 18 years of age and those who had children with special needs (a physical, mental or emotional disability) because caregivers of children with special needs often must use special feeding techniques (Powers et al., 2005; Stark et al., 2000).

To estimate the sample size to perform the main analysis, CFA, two categories of general recommendations were considered: 1) subject-to-item ratio, and 2) the absolute

number of subjects. Subject-to-item ratio is sometimes suggested to be no less than five subjects for each item in the instrument (Bryant and Yarnold, 1995; Gorsuch, 1983; Gurson, 2008) or no less than 10 subjects per item (Everitt, 1975; Gurson, 2008). For this study, that is 29 items x (5 to10 subjects) = 145 to 290 subjects. In terms of an absolute number of subjects, Comrey and Lee (1992) suggested the following sample sizes as 100 participants = poor, 200 = fair, 300 = good, 500 = very good. Considering both recommendations, it was estimated that at least 300 subjects were required, and 330 subjects were recruited.

Procedures

Before data collection, the university Institutional Review Board approval was obtained for the study design, instruments and procedures. Seven trained research staff collected the data during individual appointments or family social nights at local Head Start sites. Following informed consent, the staff assisted mothers to complete questionnaires and obtained anthropometric measurements of both the mothers and their children. Mothers received $25 grocery gift cards upon completion. To test the test-retest reliability, the same survey packet and enclosed return envelope (addressed and stamped) were sent to 60 mothers three days after their first data collection. The mothers who returned the survey within 10 days received an additional $10 grocery gift card. The procedure was tested before the actual data collection with nine mother-child dyads.

Measurements and variables

Feeding practices

Items were selected from other instruments designed to measure feeding practices and which had shown significant associations with children's food intakes. Most of the

original instruments from which the items were selected had been tested for validity and reliability (Baughcum et al., 2001; Brown et al., 2008; Hughes et al., 2006; Spurrier et al., 2008; van der Horst et al., 2007). Item selection was based on their association with the three main constructs--directive control, non-directive control and food environmental control. Each construct included two or three subconstructs as shown in **Table 10** and in **Table 16**. A five-item Likert scaled response category (never=1 to always=5) was used for each item. Items measuring undesirable behaviors (e.g., keeping sweets and salty snacks in home) were reversed scored. Experts reviewed and revised the items for content validity. For the face validity, cognitive interviews were conducted with 9 mothers to assess their understanding of the items. Based on their responses, researchers revised the wording of several items.

Child's food intakes

Foods that children ate within the past week were assessed by using the Block Kids Food Screener (NutritionQuest, Inc., Berkeley, CA). The Block food frequency questionnaire (FFQ) is a 39-food item questionnaire developed from a validated 80-item FFQ to assess food and nutrient intakes in children 2-17 years old (Block, 2008; Cullen et al., 2008). In the present study, the researchers assisted mothers to determine the portion sizes by using cups, bowls and photographs of each food item with the three different portion sizes listed on the FFQ. Of the 39 food and beverage items, 12 nutrient-dense and 16 energy-dense food items were selected for data analysis. Nutrient-dense foods were those that provided substantial amounts of vitamins and minerals and relatively few calories, i.e., fruits, fruit juice up to six fluid ounces (American Academy of Pediatrics, 2001; Barlow, 2007), non-fried vegetables and milk. Energy-dense foods were those that

contained greater than 25% of the food energy from added sugars, and/or greater than 35% of the food energy from fat per serving based on USDA's food and nutrient database, i.e., sweets, high fat meats, salty snacks and sweetened beverages, (US Department of Agriculture, 2008). Using the gram amount of each food item per day as estimated by NutritionQuest, the researchers created two food intake variables: nutrient-dense food intakes and energy-dense food intakes. These were defined as total grams of the 12 nutrient-dense foods or 16 energy-dense foods a child ate as averaged for one day in the past week.

Height and weight of mothers and children

Trained staff measured the participants' height and weight twice each by following standard procedures (Lohman et al., 1988). Height was measured to the nearest 0.1 cm using a portable stadiometer (Seca 214, Seca, Hanover, MD). Weight was measured to the nearest 0.2 kg on a digital platform scale accurate to 200 kg (BWB800AS, Tanita, Tokyo, Japan). Body mass index (BMI) was calculated for both children and mothers using the equation: weight(kg)/height(m)^2. For children, percentile by age and gender specific BMI (BMI-for-age) was obtained from the 2000 CDC Growth Charts (Kuczmarski et al., 2002).

Demographic information

Demographic data included the children's and mothers' gender, age and race-ethnicity. In addition, the mothers reported their educational attainment, current relationship, living arrangement, employment, pregnancy, breastfeeding, transportation

and frequency of grocery shopping, and participation in Supplemental Nutrition Assistance Program (SNAP) and SNAP-Education (SNAP-Ed).

Data analysis

Data preparation.

Each variable was assessed for skewness and kurtosis and log-transformed as needed. After this process, absolute values of skewness and kurtosis of all variables were within 1.5. A correlation matrix of all items demonstrated that items were correlated minimally within the three main constructs. Items were generally well correlated within each of the seven subconstructs, except for food modeling and availability. The Pearson's correlation coefficients ranged from .154 to .589 ($p<.01$). The majority of the coefficients exceeded .30, suggesting that a 7-factor structure could be an alternative for the 3-factor structure model.

Testing factorial validity.

CFA was run to assess whether the hypothesized models fit the data using maximum likelihood estimation (AMOS 17.0, SPSS Inc., Chicago, IL). The chi-square test was performed to test discrepancy between the observed covariance matrix and the model covariance matrix. Not rejecting the chi-square test (probability value equal or greater than .05) indicates it is possible that the hypothesized model perfectly fits the data. However, the chi-square test with reasonably large sample like this study tends to produce a value for $p<.05$, which does not mean the model fits poorly. Therefore, other indicators were used to evaluate the model fit, such as Comparative Fit Index (CFI), Tucker-Lewis Index (TLI) and Root Mean Square Error of Approximation (RMSEA)

(Bentler, 1992; Bentler and Bonett, 1980; Steinmetz et al., 1993). The CFI and TLI compare the hypothesized model to a null or worst fitting model. Values with >.95 approaching an upper bound of 1.00 indicate a well-fitting model. Values between .90 and .95 indicate an acceptable fit. The RMSEA reflects the model fit while rewarding models that are parsimonious approximates. A good model fit has values <.05. In addition to fit indices, feasibility of parameter estimates and model misspecification were assessed to find the most parsimonious and theoretically applicable model. To do so, the researchers reviewed statistical significance of parameter estimates, item loadings, residual matrix and modification indices to decide whether to add, remove or move paths and items. Paths that were not statistically significant and items with a loading less than .40 were subject to removal. The residual matrix was reviewed to specify covariances between the error variances associated with each of the indicators. A pair of items with standard residual correlation greater than 2.58 was subject to error covariance. For the items with low loadings, the modification index was assessed to determine the possibility that the item loaded on another latent variable.

Convergent validity

Convergent validity is the extent to which the seven factors are correlated with the other variables that are theoretically correlated with. Children's BMI-for-age percentile, nutrient-dense food intakes and energy-dense food intakes were chosen as those variables and the Pearson's product-moment correlations with the mean scores of the seven factors were calculated. It was expected that *high control* and *high contingency* would be negatively correlated with children's BMI-for-age percentile, and other factors would be

positively correlated with nutrient-dense food intakes and negatively correlated with energy-dense food intakes.

Reliability testing

Cronbach's alpha was used for all seven factors confirmed in CFA to estimate internal consistency reliability of the instrument. A value of >.60 is acceptable, and >.70 is desirable (Cronbach, 1951). Test-retest reliability was assessed using the data from 35 participants, who repeated the instrument within 10 days from the first trial. Pearson's product-moment correlations between two data points were examined (Rodgers and Nicewander, 1988). A p-value less than .05 was considered as significant, and correlation coefficients greater than 0.8 were desirable for test-retest.

RESULTS

Demographics

Mothers averaged 29.0 years of age (range: 18-62 yr), most were the biological mothers of the child (five non-biological mothers and 10 grandmothers) (**Table 11**). The majority of the mothers were white, and one-third were black, Hispanic or of mixed race-ethnicity. Most of the mothers were high school educated or less, and nearly three quarters were overweight or obese. Their children averaged 4.2 years of age, and one-third were reported to be of mixed race-ethnicity. Forty percent of the children were overweight or obese.

Model assessment and modification

First, the original 3-factor structure with the three main constructs was tested (Model 1). For this model, the assumption was that (a) the three factors were correlated, (b) each item would have a non-zero loading on the factor it was intended to measure and a zero loading on the other two factors, and (c) the measurement error among observed indicators was not correlated. In testing this model, all factor covariances were freely estimated. As shown in Table 3, the fit indices did not meet the criteria of acceptable model fit. The factor-item loadings (standard regression weights) ranged from .09 to .73, and nine items had loadings less than .40. Therefore, the items did not acceptably explain the construct that they were designed to explain.

The poor fit might be due to inclusion of multiple subconstructs under each of three main factors. Each subconstruct is practice-based and can be considered as a factor in the model. Therefore, a 7-factor model with the seven subconstucts as the factors was tested as Model 2. The assumptions were basically the same as those for Model 1, except for the number of factors. Compared to Model 1, Model 2 had a better fit (**Table 12**), although it still did not meet all criteria for acceptable fit. Two items belonged to food modeling (Items #13 and #14 in Appendix A) and one item that belonged to food availability (Item #R1 in Appendix A) had low loadings (standard regression weight less than .10). It should be noted that these three items measured nutrient-dense food related practices and were correlated to each other in the item correlation matrix, where the Pearson's *r* ranged from .192 to .434, $p<.01$). Therefore these three items were modified to load on a factor named *"encouraging nutrient-dense foods."* The remaining items were about energy-dense food modeling or availability (Items #15-18 in Appendix A) and were also correlated with each other (Pearson's *r* ranged from .272 to .509, $p<.01$).

Therefore, these four items were modified to load on a factor named *"discouraging energy-dense foods."* In summary, two factors, "modeling" and "food availability," in Model 2 were removed, and *"encouraging nutrient-dense foods"* and *"discouraging energy-dense foods"* were added with different item loadings to restructure Model 2 into Model 3.

Confirmatory factor analysis of Model 3 demonstrated a better fit than Model 2 (**Table 12**), but none of the fit indices were acceptable, except the RMSEA. Five items (R1-R5 in Appendix A) had low loadings (less than .40) suggesting that removing these items would improve the fit. These items could be viewed as the reversed wording of other items or as a concept covered by other items. Based on the examination of the residuals, error correlations were added between two *high contingency* items (#4 and #5), two *discouraging energy-dense foods* items (#15 and #16), and one *encouraging nutrient-dense foods* item and one *discouraging energy-dense foods* item (#14 and #15) (Figure 1, Model 4, final model). The CFI and RMSEA had acceptable levels. All the items had loadings greater than .40.

Description of the final model

Correlations between the final factors are presented in **Table 13**. The highest factor correlation was between *high control* and *high contingency* ($r=.607$, $p<.001$). These factors tended to correlate negatively with all the other factors, except for *child-centered* practices. *Child-centered, encouraging nutrient-dense foods* and *mealtime behaviors* positively correlated with each other. Likewise, *discouraging energy-dense foods, mealtime behaviors* and *timing of meals* were positively correlated. *Mealtime behavior* significantly correlated with all other factors.

Factor-item loadings ranged from .454 to .826, and all were significantly different from zero (**Figure 3**). Thus, all were meaningful indicators of the corresponding factors. Of all 24 items, 21 had factor loadings greater than .50.

Table 14 presents descriptive statistics for the mean factor scores, internal consistency and Pearson's correlation for test-retest reliability. The mean scores were relatively low for undesirable practices, such as *high control* and *high contingency*, and relatively high for desirable practices (the remaining constructs). Cronbach's alphas for all constructs were greater than .60, except for nutrient-dense practices. Pearson's correlational analysis for test-retest showed that in 35 mothers, randomly selected from the first 100 participants, the mean scores of each construct were significantly correlated between two different data collection points approximately 10 days apart.

Convergent validity of the feeding control instrument is illustrated in **Table 15** with correlations of average feeding control construct scores and the variables that were expected to be correlated with them (children's BMI-for-age, children's nutrient-dense food intakes and discouraging energy-dense foods). *High control* and *high contingency* correlated with children's BMI-for-age ($r=-.138$, $p<.05$, and $r=-.132$, $p<.05$, respectively). These two factors did not correlate with either of the food intake variables. Mothers' *child-centered* feeding (praise and motivation to eat) and *encouraging nutrient-dense foods* were positively correlated with children's nutrient-dense food intake ($r=.200$, $p<.01$; $r=.262$, $P<.01$, respectively). *Encouraging nutrient-dense foods* and *discouraging energy-dense foods* negatively correlated with the child's energy-dense food intake ($r= -.125$, $p<.05$; $r=-.263$, $p<.01$, respectively). *Mealtime behavior* and *timing of meals* did not significantly correlate with any of the variables in this sample.

DISCUSSION

This study developed a valid and reliable instrument to assess different types of control in child feeding situations for use with low-income mothers. In contrast to studies focused only on directive control, the broader definition of feeding control in the present study provided flexibility to explain different types of parental feeding control as seen in practical situations. Showing the relationships between these control constructs and the children's weight and dietary variables, this study contributes to the literature on facilitating parental feeding practices in positive ways.

The seven-factor structure was confirmed instead of the originally hypothesized three-factor structure suggesting that mothers use a variety of feeding practices. For the three-factor model, several different practices in one factor were included, but results revealed that they must have been conceptualized as different constructs. Other studies have also demonstrated categorizing feeding practices into multiple constructs, such as the Preschooler Feeding Questionnaire which includes eight feeding factors identified by an exploratory factor analysis (Baughcum et al., 2001). Similarly, Hendy et al. (2009) and Musher-Eizenman and Holub (2007) focused solely on feeding practices and extracted nine factors and 12 factors, respectively. These studies suggest that when developing factor structure of feeding practices, small and specific constructs need to be included to reflect the variety of feeding practices that parents use.

We anticipated that modeling eating behaviors and food availability would be separate concepts, but the model provided a better fit in this sample when the two were loaded onto the same factor. It is possible that patterns of parental uses of these practices are similar. In fact, Hendy et al. (2009) conceptualized these two concepts as

unidimensional based on exploratory factor analysis. Matheson et al. (2006) found strong correlations between parental modeling of eating fruit and vegetables and home availability of these foods. One can argue that parents cannot demonstrate eating nutrient-dense foods unless they have these foods available at home. Alternatively, not keeping energy-dense foods at home might prevent parents demonstrating to their children that they often eat energy-dense foods. To study relationships between parental food modeling and children's food intake, Tibbs and colleagues (2001) applied modeling theory, which defined parental modeling as a process of observational learning (parental behaviors stimulate similar behaviors in the child) (Tibbs et al., 2001). One of the functions in the process was "setting cognitive standards and rules about children's consumption of foods." In young children, this can be only achieved by preparing an environment with appropriate food availability. In other words, keeping healthy food available at home is fundamental for parents to model healthy eating, and vice versa for unhealthy eating.

Seven feeding control factors exhibited some associations in theoretically expected ways. The strong positive correlation between *high control* and *high contingency* as well as the relatively strong positive correlation between *high contingency* and *child-centered* feeding practices are supported by findings from a previous study by Hughes and colleagues (2006) with Head Start parents. By adding the food environmental control constructs in this study to Hughes' three constructs, this study found commonalities and differences between directive control (*high control* and *high contingency*) and *child-centered* feeding. The positive correlations among these three

constructs support that the goal of parent-centered feeding and child-centered feeding is the same – to get the child to eat a healthy diet.

However, directive control correlated negatively with food environmental control constructs while child-centered feeding control correlating positively with these constructs. This finding clearly illustrates that use of food environmental control practices differed between parents using direct control and those using child-centered feeding. What causes parents to use parent-centered types of control might be the children's weight status, because the children's weight status was only the variable correlated with *high control* and *high contingency* in this low-income sample. The direction of the correlations was negative, as has been consistently supported by previous studies including a few that were longitudinal (Hughes, 2006; Ventura and Birch, 2008; Wardle et al., 2002). Low body weight status should not be interpreted as desirable for young children, however, because low body weight can reflect undesirable eating behaviors, as well, such as pickiness or refusal to eat (Carruth and Skinner, 2000; Galloway et al., 2005). In fact, an observational study has reported that pressure to eat and threats to withdraw play rewards were most highly correlated with children's refusal to eat (Orrell-Valente et al., 2007).

Assessing food environmental constructs in feeding control is important when targeting low-income populations. Living with many other competing demands and external stressors in addition to the responsibility of feeding children, low income mothers are often not able to provide structured mealtimes and might be reluctant to set limits around their children's eating (Baughcum et al., 2001). Mothers' stress levels and

stressors must be assessed as risk predictors of quality of children's health and nutrition outcomes.

There are several limitations to this study that future studies should address. First, the present study was not powered to explore possible race/ethnic differences in feeding control. Previous studies have revealed that Black and Hispanic parents might use different feeding strategies (Anderson et al., 2005; Boles et al., 2010). Such differences are especially important, because people of color comprise a higher percentage of the low-income population than of the general population (www.census.gov). The feeding control instrument might need some modifications for use in different race/ethnic groups to establish its validity and reliability in different populations. Also, primary feeding caregivers who were male were excluded from this study, so this group should be examined as well. Secondly, items regarding parental modeling were adopted from questionnaires developed for parents of elementary school children, and these practices might be difficult for parents to establish with younger preschoolers. Although the results showed that parental modeling practices were used and correlated with young children's dietary outcomes in this sample, the finding needs to be repeated in other samples. Finally, the number of children in the household and food intake outside home should be considered in future studies.

CONCLUSIONS

A feeding control instrument with a seven-factor structure was confirmed for families with limited incomes. The theoretical constructs underlying the instrument were related to the child outcomes. This instrument will allow researchers to quantitatively

measure a set of parental controlling feeding practices and to correlate these with children's weight status and food intakes. This will help researchers and practitioners to understand the impact that specific parental feeding practices have on their children, and to develop educational interventions for parents. Further studies are warranted to refine the instrument by modifying existing items and testing with ethnically diverse populations that include males.

ACKNOWLEDGEMENT

The study was supported partly by Michigan Agricultural Experiment Station, Michigan Nutrition Network and Michigan State University Families and Communities Together Coalition (FACT). We acknowledge Capital Area Community Services-Head Start for providing the access to the study participants and resources to conduct the data collections.

Table 10. Structure of the main constructs and subconstructs and number of items for the constructs in the original 29-item instrument.

Main constructs	Subconstruct	Number of Items
Directive control	High control	3
	High contingency	4
Non-directive control	Child-centered	6
	Modeling	4
Food environmental control	Mealtime behaviors	4
	Timing of meals	4
	Food availability	4

Table 11. Characteristics of study participants.

Characteristic	Mother n=330	Child n=330
Age, yr	29±7.5	4.2±0.6
Sex, percent female	100%	49.1%
Race-ethnicity		
Non-Hispanic white	57.0%	40.3%
Non-Hispanic black	21.5%	21.5%
Hispanic	9.7%	7.3%
Mixed/Other	11.5%	30.6%
Weight status		
Underweight	1.5%	1.2%
Healthy/Normal weight	24.5%	58.8%
Overweight	26.7%	18.2%
Obesity	47.3%	21.8%
Education		
No high school	16.1%	NA
High school	62.4%	NA
College +	21.3%	NA
Employment		
Full-time	21.8%	NA
Part-time	28.2%	NA
Relationship		
Single	49.7%	NA
Married	33.0%	NA
Living together	17.3%	NA

NA=Not Applicable

For mothers, weight status was defined as follows: Underweight: BMI < 18.5kg/$m^{2;}$ Normal weight: BMI=18.5 –24.9; Overweight: BMI=25.0-29.9; Obese: BMI≥30.0 (National Institutes of Health, 1998). For children, weight status was defined as follows: Underweight: BMI-for-age <5th percentile; Healthy weight: BMI-for-age 5th – 84.9th percentile; Overweight: BMI-for-age 85th –95th percentile; Obese: BMI-for-age 95th percentile and above (Krebs et al., 2007).

Table 12. Goodness of fit indices of tested models.

	Chi-square	df	CFI	TLI	RMSEA
Model 1 (29 items, 3 factors)	1247	374	.602	.568	.084
Model 2 (29 items, 7 factors) Seven subconstructs as the factors	752	329	.794	.764	.063
Model 3 (29 items, 7 factors) Restructured	745	356	.822	.797	.058
Model 4 (24 items, 7 factors) Removed 5 items	330	228	.942	.930	.037

CFI: Comparative Fit Index, TLI: Tucker-Lewis Index, RMSEA: Root Mean Square Error of Approximation.

Table 13. Estimated factor-factor correlations among maternal feeding control variables in final model.

Variables	(a)	(b)	(c)	(d)	(e)	(f)
(a) High control	-	-	-	-	-	-
(b) High contingency	.607***	-	-	-	-	-
(c) Child-centered	.112	.327***	-	-	-	-
(d) Encouraging nutrient-dense foods	-.261**	-.089	.415***	-	-	-
(e) Discouraging energy-dense foods	-.089	-.001	.097	.046	-	-
(f) Mealtime behaviors	-.461***	-.208**	.299**	.579***	.196*	-
(g) Timing of meals	-.183	-.040	-.087	.004	.417***	.409***

*p<0.05, **p<0.01, ***p<0.001

Table 14. Maternal feeding control practices, descriptive statistics and Cronbach's alpha (n=330) and test-retest correlations (n=35).

Feeding control practices	Mean ± SD	Cronbach's alpha	Test-retest correlation
High control	1.62 ±.68	.700	.821**
High contingency	2.08 ±.78	.787	.825**
Child-centered	3.66 ±.69	.663	.763**
Encouraging nutrient-dense foods	4.06 ±.97	.586	.849**
Discouraging energy-dense foods	3.63 ±.76	.736	.794**
Mealtime behaviors	3.62 ±.39	.617	.452**
Timing of meals	3.40 ±.76	.640	.684**

**p<0.01

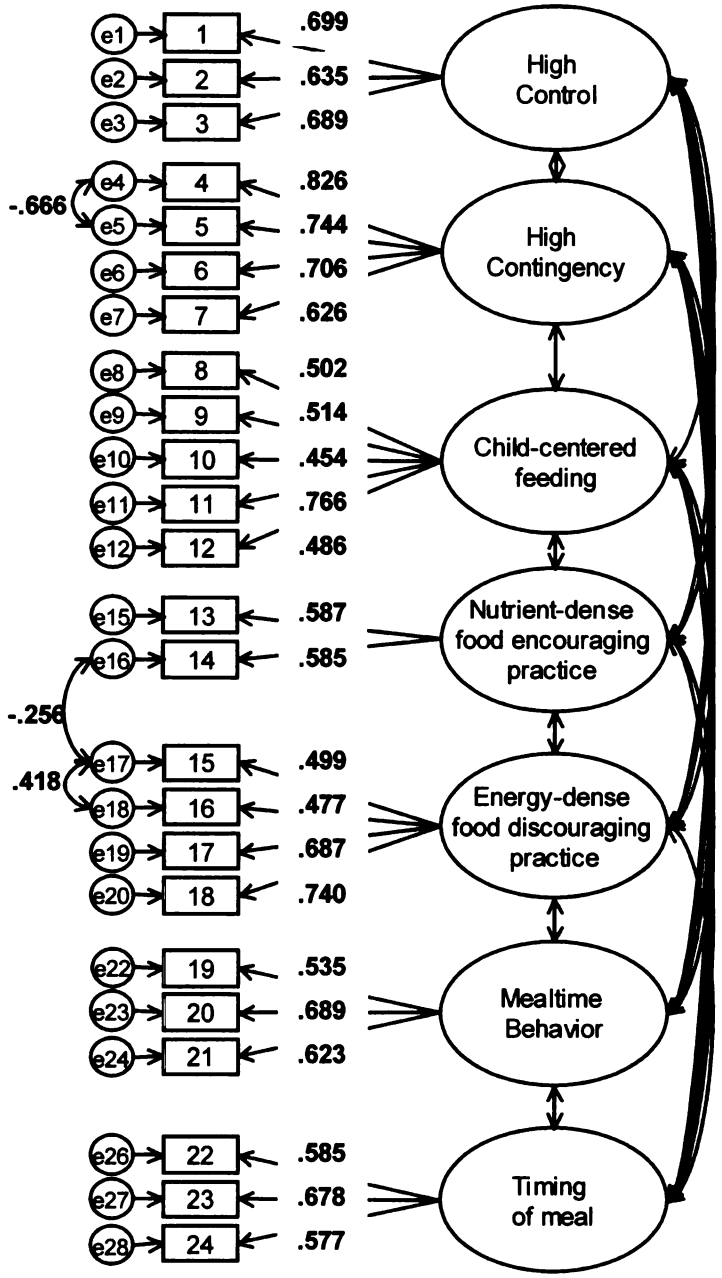

Figure 3. Standardized estimated factor-item loadings, error variances, and covariance for the final model.

Factor-factor correlations presented in Table 13. Item descriptions are in Table 16. The shapes in the diagram represent as follows; ovals: latent variables (factors), rectangles: measured variables, Letter e: error term, one-head arrow: factor loading/constrained parameter, both-head arrow: covariance.

Table 15. Pearson's correlations of maternal feeding control constructs with children's BMI-for-age (percentile) and intakes of nutrient- or energy-dense foods.

Feeding control practices	Child BMI percentile	Mother's BMI	Child's nutrient-dense food intake	Child's energy-dense food intake
High control	-.138*	-.104	.020	-.008
High contingency	-.132*	-.144**	.017	-.001
Child-centered	.029	.069	.200**	-.071
Encouraging nutrient-dense foods	.019	.052	.262**	-.125*
Discouraging energy-dense foods	-.036	-.003	-.039	-.262**
Mealtime behaviors	.073	.016	.061	.036
Timing of meals	.086	.029	-.116*	-.069

*p<0.05, **p<0.01, ***p<0.001

Table 16. Item description

#	Item description
1	I beg my child to eat dinner.
2	I spoon-feed my child to get him or her to eat dinner.
3	I physically struggle with my child to get him or her to eat
4	I warn my child that I will take away something other than food if he or she doesn't eat
5	I encourage my child to eat something by using food as a reward
6	I promise my child to something other than food if he or she eats
7	I warn my child that I will take a food away if the child doesn't eat
8	I say something positive about the food my child is eating during dinner.
9	I reason with my child to get him or her to eat
10	I help my child to eat dinner
11	I compliment the child for eating food
12	I encourage my child to eat by arranging the food to make it more interesting
13	I drink milk in front of my child.
14	I eat fruits and vegetables in front of my child.
15	I eat sweets, candy or salty snacks in front of my child.
16	I keep sweets, candy or salty snacks where my child can reach them.
*17	I keep sugar-sweetened beverages where my child can reach them.
*18	I drink sweetened beverages in front of my child.
*19	I allow my child to play and watch TV during meals.
20	We eat dinner together as a family.
21	I have my child sit down at home while eating.
*22	I allow my child to eat whenever he/she is hungry during a day.
*23	I allow my child to decide when to eat meals and snacks.
*24	I allow my child to eat an hour before meals.
R1	I ask my child questions about the food during dinner.
R2	I keep fruits and vegetables available that my child can eat.
R3	I limit my child's access to sweets, candy, salty snacks or sweetened beverages by not having them readily available.
*R4	I allow my child to eat while standing or walking.
R5	I set regular meal times for my child.

*Reversed scored. DC: Directive Control, ND: Non-directive control, FE: Food environmental control. Item R1-5 are those removed from final model during modification process.

II. Manuscript for Aim 2:

TITLE: Mothers' psychological motivation and food environmental support are associated with preschoolers' nutritious eating in low-income families

ABSTRACT

Background and objectives: Highly directive parental control practices over child feeding, such as pressure to eat and using food rewards, influence children's dietary intakes and weight status. This study expanded the concept of control in child feeding and assessed relationships to children's food intakes and weight status.

Methods: Mothers of 3-5 year old-Head Start children (n=330) completed an instrument to measure different types of control practices in child feeding and a food frequency questionnaire reflecting children's food intake over the last week. Researchers measured the height and weight of mothers and children. Multiple regression analyses tested if different types of control practices predicted children's intakes of nutrient-dense foods and of energy-dense foods, and their BMI-for-age percentiles.

Results: The scores for child-centered feeding (praise and encouragement) and modeling nutritious eating were positively associated with children's intake of nutrient-dense foods. Modeling (eating) nutrient-dense foods and "not modeling energy-dense foods was negatively associated with children's intake of energy-dense foods. None of the control practices significantly predicted the children's weight status.

Conclusion: Low-income parents can promote children's consumption of nutrient-dense foods and reduce energy-dense foods by positively interacting with children during meals and modeling nutritious eating.

KEY WORDS: Child, Preschool, Parents, Poverty, Parenting, Feeding behavior, Diet, Body weight.

INTRODUCTION

Parental behaviors in feeding situations are one of the most critical parental factors in the development of children's food preference and eating patterns (Scaglioni et al., 2008). The interactive behavioral processes occurring between parents and the child during mealtimes influence children's eating behaviors and weight status (Orrell-Valente et al., 2007; Wardle et al., 2005). Specifically, feeding practices like food restriction, food rewards and pressure to eat have been negatively linked to the children's self-regulation of energy intakes and food preferences (Fisher and Birch, 1999a; 1999b; Fisher et al., 2002). Although such controlling feeding practices are only one aspect of parental feeding, they are sometimes used as indicators of all types of parental feeding control. Moreover, food restriction, in particular, has been consistently associated with overweight and heavier weight status in children, although these associations might depend on family income levels (Clark et al., 2007a; Faith et al., 2004b; Ventura and Birch, 2008). Parental control of child feeding defined this way might lead caregivers to interpret that exerting any control in child feeding is bad for the child. If parental control in feeding situations is viewed as contributing to child obesity, then parents might assume that permissive feeding practices are good. This is a problem when the research on child feeding contradicts this with indulgent feeding styles being associated with the highest body weights of children (Hughes et al., 2005).

Providing a choice of nutrient-dense foods, preparing foods to make them interesting to the child and eating nutrient-dense foods in front of the child (modeling) can be interpreted as psychologically positive types of control to motivate the child to eat these foods, but in a child-centered way (Cullen et al., 2001; Hughes et al., 2008a; Reinaerts et al., 2007). Similarly, making nutrient-dense foods readily available and having rules and routines for mealtime behaviors and the timing of meals and snacks can be positive types of non-directive parental control over the food environment (Bere and Klepp, 2004; 2005; Cullen et al., 2001; De Bourdeaudhuij et al., 2005; Downs et al., 2009; Hang et al., 2007; Hanson et al., 2005; Hendy et al., 2009; Koui and Jago, 2008; Wind et al., 2006).

Researchers need to focus not only on directive types of feeding control in relation to children's weight status, but also on non-directive types of feeding control. Parents can psychologically motivate the children and structure the home food environment to support their children eating a nutrient-dense diet as types of non-directive feeding control. To this end, this study explored if and how different types of parental control in child feeding might impact the children's food intakes as well as their weight status. We hypothesized that parental feeding practices with less directive control and more child-centered and food environmental control would relate to healthier dietary intakes by children consuming more nutrient-dense foods and fewer energy-dense foods.

METHODS

Sample and recruitment

Data were collected from 330 dyads of female primary feeding caregivers (hereafter called mothers) and their children participating in Head Start programs in central Michigan from October 2009 through February 2010. For the recruitment, researchers attended the Head Start teacher trainings to distribute the study flyers and sign-up sheets for teachers to post in classrooms. The researchers also attended monthly Head Start parent night social activities to recruit mothers. Excluded were mothers younger than 18 years of age and children with special needs (such as asthma or a physical, mental or emotional disability). Caregivers of children with special needs often must use special feeding techniques (Powers et al., 2005; Stark et al., 2000).

Procedures

Before data collection, researchers obtained study approval from the university's Institutional Review Board for the study design, instruments and procedures. Seven trained research staff collected the data during individual appointments or family social nights at local Head Start sites. Following informed consent, the research staff measured the heights and weights of the mothers and their children and assisted mothers in completing questionnaires. Mothers received a $25 grocery gift card upon completion. The procedures were pilot-tested before the data collection with nine mother-child dyads and revised as needed.

Measurements and variables

Feeding control practices

An instrument to measure parental feeding control with seven feeding control constructs was developed for this study from the literature. the seven control constructs were "high control" (physical and verbal pressure to eat), "high contingency" (rewards,

threats), "child-centered" (praising, encouraging to eat), " encouraging nutrient-dense foods" (healthy eating modeling), " discouraging energy-dense foods" (not keeping high fat and sugar foods at home, not eating those foods in front of the child), "mealtime behaviors" (family meals, eating at dinner table, not viewing television during meals) and "timing of meals" (setting regular meal and snack times). A five-point-Likert scale (where never= 1 to always=5) was used for all 24 items. Confirmatory factor analysis showed the acceptable model fit of the seven factor structure; Chi squared=330, df=228 $p<0.05$, CFI=.942, TLI=.930, RMSEA=.037). Cronbach's alpha ranged from .586 to .787 (six of seven factors were >.60). Repeat tests were conducted with 35 randomly selected participants within 10 days of the first measurement, and the Pearson's correlation ranged from .452 to .849 (all the correlations were $p<0.01$).

Child's food intakes

Mothers reported that the child's food intake for the previous week using the Block Food Frequency Questionnaire (Block FFQ) developed for children 2-17 years old. This Block FFQ has 39 food items and measures the frequency that children ate each food item during the past week using a 6-point scale (i.e. none, 1 day, 2 days, 3-4 days, 5-6 days, and every day). The amount of each food item consumed in one day over the past week used 3-point scales. This use of a semi-quantitative food frequency questionnaire was the most appropriate method to obtain children's dietary intakes, because it could address day-to-day variability and it had a lower response burden than multiple days of food recalls (Institute of Medicine and Food and Nutrition Board, 2002b).

The researchers assisted mothers to determine the portion sizes by using cups, bowls and photographs of each food item with the three different portion sizes. Of the 39

items, we selected 14 nutrient-dense and 16 energy-dense food items for data analysis (**Table 17**). Nutrient-dense foods were those that provided substantial amounts of vitamins and minerals and relatively few calories, i.e., fruits, 100% fruit juice, vegetables and milk. Energy-dense foods were those that contained greater than 25% energy from added sugars, and/or greater than 35% energy from fat per serving based on USDA's food and nutrient database, i.e. sweets, high fat meats, salty snacks and sweetened beverages (US Department of Agriculture and Agricultural Research Service, 2008). Fruit juice greater than 6 fl oz was considered an energy-dense food (American Academy of Pediatrics, 2001). Total grams of 14 nutrient-dense food items or 16 energy-dense food items per day were calculated and used as the children's food intake variables for the analysis.

Height and weight of mothers and children.

Trained staff following standard procedures (Lohman et al., 1988) measured participants' height and weight twice each. Height was measured to the closest 0.1 cm using a portable stadiometer (SECA 214, Seca Corp., Hanover, MD). Weight was measured to the closest 0.2 kg on a digital platform scale accurate to 200 kg (BWB-800AS Digital Scale, Tanita, Tokyo, Japan). Body mass index (BMI) was calculated for both children and mothers using the equation, weight (kg)/height $(m)^2$. There were nine mothers who were pregnant at the time of data collection. For mothers, self-reported prepregnancy weight was used to calculate their BMI. For children, BMI percentile by age and gender (BMI-for-age) was obtained from the 2000 CDC Growth Charts (Kuczmarski et al., 2002).

Mothers reported their children's and own demographic information (gender, race/ethnicity, age). Researchers also queried the mothers' socioeconomic status via education level attained, marital relationship and employment status (**Table 18**).

Data analysis

Frequencies, means and standard deviations were calculated for descriptive analysis. Multiple regression analyses tested which control feeding practices predicted the children's nutrient-dense food intakes, energy-dense food intakes and BMI-for-age percentiles. Correlational analysis showed that child's age, child's race-ethnicity (white vs. others), mother's age, mother's race-ethnicity (white vs. others), mother's education and mother's BMI were correlated with at least one of the predictors or outcome variables (**Table 19**). Therefore, these were included in the regression analysis as covariates. Probability values less than .05 were considered to be statistically significant. SPSS 17.0 was used for all analyses (SPSS Inc., Chicago, IL).

RESULTS

The mean age of mothers was 29 years old and most were white, with the remainder of Black, Hispanic and mixed race-ethnicity. Nearly all were biological mothers (5 non-biological mothers and 10 grandmothers) (**Table 18**). Most mothers had at least a high school degree and half were employed. Almost half of the mothers were single and nearly three-quarters were overweight or obese. The children averaged 4.2 years of age. Compared to mothers, a larger percent of children were reported as mixed race. In contrast to the mothers 40% of the children were overweight or obese.

A strong positive correlation was found between *high control* and *high contingency* (r=.443, p<.001) (**Table 19**). These two factors positively correlated with *child-centered* and had negative or no correlations with other factors. E*ncouraging nutrient-dense foods* was moderately and positively correlated with child-centered practices and with *mealtime behaviors*. Discouraging e*nergy-dense foods* was correlated with *timing of meals*.

The children's nutrient-dense food intakes, energy-dense food intakes and BMI-for-age percentiles were regressed on the mother's control feeding practices as predictors (**Table 20**). The seven predictors accounted for 9.7% variance in predicting child's nutrient-dense food intakes (F=4.956 (7, 322), p<.001), 8.6% variance for energy-dense food intakes (F=4.347 (7, 322), p<.001), and 4.3% variance for BMI-for-age percentiles (F=2.049 (7, 322), p=.049). *Child-centered* feeding and *encouraging nutrient-dense food* were positively associated with nutrient-dense food intakes. E*ncouraging nutrient-dense foods* and *discouraging energy-dense foods* were negatively associated with the children's energy-dense food intakes. None of the predictors was associated with the children's BMI-for-age percentiles. The regression analyses were repeated with the covariates of the child's age and race-ethnicity (white vs. others), as well as of the mother's age, race-ethnicity (white vs. others), educational level and BMI (**Table 21**). For the children's nutrient-dense food intakes and energy-dense food intakes, adding the covariates neither contributed to significant increases in the percent of variance explained nor changed the direction and significance of the associations found in **Table 20**. The F changes for these two outcome variables were .922 (5, 317) and 1.500 (5, 317), respectively. For the BMI-for-age percentile, adding the covariates significantly

increased the variance explained by 3.9 % (F change=2.681 (5, 317), p=.022), although the associations between the predictors and the BMI-for-age remained non-significant.

DISCUSSION

This study demonstrated that some types of parental control practices in child feeding were associated with children's food intake, but not with children's weight status in this low-income sample. The results indicated that parents positively interacting with children during meals and modeling nutritious eating did relate to their children consuming more nutrient-dense foods. These findings suggested that children's intake of energy-dense foods could be reduced not only by parents modeling eating nutrient-dense foods, but also by limiting energy-dense foods in the home. These findings agree with previous studies of preschoolers (Sleddens et al., 2010; Spurrier et al., 2008; Zeinstra et al., 2010) as well as of school-aged children (Hendy et al., 2009; Matheson et al., 2006; Reinaerts et al., 2007). The variances in children's food intake and weight status explained by mothers' feeding practices were small but significant, supporting that mothers' feeding practices play a role in children's dietary intakes. This study is one of the few in the U.S. with preschoolers and their parents from families with limited incomes to find that maternal child feeding practices were be associated with their children's food intakes.

A possible reason why highly directive types of parental control (high control and high contingency) were not associated with the children's weight status found previously by Hughes and colleagues (Hughes et al., 2006) is that ethnic differences were not considered in this analysis. As Hughes and colleagues reported, Hispanic parents were

more involved in interactions with their children in both directive and child-centered ways than were African-American parents, and the relation to the children's weight status were different by these ethnic groups (Hughes et al., 2006). Another reason might be that low-income parents in this sample did not report high use of directive feeding strategies (high control and high contingency) with their children. The mean scores for these constructs were relatively low compared to those for other constructs. This finding might also explain the absence of associations of these feeding constructs with children's food intakes in this study, although these associations have been found in middle-income families (Wardle et al., 2005). This difference by income level could stem from parental concerns about child's weight status. For middle-income parents, use of control practices (e.g., pressure to eat and food rewards/threats) appears to come from their concern about the child's risk of overweight (Birch and Fisher, 2000), but low-income parents seem less concerned about their child's weight status (Anderson et al., 2005; Hughes et al., 2010).

Neither *mealtime behaviors* nor *timing of meals* was associated with the child's food intakes in this study. "Eating meals as family," "not viewing television during meals" and "eating at a dinner table" were conceptualized as desirable practices that help children to develop good mealtime behaviors in this study. A recent national study revealed that family meal frequency and television viewing were related to lower and higher obesity rates in 4-year-old children, respectively (Anderson et al., 2010). It is less clear if these factors are related to the children's food intakes. In a recent review paper, family meal frequency was not always associated with fruit and vegetable intakes in older children and adolescents (Pearson et al., 2009b). The contexts of shared mealtime, such as mealtime conversation and disruption, might be important dimensions to assess family

meal functions in addition to family meal frequency (Kiser et al., 2010). Hours of television viewing at any time in a day have been linked with increased intake of energy-dense foods in young children as well as in older children and adolescents (Campbell et al., 2010; Taveras et al., 2006). However, if and how mealtime television viewing affects children's food intake is less clear. Only a few studies have linked mealtime television viewing in particular to school-aged children eating more energy and less fruit and vegetables (Matheson et al., 2004a; Matheson et al., 2004b). Preschoolers' mealtime television viewing habits might not yet directly relate to unhealthy eating patterns, but develop in later years. Eating while seated and at a table is often suggested to families with young children, but low income families might not even have a dinner table (Rawlins, 2009), which would limit family meals and increase the chance of eating in front of a television.

There has been limited research on the relation of regularity of mealtimes to young children's food intakes, but it is considered a desirable behavior, because Yoo and colleagues reported that mealtime regularity was related to parent-perceived child's health status in low-income groups (Yoo et al., 2010). In our sample, however, setting regular mealtimes correlated negatively with the children's intake of nutrient-dense foods. For young children, setting regular mealtimes might limit the children's total food intake. If parents provided child nutritious foods whenever the child desired it throughout the day, then these will likely be the children with the highest intakes of these foods. Although experts often suggest setting regular eating times for preschool-aged children, it might be too early to assess if mothers' are routinely scheduling eating times for the children, and if such a practice is associated positively with the children's food intakes.

A limitation of this study is that race-ethnic differences in mothers' feeding practices were not considered. As mentioned previously, another study found low-income African-American and Hispanic parents to differ in terms of their feeding practices (Hughes et al., 2006). Because approximately 40% were from these race-ethnic groups in our sample, future studies need to target a larger number of subjects. Another limitation is that the mothers' use of feeding control practices were self-reported. Observations of mealtime interactions between mothers and children are recommended for future studies. In addition, future studies might also consider other influential factors, such as mother's food intakes (Wardle et al., 2005; Zeinstra et al., 2010), the number of children in the family, influences of the father and other family members, the child's attendance in other daycare facilities than Head Start, and children's food intakes at those facilities and at Head Start.

CONCLUSIONS

Low-income parents can help their children consume a healthy diet by motivating their children in child-centered ways to eat nutrient-dense foods, modeling nutritious eating themselves as well as by organizing the home food environment to offer nutrient-dense foods and limit access to energy-dense ones.

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Services-Head Start for providing the access to the study participants to conduct data collection.

Table 17. Block FFQ food items categorized as nutrient-dense foods and energy-dense foods.

Nutrient-dense foods	Energy-dense foods
▪ 100% fruit juice up to 6 fluid ounces	▪ Ice cream
▪ Apples, bananas or oranges	▪ Candy, candy bar
▪ Applesauce, fruit cocktail	▪ Cookies, donuts, cakes
▪ Other fruits (strawberries, grapes)	▪ Breakfast bars, granola bars
▪ Non-fried potatoes (e.g. mashed, boiled)	▪ Sugar-sweetened cereal
▪ Lettuce salad	▪ French fries, tater tots
▪ Tomatoes	▪ Hamburgers
▪ Green beans or peas	▪ Hot dogs
▪ Other vegetables, e.g. corn, carrots, broccoli	▪ Lunch meats
▪ Vegetable soup	▪ Pizza
▪ Beans	▪ Macaroni & cheese
▪ Refried beans	▪ Buttered Popcorn
▪ Glasses of milk	▪ Snack chips
▪ Whole wheat bread	▪ Cheese
▪ Low-sugar, whole wheat cereal	▪ Sugar-sweetened beverages

Table 18. Demographic characteristics of mothers and children.

	Mother	Child
n	330	330
Age, yr	29±7.5	4.2±0.6
Sex, percent female	100%	49.1%
Race/ethnicity		
Non-Hispanic white	57.0%	40.3%
Non-Hispanic black	21.5%	21.5%
Hispanic	9.7%	7.3%
Mixed/Other	11.5%	30.6%
Weight status		
Underweight	1.5%	1.2%
Healthy/Normal weight	24.5%	58.8%
Overweight	26.7%	18.2%
Obesity	47.3%	21.8%
Education		
No high school	16.1%	N/A
High school	62.4%	N/A
College	15.8%	N/A
Advanced	5.5%	N/A
Employment		
Full-time	21.8%	N/A
Part-time	28.2%	N/A
Relationship		
Single	49.7%	N/A
Married	33.0%	N/A
Living together	17.3%	N/A

For mothers, weight status was defined as follows: Underweight: below 18.5kg/m^2, Normal weight: 18.5 –24.9, Overweight: 25.0-29.9, Obese: 30.0 and above (National Institutes of Health (1998). "Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults--The Evidence Report." Obes Res 6(6): 464 Suppl 2:51S-209S).
For children, weight status was defined as follows: Underweight: below 5th percentile, Healthy weight: 5th – 84.9th percentile, Overweight: 85th –95th percentile, Obese: 95th percentile and above (Krebs, N. F., J. H. Himes, et al. (2007). "Assessment of child and adolescent overweight and obesity." Pediatrics 120 Suppl 4: S193-228).

Table 19. Mean and standard deviation (SD) of the children's weight status and food intakes and maternal feeding control variables and maternal demographics and Pearson's correlations among the variables.

	Mean	SD	1	2	3	4	5	6	7	8
1. Child's nutrient-dense food intake (g/d)	778	296	-	-	-	-	-	-	-	-
2. Child's energy-dense food intake (g/d)	228	153	.304**	-	-	-	-	-	-	-
3. Child's BMI percentile	73.0	24.9	-.046	-.010	-	-	-	-	-	-
4. High control	1.62	.68	.017	-.008	-.138*	-	-	-	-	-
5. High contingency	2.08	.78	.015	-.001	-.132*	.443**	-	-	-	-
6. Child-centered practices	3.66	.69	.200**	-.071	.029	.110*	.285**	-	-	-
7. Encouraging nutrient-dense foods	4.06	.97	.258**	-.125*	.019	-.154**	.004	.293**	-	-
8. Discouraging energy-dense foods	3.63	.76	-.036	-.262**	-.036	-.040	-.017	.061	.032	-
9. Mealtime behaviors	3.62	.39	.060	.036	.073	-.128*	-.089	.094	.153**	-.020
10. Timing of meal	3.40	.76	-.119*	-.069	.086	-.122*	-.017	-.079	-.024	.262**
11. Child's age	4.2	.60	-.036	.024	.077	-.086	-.085	-.107	.060	-.139*
12. Child's male gender	N/A	N/A	-.051	.096	-.089	.083	-.024	.096	-.001	-.070
13. Child's white ethnicity	N/A	N/A	.004	-.022	.055	-.032	-.013	.043	.137*	-.107
14. Mother's age	29.0	7.5	-.040	-.054	.000	-.049	-.168**	-.180**	.030	-.073
15. Mother's white ethnicity	N/A	N/A	.031	-.039	.108	-.041	-.040	.035	.124*	-.136*
16. Mother's education	N/A	N/A	-.035	-.111*	-.143**	.074	.039	-.032	-.005	.032
17. Mother's BMI	31.3	8.9	.033	.091	.044	-.028	-.049	.006	-.053	.035

*p<0.05, **p<0.01

Table 19 continued. Mean and standard deviation (SD) of the children's weight status and food intakes and maternal feeding control variables and demographics and Pearson's correlations among the variables.

	9	10	11	12	13	14	15	16
1. Child's nutrient-dense food intake (g/d)	-	-	-	-	-	-	-	-
2. Child's energy-dense food intake (g/d)	-	-	-	-	-	-	-	-
3. Child's BMI percentile	-	-	-	-	-	-	-	-
4. High control	-	-	-	-	-	-	-	-
5. High contingency	-	-	-	-	-	-	-	-
6. Child-centered practices	-	-	-	-	-	-	-	-
7. Encouraging Nutrient-dense foods	-	-	-	-	-	-	-	-
8. Discouraging Energy-dense foods	-	-	-	-	-	-	-	-
9. Mealtime behaviors	-	-	-	-	-	-	-	-
10. Timing of meal	.037	-	-	-	-	-	-	-
11. Child's age	.059	-.003	-	-	-	-	-	-
12. Child's male gender	-.003	-.039	-.055	-	-	-	-	-
13. Child's white ethnicity	.058	.013	.041	-.069	-	-	-	-
14. Mother's age	.043	.032	.151**	.087	.007	-	-	-
15. Mother's white ethnicity	.042	-.015	.078	-.114*	.860**	.051	-	-
16. Mother's education	.051	-.138*	.113*	.064	-.028	.209**	-.046	-
17. Mother's BMI	.010	.064	-.045	-.036	-.019	-.015	-.038	-.117*

*p<0.05, **p<0.01

Table 20. Children's food intakes by nutrient-dense and energy-dense classification and BMI percentile predicted by their mothers' feeding control practices.

	Nutrient-dense food intake				Energy-dense food intake				BMI percentile			
	B	SE	Beta	p	B	SE	Beta	p	B	SE	Beta	p
High control	20.2	26.3	.047	.443	-9.0	13.6	-.040	.509	-3.11	2.28	-.085	.174
High contingency	-17.4	23.3	-.046	.454	4.9	12.1	.025	.682	-3.63	2.02	-.114	.073
Child centered feeding	58.7	25.3	.136	.021	-6.3	13.1	-.029	.629	3.08	2.19	.085	.161
Encouraging nutrient-dense foods	67.3	17.3	.221	.000	-19.2	9.0	-.123	.033	-.53	1.50	-.021	.725
Discouraging energy-dense foods	-10.3	21.6	-.026	.634	-50.8	11.2	-.252	.000	-2.30	1.87	-.070	.219
Have mealtime behavior rules	14.0	41.4	.018	.735	19.4	21.4	.049	.365	2.71	3.59	.042	.451
Setting regular timing of meals	-35.9	21.8	-.092	.100	-2.9	11.3	-.014	.800	3.17	1.89	.096	.094
R^2/Adjusted R^2	.097/.078				.086/.066				.043/.022			

B: unstandardized regression coefficient, Beta: Standardized regression coefficient.

Table 21. Children's food intakes by nutrient-dense and energy-dense classification and BMI percentiles predicted by their mothers' feeding control practices with the children's and mothers' sociodemographics entered as covariates.

	Nutrient-dense food intake				Energy-dense food intake				BMI percentile			
	B	SE	Beta	p	B	SE	Beta	p	B	SE	Beta	p
High control	19.5	26.4	.045	.462	-8.0	13.6	-.036	.557	-2.59	2.26	-.071	.253
High contingency	-21.1	23.5	-.056	.371	3.2	12.1	.016	.794	-2.75	2.01	-.087	.172
Child centered feeding	59.9	25.7	.139	.020	-6.0	13.2	-.027	.651	2.51	2.19	.069	.253
Encouraging nutrient-dense foods	70.1	17.5	.230	.000	-18.1	9.0	-.115	.046	-.85	1.50	-.033	.573
Discouraging energy-dense food s	-11.5	22.1	-.029	.602	-50.7	11.4	-.252	.000	-1.21	1.89	-.037	.524
Have mealtime behavior rules	18.5	41.6	.024	.656	22.2	21.5	.057	.301	3.28	3.56	.051	.357
Setting regular timing of meals	-35.7	22.1	-.091	.107	-6.2	11.4	-.031	.585	2.41	1.89	.073	.203
R^2/Adjusted R^2	.110/.077				.107/.074				.081/.047			
ΔR^2	.013				.021				.039			

Sociodemographic variables included child's age, child's race-ethnicity (white vs. others), mother's age, mother's race-ethnicity (white vs. others), mother's education and mother's BMI

B: unstandardized regression coefficient, Beta: Standardized regression coefficient.

CHAPTER 5

SUMMARY

I. Main findings

This research aimed to address the importance of parental feeding balanced among different types of control practices as relating to the diet quality of young children from low-income families. This study expanded the definition of parental "control" over child feeding from the one in current literature that focuses solely on food restriction and pressure to eat to also include child-centered, non-directive and food environmental practices. To measure these different aspects of parental control in child feeling situations, an instrument originally consisting of three constructs--directive control, non-directive control and food environmental control--was generated and tested for its factorial validity and test-retest reliability. The hypothesized three-factor model in Aim 1 did not fit the data from a sample of 330 mothers and their Head Start children, but the alternative model with the following seven constructs did: *"high control"* (pressure to eat), *"high contingency"* (food rewards and threats), *"child-centered feeding"* (praise and encouragement), *"encouraging nutrient-dense foods"* (modeling nutritious eating), *"discouraging energy-dense foods"* (not modeling eating of energy-dense foods and limiting such foods in the home), *"mealtime behaviors"* (family meal, meals at a table and no television viewing during meals) and *"timing of meal"* (scheduling meal and snack times). Regression analyses for Aim 2 demonstrated that the children's consumption of nutrient-dense foods was predicted by the mothers' use of *child-centered* feeding and *encouraging nutrient-dense foods*, whereas the children's intake of energy-dense foods was associated with mothers' *encouraging nutrient-dense foods* and

discouraging energy-dense foods. The results demonstrated that the mothers' feeding practices--such as motivating their child in non-threatening ways to eat during meals, modeling nutritious eating and providing nutrient-dense foods in the home food environment--predicted children's intakes of more nutrient-dense foods and of fewer energy-dense foods. Contrary to Hypothesis 2, two types of food environmental feeding control, *mealtime behaviors* and *timing of meals*, were not associated with the children's food intakes. No maternal feeding control practices were associated with the child's weight status in this study.

II. Study strengths and limitations

Strengths

The sample represents the target population. The sample of 330 mothers and children in this research were recruited from all Head Start classrooms in the targeted area (four counties in central Michigan). Because the researchers visited the local classrooms for data collection and had good participation at all, there was minimal regional bias. The Head Start programs in the four counties were all managed by the Capital Area Community Services (CACS), so the researchers were able to compare the study's demographic and weight data to that of the larger Head Start enrollments (~1400). The good match supported that the sample was representative of the target population, except for fewer Hispanic mothers. In addition, the sample size was large enough to perform the statistical analyses proposed.

Dietary assessment by FFQ was appropriate for the target population and analyses. Although in general some FFQs tend to overestimate the child's dietary intake

due to limitations of the portion size scales (Institute of Medicine, 2002b), it is likely that the dietary intake was fairly accurate in this study. The original FFQ of the short version used in this research (Block Kids Food Screener) was developed for children, and validation studies have been done in multi-ethnic low income groups (US Department of Agriculture and Food and Nutrition Service, 1994). In addition, because a FFQ assesses food intakes for a longer period (one week in this case) than a 24-hour recall or three days of dietary records, the FFQ provided better data distribution for the path analysis than would a single or three-day diet recalls.

Height and weight were measured. Studies in the literature have often used mother-reported height and weight to assess the child's weight status. However, some concerns about such self-reports are that mothers often do not remember the values correctly, young children grow fast and in spurts, and data sources of the measurements vary for each child (e.g., well child clinics), all making the accuracy of the children's anthropometric values questionable. Self-reported heights and weights for the mothers can also be a problem, because women tend to underestimate or underreport their weight status, especially those with overweight and obesity (Briefel et al., 1997). In this research, valid, reliable and calibrated scales were used to reduce systematic errors. In addition, all the research staff had satisfactory inter-observer reliabilities on two separate trainings.

Limitations

The sample size was inadequate to test ethnic differences. Some race-ethnic groups might vary in their child feeding practices, and, if so, the influences of such practices on children might differ. For instance, authoritarian parenting style (highly demanding of the child or parent-centered, but not warmly responsive to the child or not

child-centered) has been associated with positive outcomes, such as lower aggression and externalizing behaviors, in African American children, but not in white children (Lansford et al., 2004). In feeding situations, Hispanic parents with children in Head Start have been reported to be more interactive with the child in both parent-centered and child-centered ways, and the associations with the child's weight status and food intakes differed for black and Hispanic race-ethnic groups (Hughes et al., 2006). Testing for such race-ethnic differences would require a larger number of participants by race-ethnic group than were recruited in this study.

Convergent validity was not assessed to help validate the feeding control instrument. The validity of the feeding control instrument could be further strengthened by assessing the constructs using other existing instruments to test for agreement, especially for the food environmental control items. Because the original hypothesis was that home food availability, mealtime behaviors and timing of meals were the same construct and no validated instrument existed that measured such a construct, another instrument was neither proposed nor used for convergent validity in the present study. Some instruments, however, do measure the factors similar to those found as a result the confirmatory factor analysis in this study (Baughcum et al., 2001; Birch et al., 2001; Wardle et al., 2002). Future studies could include those measurements.

Mothers' use of feeding practices was self-reported. Although many studies in the literature have used parent-report methods to measure parental feeding practices, accuracy is not guaranteed. Comparing feeding studies using parent-report methods and those using observation methods, Faith and colleagues (2004b) commented in a review paper that "observational methods may offer a more valid picture of true parent-child

feeding dynamics." However, observational methods are more expensive and time consuming compared to parent-report methods. More importantly, because of the presence of observers or video cameras, parents' usual feeding practices as well as children's usual eating behaviors might not be observed. Using both methods might improve the quality of the data, but increase the participant burden.

Other factors that might relate to mothers' feeding practices or to the children's food intake. First, mothers' food intake was not assessed in this study, although it is known to be a strong predictor of children's food intake (Hoerr et al., 2006; Wardle et al., 2005; Zeinstra et al., 2010). Secondly, attendance in daycare facilities other than Head Start was not assessed and this might have affected the child's food intake. During data collection, the researchers noted that some children also attended daycare facilities, in addition to preschool at Head Start. This study only assessed the children's food intake at home, and food intakes at Head Start and other facilities might have affected the children's food intake at home. Thirdly, the researchers did not assess if and how many siblings lived with the target Head Start child. Mothers might adjust feeding practices depending on the existence of other children, although no research was identified to support this. In addition, other children in the family who were older or younger might influence the mother's feeding practices with the target child and his/her food intakes. Finally, men were excluded from this study and some men do feed young children, especially in an economy where both parents need jobs to support a household with children. Only two male feeding caregivers were excluded by gender from participation in this study.

III. Implications

The valid and reliable instrument developed in this study will permit researchers to quantitatively measure a set of parental child feeding control practices and to correlate these with children's food intakes and weight status. This will help both researchers and practitioners to understand the impact that parental feeding practices have on their children. This study found that healthier dietary intakes in children were associated with the mothers' feeding practices that motivated (praise and encouragement) and environmentally supported (food availability) the children to eat nutritious foods. This knowledge can be used to develop educational interventions for parents emphasizing strategies for influencing practices in parental groups with limited incomes.

IV. Recommendations for future studies

It is recommended that this study be repeated in other samples addressing the the following points. First, although the instrument developed in this study showed acceptable validity and reliability, it should be tested in a larger sample to evaluate its practicability and examine race-ethnic differences. An item regarding availability of fruit and vegetables in the home was dropped during the confirmatory factor analysis process. However, this practice is a recognized influence on fruit and vegetable intakes of adolescents. Even though data from this sample did not fit the measurement model with this item, it is suggested that future studies re-examine whether this practice relates to the child's food intake in low-income families.

Secondly, studies with larger samples with multi race-ethnic groups are needed to assess cultural and ethnic differences in feeding practices, and to perform a more

thorough analysis. Because race-ethnic distribution can differ by region, it is highly recommended to target multiple Head Start programs around the country to recruit sufficient numbers and variety. As the power analysis for the CFA in this study suggested, it will require at least 300 subjects for each race-ethnic group (i.e., African-American and Hispanic).

APPENDIX

1. Study protocol

Parent Feeding Study
Data collection manual

Dissertation research
"The relationship of parental feeding control practices to food intake of 3-5yr children in families with limited incomes"

Megumi Murashima
Dept Food Science & Human Nutrition
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(Updated 11/16/09)

Table 22. Research team

	Name	Phone	Email
PI	Sharon Hoerr, RD, PhD		
Graduate research assistant	Megumi Murashima, MS		
Undergraduate research assistant	Beatriz George		
Undergraduate research assistant	Stephanie Darkins		
Head Start health manager	Teresa Spitzer, RN		
Head Start dietitian	Gail Hagbom, RD		

Expectations for Research Assistants

1. Work ~15 hours a week.
2. Attend training sessions prior to the data collections and learn research protocols.
3. Take human research protection training from MSU Institutional Research Boards (http://humanresearch.msu.edu/requiredtraining.html), and provide copy of certificate.
4. Attend weekly meetings (~30min) and take minutes.
5. Schedule appointments with participants.
6. Drive to Head Start research site and collect data.
7. For the data collection, wear professional casual dress (see *"Appropriate clothing for data collection"* on **page 108)** and name badge (student ID) with "Dietetic Research Aide" posted on "Student".
8. Enter data in a spread sheet in computers, and store completed surveys and consent forms in locked file cabinets in room 136 GM Trout.
9. Track and distribute participant incentives.
10. Report problems, issues and concerns immediately to Dr. Hoerr and/or Megumi.

Summary of the research (grant proposal submitted to NIH 6/15/2009)

The long-term objective of this study is to develop and test parental feeding strategies for an R01 application to reduce childhood obesity and improve diet quality among low-income groups. The specific aims are to:

Aim 1) Define constructs of parental feeding control practices that influence weight status and dietary intake of 3-5 yr children from low-income families;

Aim 2) Test and estimate a model that explains how parental feeding practices affect the diet quality and weight status the children; and

Aim 3) Develop and pilot test an video-based interactive educational intervention to improve parents' feeding practices to optimize the child's weight and food intake.

Achievement of these aims reflect the National Institute of Health's mission *to apply knowledge of behavior of living systems to extend healthy life and educe the burden of illness* by providing a means to reduce child obesity and improve diet quality via *dissemination of information in health.* This cross sectional study will target about 400 mother-child dyads, children ages 3-5 yr, from 26 Head Start sites in greater Lansing, Michigan and be conducted in 2 phases.

Phase 1 will use a cross-sectional design to develop an instrument to investigate relationships among the three types of parental feeding practices and the child's intake of nutrient-dense and energy-dense foods and child weight status controlling for maternal weight status and the child's sedentary activity (n=330). For the instrument, confirmatory analysis, Cronbach's alpha and test-retest reliability will be used. Furthermore, structural equation modeling will be conducted to test the relationships among the variables.

Phase 2 will use the constructs from the instrument and framework in Phase 1 to develop and pilot test a video-based, interactive educational intervention to improve parental feeding practices, child diet quality and child weight status. The goal is to produce six short length video segments for an interactive DVD with menu selection options and use it educate about non-directive and food environmental types of control, stimulating small group discussion. The interactive video intervention will be pilot tested and evaluated using formative and outcome evaluation. Outcome evaluation will include use of the instrument developed in the Phase 1 and the child's food intake and weight status in a pre-post test.

Study outline

The overall goal of this study is to understand feeding practices of Head Start mothers in relation to their children's weight status and dietary intakes. This will be achieved by the following three steps over 8-10 months.

1. **Cognitive test.** Test the feasibility in and the understanding by the target population of using the questionnaires prepared for the actual data collection (n=10).

2. **Pilot data collection.** Simulate the participant recruitment, data collection, data entering and analysis to predict possible issues in the actual research implementation (n=10).

3. **Actual data collection.** Conduct the recruitment, data collection, data entering and analysis at 26 Head Start sites (see **Table 24**).

Table 23. Timeline

Activity	When	Where	What
Cognitive test	Jun'09 – Jul'09	• Head Start sites • Participants' house*	• Survey • Interview
Pilot data collection	Jul'09 – Aug'09	Head Start sites	• Survey • Height & weight measurements
Actual data collection	Sep'09 – Feb'10	Head Start sites	• Survey • Height & weight measurements
	Sep'09	US mail	• Repeat survey with first 60 participants

Table 24. Head Start site locations (personal information was removed)

	Head Start classroom	Address	Mileage from MSU
1	Willow (Manager's office)	101 E. Willow St. Lansing, MI 48906	4.0
2	Maplehill*	640 Maplehill Lansing, MI 48910	5.2
3	Wainwright	4200 Wainwright Lansing, MI 48910	9.2
4	Durand	204 Russel St Durand, MI 48429	32.3
5	Perry	9926 W. Stoll Road Haslett, MI 48840	10.5
6	Elliot	4200 Bond St. Holt, MI 48842	11.6
7	South Cedar	2357 Delhi Commerce Drive Holt, MI 48842	8.8
8	Towar Garden	6223 Towar Garden East Lansing, MI 48823	4.0
9	Eaton Rapids	912 Greyhound Dr. Eaton Rapids, MI 48827	23.2
10	Charlotte	1370 North Clinton Trail Charlotte, MI 48813	25.2
11	Baker Street	840 Baker Street Lansing, MI 48910	4.0
12	St. Johns	4179 South U.S. 27 St. Johns, MI 48879	32.4
13	Elmhurst	2400 Pattengill Lansing, MI 48910	6.5
14	Mt. Vernon	3338 N. Waverly Lansing, MI 48906	10.1
15	High Street	1717 N. High St. Lansing, MI 48906	6.2
16	Haslett	5750 Academic Way Haslett, MI 48840	6.7
17	Owosso (Roosevelt 1 and 2)	312 W. Main St. Suite 1 Owosso, MI 48867 (Office) 201 N. Brooks Owosso, MI 48867 (Classroom)	29.2
18	North Owosso	1249 N. Chipman Owosso, MI 48867	30.4
19	Hildebrandt	3122 N. Turner Lansing, MI 48906	7.3
20	Bath	13789 Webster Rd Bath, MI 48808	12.7
21	LaRoy Froh	2400 Reo Rd. Lansing, MI 48911	9.4
22	South Lansing	213 W. Holmes Lansing, MI 48910	6.7
23	Rainbow	8161 Executive Drive Lansing, MI 48917	13.2
24	Grand Ledge/Hollbrook	615 Jones Grand Ledge, MI 48837	17.7
25	Grand River	1107 E. Grand River Lansing, MI 48906	4.5

Cognitive test

Participants: 10 Head Start mothers (see **Table 25**)

Inclusion criteria: mothers 18 years old or older whose child does not have special needs listed below. Numbers in ( ) is from 2008.

Autism (1)
Development Impairment (35)
Health Impairment (2)
Mental Retardation (1)
Visual Impairment/Blindness (3)

NOTE: Orthopedic impairment (2) and Speech/Language impairment (136) will be included.

Location for the data collection: At one of the three Head Start sites (Manager's office, Maplehill or Lansing West Side-Holy Cross) or the participant's house

Data collectors: Two research assistants preferred. All house visits must include two research assistants.

Pre-study training: One session on survey and interview protocol will be provided. The date will be determined.

Procedure

Step 1. Recruitment

Dr. Hoerr attended the parent advisory meeting on 5/15/09 and recruited 7 mothers mostly white. Head Start staff will provide two African-American and a Hispanic mothers.

Step 2. Screening and appointment

Call mothers on the list and screen if the mother fits the inclusion criteria. Schedule 60min appointment for survey (15min) and interview (45min). Try to meet at one of the Head Start sites, and help keep the child occupied during the data collection if needed. Participant's house is optional.

Step 3. Reminder

Call the participant one day prior to the appointment.

Step 4. Data collection

1) Informed consent. Briefly explain about the study and obtain signature on the consent form for agreement for participation.
2) Survey. Have participant complete the survey packet. Do first couple of questions together with the respondent. For the rest of the questions, assist her as needed.

3) Interview. Assess if the participant understands randomly selected items (up to 45 minutes). Record entire interview and take field notes (see *"Cognitive test procedure and interview guide"* on **page 110**).
4) Incentive. Give $10 gift certificate for completion of survey and interview. Obtain date and signature on the incentive signature sheet for receipt of the incentive.

Step 5. Write-up
Type up the interview and field notes within 24 hours in a WORD document, and save in the lab computer (File location→ V:\Research\Parent Feeding Study\Cognitive test\Interview_transcription)

Required items for the data collection

- Consent forms (2 copies for each interview)
- Survey packets
    - 30-item feeding questionnaire
    - Food Frequency Questionnaire
    - Demographics
- Pencils, No. 2
- Interview guide
- Digital recorder
- Incentive ($10/participant)
- Participant signature sheet for incentive receipt

Questions from cognitive test participants
Demographic form
Q: (Living arrangement) Where does extended family fit into?
A: "with others"

Feeding questionnaire
Q: Item No. 2 (I spoon-feed my child to get him or her to eat dinner.) and No. 21 (I help my child to eat dinner. for example, cutting the food into smaller pieces) look same to me.
A: Spoon-feeding is a way a parent directly control child's eating. Help is a way a parent motivates or encourages the child to feed him/herself.

FFQ
Q: What types of ice cream are included in "ice cream"?
A: Ice cream that is high in sugar and fat is included in "ice cream". For example, an ice cream sandwich is "ice cream", but a Popsicle is "candy".

Q: Foods that are frequently eaten by the child are not on the questionnaire.
A: Assist the mother to choose the closest food items from the FFQ. If not find, leave note on a sticky note.

Pilot data collection

Participants: 10 Head Start mother-child dyads (see **Table 26)**

Inclusion criteria:
Mother: 18 years old or older
Child: those without special needs listed under "*Inclusion criteria*" on **page 101**.
NOTE: Both mother and child should meet the criteria to participate.

Location for the data collection: Three Head Start sites that are opened during summer will be selected from all Head Start sites (see **Table 24**)

Data collectors: Trained Research Assistants. Number will be announced prior to the data collection.

Pre-study training: Three sessions will be provided. Date will be determined.
Session 1: Overview of study and survey protocol
Session 2: Anthropometric measurements
Session 3: Inter-observer error assessment

Procedure
Step 1. Recruitment & screening in two ways
a) Dr. Hoerr and Megumi will attend a parent meeting on selected date to recruit participants. Only those who meet the inclusion criteria will be enrolled.
b) Teresa Spitzer, Head Start Health Coordinator, will assist in recruitment of participants and data collection locations.

Step 2. Reminder one day prior to the appointment
a) Call the participant mother.
b) Contact the data collection site (tell them what time and how long we will be there).

Step 3. Set-up
Calibrate the stadiometers and weight scales. Set up privacy screens for weight measurements, and tables and chairs for survey.

Step 4. Data collection
1) Informed consent. Briefly explain the study and obtain signature on consent form for agreement for participation.
2) Measure child's height & weight (see *"Standard procedure for weight & height measurements"* on **page 111)**.
3) Have mother complete questionnaires (survey packet). Do first couple of questions together with the respondent. For the rest of the questions, assist her as needed.
4) Measure mother's height & weight (see *"Standard procedure for weight & height measurements"* on **page 111**).

5) Incentive. Give $25 gift card and list of food resources for completion of survey and measurement. Obtain date and signature on the incentive signature sheet for receipt of the incentive.

*** Have the child color a picture while the mother is answering questionnaire.

Required items for the data collection

- Consent forms
- Data collection packets
    - Height & weight recode sheets
    - 30-item feeding questionnaire
    - Food Frequency Questionnaire
    - Demographics
- Pencils and pens
- Incentive ($25/participant)
- 2 stadiometers & calibration rod
- 2 digital scales & calibration weight
- Privacy screens (if no room available)
- Participant signature sheet for incentive receipt
- Coloring pictures and crayons

Actual data collection

Participants: 330 Head Start mothers and children (see **Table 27**).

Location for the data collection: 25 Head Start sites in target area (see **Table 24**). Dr. Hoerr will contact the supervisor at each site prior to the data collection.

Data collectors: Trained research assistants. Number will be depend on the number of participants and announced prior to each data collection.

Pre-study training: The three sessions for pilot data collection will be provided to the research assistants who have not attend those sessions.

Procedure

Step 1. Recruitment

a) Through the classroom teachers
   Attend the *teacher training* to ask teachers to 1) post and distribute the study flyer, 2) leave the sign-up sheet at classroom, and 3) call/fax/email the names on the sign-up sheet.

b) Direct recruitment at *parent orientations*
   Set up a station (poster is in 136 Trout) at Head Start sites during parent orientation, and obtain names and phone numbers of those who are interested in the study.

c) Direct recruitment at *family social nights*
   Same as b). Data collection can be done during social nights.

d) Outdoor signs
   During data collection at a Head Start site, post door sign with the study flyer on the outside door. Megumi will ask permission from the supervisor prior to data collection.

Steps 2. Screening and scheduling appointments

a) Call those who signed up (see "*Phone script – researcher to participant*" on **page 114**).

b) When a mother called the lab, ask screening questions (see "*Phone script – participant to researcher*" on **page 115**). Schedule an appointment if possible.

Step 3. Reminder one day prior to the appointment

a) Call the participant mother.
b) Contact the data collection site (tell them what time and how long we will be there).

Step 4. Data collection

1) Set up. Calibrate the stadiometers and weight scales. If there is no separate room available, set up privacy screens for weight measurements, and tables and chairs for survey.

2) Informed consent. Briefly explain the study and obtain signature on consent form for agreement for participation.

3) Questionnaires. Start with demographic & feeding forms.
Things to remember:

Demographic form

- Pregnancy - If mother is pregnant, ask prepregnancy weight
- Living situation – if no check on "with children" confirm.
- Child age/birthday – confirm what participant write on.

Feeding questionnaire

- Do first couple of questions together with the respondent.
- For the rest of the questions, assist her as needed.

FFQ

- Do first couple of questions together with the respondent.
- Use the visual aide with bowls, cups and sipping bottles. Turn the visual aide pages as she moves on.

*** Have the child color a picture while the mother is answering questionnaire.

4) Anthropometric measurement. Measure child's and mother's height & weight (see *"Standard procedure for weight & height measurements"* on **page 111**). Be flexible with the order.

5) Incentive. Give $25 gift card and list of food resources for completion of survey and measurement. Obtain date and signature on the incentive signature sheet for receipt of the incentive.

Required items for the data collection

- Same as items for pilot data collection

Test-retest reliability

Participants: 30 Head Start mothers who completed the actual study. Expected race/ethnic distribution is in (see **Table 28**).

Procedure

1) Mail the same survey packet with an addressed & stamped return envelope to the first 60 participants within 10 days from the actual data collection.

2) Accept only those packets returned within 10 days from the day the packet was sent.

3) If at least 30 complete packets are not returned, mail the packets to additional participants until 30 complete packets are returned.

4) For those who returned the survey within 10 days, leave $10 grocery certificate and signature form at front desk of the data collection site.

5) Call them that the gift card is ready to be picked up at the site. If missing information is found in the returned survey, ask them first.

Required items for the data collection

- Mailing supplies
    - Envelopes (to send and to return)
    - Stamps (for return only)
- Incentive for repeat data collection ($10 grocery certificate/participant)
- Participant signature sheet for incentive receipt

Appropriate clothing for data collection

Business Casual for Women: General guidelines:

- Casual does not mean sloppy! Whatever you wear should be clean, pressed, and in good condition. Check for missing buttons, dangling threads, and signs of wear and tear.
- Stores and catalogues that have a "business casual" section frequently show khakis on their models. While this doesn't necessarily mean that you have to wear Dockers every day, the style is a good guideline; very loose or flowing pants, leggings, or jeans-type styles (even in a dressy fabric) may be questionable.
- If you choose to wear a skirt, stay away from short hemlines, high slits, and anything tight. Take the "sit" test; try the skirt on in front of a mirror and sit, cross your legs, stoop, reach and do anything you would do during the course of a normal day. Check to make sure you're not showing too much leg and that you'll be comfortable wearing this item.
- Sweater sets and tailored shirts are a safe bet. Avoid anything sheer, tight, or low-cut, just as you would when preparing for an interview; unlike an interview, you have more room to experiment with colors and patterns. Remember the general rule: If something looks like you could wear it to the bar, you probably shouldn't wear it to work.
- Don't wear athletic shoes, sandals, or trendy styles like platform shoes.
- You can be more creative with your accessories when dressing in business casual, but don't be extreme; your 15 bracelets shouldn't clank together every time you move your arms, for example. How much flexibility you have with wardrobe details like this will depend a great deal on what industry you work in.
- When in doubt, be more conservative -have we reinforced that yet? This isn't the most fun or glamorous wardrobe imaginable and it might not express your personal style, but it's essential to appear professional if you wish to be treated as a professional.
- Remember that it's easier to move from a conservative look to a more casual one than the other way around. See what other people in your office are wearing to get a clearer idea of what is acceptable. Pay attention to how your boss dresses; the staff may look ready for a night on the town and your supervisor may look like she's straight from the pages of an Eddie Bauer catalog. She's the one who got the promotion. Successful people tend to look the part.

http://careernetwork.msu.edu/students/findingajob/creating-a-professional-image

Enrollment plan

Table 25. Enrollment plan for 10 participants for the cognitive test

Racial Categories	N (mother)
White	5
Black or African American	3
Hispanic	2
Asian/Native American	0
Total	10

Table 26. Enrollment plan for 10 mother-child dyads for the pilot data collection.

Racial Categories	N (mother)	N (child)
White	4	4
Black or African American	3	3
Hispanic	2	2
Asian/Native American	1	1
Total	10	10

Table 27. Enrollment plan for 330 mother-child dyads for the actual data collection

Racial Categories	N (mother)	N (child)
White	164	164
Black or African American	116	116
Hispanic	40	40
Asian/Native American	10	10
Total	330	330

Table 28. Enrollment plan for 60 participants for the repeat data collection

Racial Categories	N (mother)
White	24
Black or African American	18
Hispanic	12
Asian/Native American	6
Total	60

Cognitive test procedure and interview guide

Cognitive test for feeding questionnaire

1. Interviewer tells respondent that she will pick 6 items and ask questions about the items.
2. Interviewer reads one of the items on the list to the respondent asks the following questions.
   1) Would you rephrase the sentence in your own words?
   2) Was it hard or easy to pick one answer?
   2-a) How hard was it? or How easy was it?
   3) How sure are you of your answer?

   Additional question for the item#29 and #30:
   (Showing the answer choice for #29 &30), *If the choice was Never-Always as most of other items, would you be easier to answer?*

   Repeat Steps 2 and 3 for all 6 items.
3. Interviewer shows respondent the completed questionnaire, and ask:
   1) Which one was the hardest to pick an answer? Why?
   2) Which one was the easiest to pick an answer? Why?

Cognitive test for food frequency questionnaire

1. Interviewer asks: *Are there any foods your child eats often that were not on the list?*
2. Interviewer tells respondent that she will pick 6 food items and ask questions about the items
3. Interviewer reads one food item on the list to the respondent.
4. Interviewer asks following questions.
   1) How did you figure out how OFTEN your child eats this food?
   2) Was it hard or easy to figure this out?
   2-a) How hard was it? or How easy was it?
   3) How sure are you of your answer?
   4) How did you figure out how MUCH your child eats this food?
   5) Was it hard or easy to figure this out?
   5-a) How hard was it? or How easy was it?
   6) How sure are you of your answer?

   Repeat Steps 3 and 4 for all 6 items.
5. Interviewer shows respondent the completed questionnaire, and ask:
   1) (Pointing at "Ice cream"), When you pick answers for ice cream, did you include popsicles and ice cream novelties?
   2) Which one was the hardest to pick an answer? Why?
   3) Which one was the easiest to pick an answer? Why?

Standard procedure for weight & height measurements

1. Responsibility

- During the study, each anthropometric measurement must be taken at least twice and recorded immediately.
- All height and weight data must be reported in English units feet, inches and pounds and ounces.
- All measurements must be recorded each time, but only the two measurements agreeing as defined below should be entered into the spread sheet.
- Enter the data into the computer file either during or at the end of each day of measurement and have somebody double-check it.

Pre-Assessment Instructions to Participants

- Wear or bring a T-shirt and a pair of shorts.
- Participants will be measured without shoes.

2. Assessment of Weight

Required Item(s) for Weight Assessment

- Digital scale
- Standardized weights for calibration
- Extra t-shirts and shorts available if needed
- Nearby restroom facilities

Protocol

1. Calibrate and zero the scale.
2. Ask participants to **empty their bladder** prior to being weighed.
3. Ask participants to **remove excess clothing, shoes and socks, and empty the pockets** prior to being weighed.
4. Have the participant step up into the middle of the scale platform being sure that both feet are on the scale completely.
5. Have the participant stand completely still with arms at sides while looking straight ahead.
6. Record weight on the data collection sheet.
7. **Repeat measurement**. If > 0.25 lb difference between measurements repeat until two measurements are within 0.25 lb. Record all measurements.

Data entry

Enter two values that are closest into the spread sheet. The equation in the spread sheet will average the two values.

Things to keep in mind

- Calibrate the scale before the first measurement of the day.

- The participants' feet must be entirely on the scale and in the middle of the platform.
- Have the participant facing away from the balance beam or digital readout. This reduces anxiety and the likelihood that the participants will move their hands and body.
- It is important not to comment on the participant's weight and not respond if the participant does makes self-deprecating remarks. (Say "Thank you for helping us with this measurement.")

3. Assessment of Height

Required Item(s) for Height Assessment
- Portable stadiometer
- Calibration rod
- Stool or chair to assist reading the measurement at eye level

Protocol
1. Ask the participant to remove shoes, socks and any hair ornaments that prevent them from being able to place the entire back of their head against the stadiometer.
2. Have the participant step completely under the slide of the stadiometer being sure that the subject is centered with stadiometer.
3. Have the participant stand as straight as possible with feet together and heels, buttock, shoulder blades, and back of head touching the wall completely or as best as possible (see **Things to keep in mind** below).
4. To take the measurement, be sure that the subject is looking straight ahead so that there is a horizontal plane from the lower bony socket of the eye and the notch above the projection of the ear (Frankfurt Plane).
5. Ask the participant to take a deep breath in and hold it to completely straighten the spine (since most people like to be taller, this can be used to encourage compliance with this important instruction).
6. When the subject inhales, let the slide of the stadiometer lightly drop to the top of their head.
7. Fix the slide in place and allow the participant to continue breathing normally.
8. Record height to the nearest foot and 1/16 inch on the data collection sheet. Be sure to avoid *parallax* when reading the measurement (see **Things to keep in mind** below).
9. Repeat the measurement until two measurements are within 1/8 in. Record all measurements on the data collection sheet.

Data entry
Enter the two values that are closest into the spreadsheet. The equation in the spreadsheet will average the two values.

Things to keep in mind

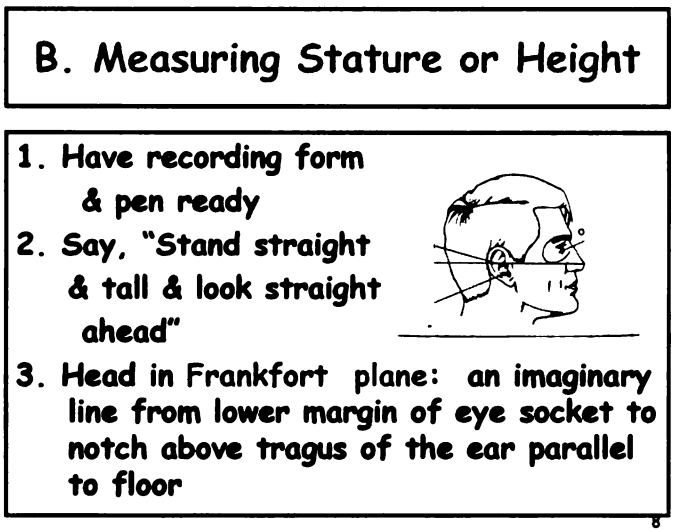


Figure 4. Measuring stature or height.

- The stadiometer has to be located in a non-carpeted area. If it is not, a solid, non-flexible floor board will be needed for participants to stand on.
- For an obese participant, it can be difficult to have four points of contact with the vertical backboard or wall. In this case, it is important to have as many contact points as possible, making sure the subject is looking straight ahead (For example, have the buttocks and shoulders touch to wall).
- To avoid *parallax* when reading a height measurement, you must be at eye level with the person being assessed. Have a step stool or chair near by when taking a height measurement of someone taller. Similarly, be sure to crouch down to the eye level of someone who is shorter than the person taking the reading.

Sample script for assessing children:

First, let's see how much you weigh. Please step in the middle of the scale, and stand still for a few seconds so I can get a reading. That's all. Thank you!

Next, let's see how tall you are. Put your back flat against the wall. We need to be sure your feet, shoulders and head touch the wall.

Phone script – researcher to participant

When researcher call interested mothers to schedule appointments.

1) Introduction

Hello, ____, my name is _____ and I am a Research Assistant at MSU. I am calling you because you had signed up to receive more information about our research study at Head Start. We are now setting up appointments to meet with mothers.

2) Screening

"I just need to ask you a couple of questions to make sure that we can accommodate you for the study.

- *Which school is your child enrolled at?*
- *Are you the primary person that feeds the child?*
- *Has your child been diagnosed with any type of disability?"*

If they say yes, ask:

Is it a speech and language or orthopedic disability?

If they say no, then respond with:

I need to consult with the professor in charge of the study to determine if we can still accommodate you for the study. I will call you back as soon as I know. Thank you for your time.

If they meet the requirements, then say,

It looks like you are eligible for the study. What we are doing today is setting up appointments to meet with you and your child.

3) Data collection and incentive explanation

At this appointment, which takes about 20-30 minutes, you will be filling out two questionnaires, and we are going to measure the height and weight of you and your child. Your information is kept confidential, and when we are done, we provide you with a $25 Gift card to Wal-Mart.

4) Schedule an appointment

This week, we are meeting mothers at Maplehill. Are you able to meet us at Maplehill with your child?

Maplehill is located at 640 Maplehill, which is located near the intersection of S. Cedar/E Cavanaugh

The phone number is: 882-5025

Is there a day that works best for you, keeping in mind that we need to meet with you and your child? We will be at Maplehill on: (look at the schedule)"

Confirm the appointment date, time and location

When you arrive at Maplehill, please check in with the office to find out which room we are meeting mothers in.

If the mother cannot make it to Maplehill,

If you are still interested, then we will call you back when we have appointment dates set up at your child's school.

5) Closing

Do you have any other questions? Thank you for your time.

Phone script – participant to researcher

When you (researcher) receive a phone call from interested mothers,

1) Screening

Thank you SO MUCH for calling! I just need to ask you a couple of questions to make sure that we can accommodate you for the study.

- *Which school is your child enrolled at?*
- *Are you the primary person that feeds the child?*
- *Has your child been diagnosed with any type of disability?*

If they say yes,

Is it a speech and language or orthopedic disability?

If they say no, then respond with:

I need to consult with the professor in charge of the study to determine if we can still accommodate you for the study. I will call you back as soon as I know. Thank you for your time.

2) Data collection and incentive explanation

It looks like we are able to accommodate you for the study. At this appointment, which takes about 20-30 minutes, you will be filling out two questionnaires, and we are going to measure the height and weight of you and your child. Your information is kept confidential, and when we are done, we provide you with a $25 Gift card to Wal-Mart.

3) Schedule an appointment

See "*Phone script – researcher to participant*" on **page 114.**

4) Closing

See "*Phone script – researcher to participant*" on **page 115.**

APPENDIX

2. Instruments and study flier

Parent Questionnaire

Please circle all that apply best to you and your child.

Mother

Age: (_____ yr)

Ethnic Background:
1. White/Caucasian
2. Black/African American
3. Hispanic/Latino
4. Asian
5. Hawaiian or Pacific Islander
6. Native American
7. Mixed Race (_____)

Education:
1. No high shool
2. Completed high school
3. Completed college
4. Advanced degree

Current relationship:
1. Single
2. Married
3. Living together

Current living (all that apply):
1. Alone
2. With parents
3. With partner/spouse
4. With others
5. With children

Are you currently employed?
1. Yes
   Full time · Part-time (circle one)
2. No

Are you currently pregnant?
1. Yes, (_____months)
2. No

Are you currently nursing?
1. Yes, (_____months)
2. No

How often do you go grocery shopping?
1. 1/month
2. 2-3/month
3. 1/week
4. 2-3/week
5. Other (_____)

How do you go grocery shopping?
1. By car
2. By bus
3. Car pool
4. Other (_____)

Are you on Food Stamps or SNAP?
1. Yes
2. No

Are you receiving nutrition education from the Food Stamp program or SNAP-Ed?
1. Yes
2. No

Child

Gender:
1. Boy
2. Girl

Age: (_____ yr_____ mo)

Birth date: (____/____/_____)
day/month/year

Ethnic Background:
1. White/Caucasian
2. Black/African American
3. Hispanic/Latino
4. Asian
5. Hawaiian or Pacific Islander
6. Native American
7. Mixed Race (_____)

Head Start class attendance
Which days last week did he attend the class? (all that apply)
1. Monday
2. Tuesday
3. Wednesday
4. Thursday
5. Friday

What time do you usually
a. deliver him/her?
   (_____am / pm)
b. pick up him/her?
   (_____am / pm)

The next 30 statements describe how you interact with your child during mealtime. Please circle one that applies best to you.

1 I beg my child to eat dinner.	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
2 I spoon-feed my child to get him or her to eat dinner.	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
3 I physically struggle with my child to get him or her to eat (for example, putting my child in the chair so he or she will eat).	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
4 I warn my child that you will take away something other than food if he or she doesn't eat (for example, "If you don't finish your meal, there will be no TV tonight after dinner").	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
5 I promise my child to something other than food if he or she eats (for example, "If you eat your beans, we can play ball after dinner").	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
6 I encourage my child to eat something by using food as a reward (for example, "If you finish your vegetables, I'll get you some ice cream").	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
7 I warn my child that I will take a food away if the child doesn't eat (for example, "If you don't finish your vegetables, you won't get dessert").	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
8 I keep fruits and vegetables available that my child can eat.	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
9 I keep sweets, candy or salty snacks where my child can reach them.	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
10 I keep sugar-sweetened beverages* where my child can reach them. *Drinks like Coke, 7-Up, Sunny Delight, Hawaiian Punch, or aguas frescas (DO NOT include 100% fruit juice and diet soda)	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**

11	I limit my child's access to sweets, candy, salty snacks or sweetened beverages by not having them readily available.	Never	Rarely	Some-times	Most of the time	Always
12	I allow my child to play and watch TV during meals.	Never	Rarely	Some-times	Most of the time	Always
13	We eat dinner together as a family.	Never	Rarely	Some-times	Most of the time	Always
14	I allow my child to eat whenever he/she is hungry during a day.	Never	Rarely	Some-times	Most of the time	Always
15	I allow my child to decide when to eat meals and snacks.	Never	Rarely	Some-times	Most of the time	Always
16	I allow my child to eat an hour before meals.	Never	Rarely	Some-times	Most of the time	Always
17	I set regular meal times for my child.	Never	Rarely	Some-times	Most of the time	Always
18	I have my child sit down at home while eating.	Never	Rarely	Some-times	Most of the time	Always
19	I allow my child to eat while standing or walking.	Never	Rarely	Some-times	Most of the time	Always
20	I say something positive about the food my child is eating during dinner.	Never	Rarely	Some-times	Most of the time	Always
21	I reason with my child to get him or her to eat (for example, "Milk is good for your health because it will make you strong").	Never	Rarely	Some-times	Most of the time	Always

22 I help my child to eat dinner (for example, cutting the food into smaller pieces).	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
23 I compliment the child for eating food (for example, "What a good boy! You're eating your beans").	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
24 I encourage my child to eat by arranging the food to make it more interesting (for example, making smiley faces on the pancakes).	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
25 I ask my child questions about the food during dinner.	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
26 I eat fruits and vegetables in front of my child.	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
27 I drink milk in front of my child.	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
28 I eat sweets, candy or salty snacks in front of my child.	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
29 I drink sweetened beverages in front of my child.	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
30 I worried that my child is overweight right now	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**
31 I am worried that my child will become overweight.	**Never**	**Rarely**	**Some-times**	**Most of the time**	**Always**

Attention Head Start Mothers

Earn $25 gift card

Michigan State University is doing a research project on mealtime interactions of mothers & children. We need your help!

DATE & TIME: by appointment
LOCATION: by appointment
WHO: Head Start mothers & children

What to do

- **Questionnaires (15min)**
- **Height & weight measurements (10min)**

We will offer $25 grocery gift card

How to sign up???

Please

- **Contact Teresa Spitzer at 517-482-1504**
- **Or contact Dr. Sharon Hoerr at**
  - **Phone: 517-355-8474 x156 or x110**
  - **Email: hoerrs@msu.edu**

APPENDIX

3. Findings from instrument feasibility test

The instrument that was used in the study was tested its feasibility of using in the target group. This section includes the findings from the feasibility tests.

Summary of findings

Nine mothers of children 3-5yr participating Lansing area Head Start program. They were recruited by Head Start staff and classroom teachers, and researchers. The respondents included three White, one Black, one Hispanic, one Asian and one Native American. One had no high school degree, six completed high school, one completed college, and one had advanced degree. Six were married and three were single. Age was not asked.

Average time for completing questionnaires was 16.3±6.7 minutes (range 10-30min). One respondent who needed language assistance to complete the questionnaire took 30 minutes. Average time for completing interview was 25.1±9.4 minutes (15-40minutes). The first interview took longest (40min) and the last (ninth) interview was shortest (15minutes). The respondents spend less to complete the 30-item feeding questionnaire compared to the food frequency questionnaire. Most of them did not miss any single item. There was no item that was hardly understood by the respondents. Some mothers directly rephrased the item no matter if she did those practices to her child, and others mentioned what she would do in the situations described in the questionnaire items. Quotes from all interviews were in the **Table 29**.

Table 29. Mothers' responses to the question "Would you rephrase the item in your own words?"

Item	"Quotes from interview" (respondent's race-ethnicity, education)	Note
1. I beg my child to eat dinner.	*"Now, if she gets up and gets down, I'll reiterate to her 'okay, come and sit down and eat. Come and sit'... but I don't I don't after a certain point I just don't ask her anymore."* *(Native American, Married, Some college)* *"... I wouldn't say force them to, but just like do anything to make them eat"* *(Black, Married, Completed college)*	
2. I spoon-feed my child to get him or her to eat dinner.	*"That's like a forceful way...."I don't force her to eat if she don't wanna eat"* *(Native American, Married, Some college)* *"I think it looks the same like this one (pointing to 'I help my child to eat dinner) because you use like spoon-feed the child'"* *(Black, Married, Completed college)*	
3. I physically struggle with my child to get him or her to eat	*"Does your kid constantly get up and move around or want to go play while they're eating? We have to constantly say, 'Okay, we can talk after you get done eating but you have to eat right now'"* *(Mixed race, Married, Completed high school)* *"Meaning was it difficult with me to feed my child or force her to eat?"* *"I force her to sit down and it gives me the impression that ... the child has .... An answer on the face, and then you're trying to get her to say yes. .... Maybe she doesn't like the food that's' in front of her and you're forcing her with the option." (Asian, Married, Advances degree)*	
4. I warn my child that you will take away something other than food if he or she doesn't eat.	*"You are punishing them if they don't finish their food."* *(Mixed race, Married, Completed high school)* *"I'll deprive you of something if you don't listen to me. You cannot get to watch the next TV program if you don't finish your lunch or that she's going to be late to go and play."* *(Asian, Married, Advances degree)*	
5. I promise my child to something other than food if he or she eats.	*"I promise you will get some ice cream if you eat your sandwich?"* *(White, Married, Some college)* *"If you do this I well let you watch 30 more minutes of TV"* *(White & Black, single, some college)*	

Table 29 continued. Mothers' responses to the question "Would you rephrase the item in your own words?"

6. I encourage my child to eat something by using food as a reward.	*"I offer a piece of candy for eating a banana."* *(White, Married, Some college)* *"If you finish your green beans then I'll give you a scoop of ice cream." (White & Black, single, some college)*	
7. I warn my child that I will take a food away if the child doesn't eat.	*"If you don't eat the food, you're not getting any ice cream, candy or junk food."* *(White, Single, Some high school)* *"He has to finish his food, his vegetables, so that afterwards he may eat ice cream or a piece of cake. It is more important that he eat his vegetables and than afterwards he can eat ice cream."* *(Hispanic, Single, Completed high school)*	
8. I keep fruits and vegetables available that my child can eat.	*"There's carrots and cantaloupe in the refrigerator for my kids to eat all the time..... .....I get food assistance, so at the beginning of the month it's easy for me to answer..... but then towards the end of the month when my food stamps run out then it's more difficult."* *(White, Single, Some high school)* *"at his reach so that he can get them whenever he wants. I have in the refrigerator, at his reach, carrots, or grapes, or bananas that he can get."* *(Hispanic, Single, Completed high school)*	Food availability depends on how much left in the food stamp. May need additional questions on grocery shopping.
9. I keep sweets, candy or salty snacks where my child can reach them.	*"I think, like right on the countertop, within little hands reach. But if it was her"* *(White, Married, Some college)*	
10. I keep sweetened beverages where my child can reach them.	*"It just doesn't specify but what sweetened drinks..... I keep juice, but it's 100% juice.....To me those are sweet, but it's 100% juice."* *(White, Married, Some college)*	*Sweetened beverages were not clear to her.*
11. I limit my child's access to sweets, candy, salty snacks or sweetened beverages by not having them readily available.	*"Not having readily available is not access to it on a level where she can reach it and not having it in the house. She's allowed juice and she's allowed Kool-Aid with natural sugar and she's allowed milk. Um, we don't buy candy, um, just now and then as a treat."* *(Native American, Married, Some college)* *"When you, you don't want your child eating like candy so you don't like buy any, don't buy much at home or have it around eating"* *(Black, Married, Completed college)*	

Table 29 continued. Mothers' responses to the question "Would you rephrase the item in your own words?"

12. I allow my child to play and watch TV during meals.	*"It's almost time for dinner, you know, you need to shut the TV off."* *(Native American, Married, Some college)* *"While they are eating you put the television on."* *(Black, Married, Completed college)*	
13. We eat dinner together as a family.	*"To me it consists of everybody that's in the house. So for me, it would be my husband, my daughter and myself."* *(Mixed race, Married, Completed high school)* *"Do you sit together at the table? Are you having the TV off? Do you have a quiet time? And maybe talking about some nice things, maybe like what happened during school."* *(Asian, Married, Advances degree)*	
14. If my child doesn't like a food served, I make him/her wait until the next meal or snack to eat.	*"It means telling your kid that if they don't like what they eat, they can't have anything else until the next meal."* *(Mixed race, Married, Completed high school)* *"Basically depriving the child of food. If you cook something and then the child doesn't like it, I don't give her options and then just keep her waiting for a snack.....I don't see why a child should be made to wait for food. I just didn't see that's a possibility at all."* *(Asian, Married, Advances degree)**	*She did understand the meaning of the question, but she didn't understand why anyone does this.
15. I allow my child to eat an hour before meals.	*"I allow my child to eat a snack before a meal." (White, Married, Some college)* *"no I don't know that." (White & Black, single, some college)*	
16. I set regular meal times for my child.	*"I have my child; my child eats at eight o'clock for breakfast and twelve o'clock for lunch and five o'clock for dinner.* *(White, Married, Some college)* *"Today we are having dinner at six." (White & Black, single, some college)**	*What she mentioned sounds like irregular meal habit, because she is at work all the time and can't have regular mealtime
17. I have my child sit down at home while eating.	*"If I can get him to eat something, I don't care if he takes the peanut butter and jelly sandwich and runs through the house, as long as it gets in his stomach, I don't care."* *(White, Single, Some high school)* *"the only hour that I can share with them is when we sit down to eat"* *(Hispanic, Single, Completed high school)*	

Table 29 continued. Mothers' responses to the question "Would you rephrase the item in your own words?"

18. I allow my child to eat while standing or walking.	*"Ken's running around while he's eating."* *(White, Single, Some high school)* *"He has to sit down to eat with me, or sit down to eat something"* *(Hispanic, Single, Completed high school)*	She said that child runs around while eating, but she didn't say what she does to that behavior.
19. I say something positive about the food my child is eating during dinner.	*"what I think it means is do you tell your child, how I feel is my mom didn't like something, she'd flat out tell us.....So, kind of just makes her think positively about all the food that I put in front of her."* *(White, Married, Some college)*	
20. I reason with my child to get him or her to eat.	*"This one was kind of confusing for me...."I'm more trying to convince them of eating it or drinking..... I always tell them that everything, if you try, from every food group at every meal"* *(White, Married, Some college)*	It was confusing to her probably because she rather "convinces" than "reasons".
21. I help my child to eat dinner (for example, cutting the food into smaller pieces).	*"I try to encourage independence and have her cut up her own food and then if she asks for help then I help her." "I try to foster as much independence for her."* *(Native American, Married, Some college)* *"I try to feed my child from a spoon...I try to help feed them."* *(Black, Married, Completed college)*	
22. I compliment the child for eating food (for example, "What a good boy! You're eating your beans").	*"I say, 'you're chewing very well with you're manners', 'I like the way you're chewing with your mouth closed.' 'I like how you're using your napkin,' un, 'I'm proud of you because your are you know, you're listening is on.' That type of thing".* *(Native American, Married, Some college)* *"You try to praise them to help them eat".* *(Black, Married, Completed college)*	
23. I encourage my child to eat by arranging the food to make it more interesting.	*"She likes to make a Mickey Mouse face." "We (she and her daughter) make the food fun."* *(Mixed race, Married, Completed high school)** *"If I'm using, say ketchup, liquid or salad dressing. I try to make a funny face on the triangle that I cut out, like a smiley face. Or I think I cut up carrots and then arrange them in basically something that's interesting for her to eat" (Asian, Married, Advances degree)*	*She got "arranging" but didn't care if she "encourage". Maybe we can change this item to "I arrange the food to make it more interesting"

Table 29 continued. Mothers' responses to the question "Would you rephrase the item in your own words?"

24. I ask my child questions about the food during dinner.	*"Do you ask if they like it, or if it's something they would like to have again? Just have a conversation about the food."* *(Mixed race, Married, Completed high school)* *"She asks questions and we do talk about how healthy the food is....I always keep telling her that if she ate that kind of food then she would have the energy, she would get strong bones."* *(Asian, Married, Advances degree)**	*She mentioned about her child asking questions to her, and herself answering and explaining about her questions.
25. I eat fruits and vegetables in front of my child.	*"I eat apples and bananas in front of my child."* *(White, Married, Some college)* *"Aniya, I'm eating an apple, would you like some?"* *(White & Black, single, some college)*	
26. I drink milk in front of my child.	*"I drink a cup of milk in front of my child."* *(White, Married, Some college)* *"Aniya, I am having a glass of milk, would you like one."* *(White & Black, single, some college)*	
27. I eat sweets, candy or salty snacks in front of my child.	*"I eat junk food in front of my kids."* *(White, Single, Some high school)* *"I am giving him an example if he sees me drinking soda, then he wants to drink soda...so whatever I eat, he wants to eat.."* *(Hispanic, Single, Completed high school)*	
28. I drink sweetened beverages in front of my child.	*"I drink juice in front of my kids, but that would be a sweetened beverage for me." (White, Single, Some high school)* *"if I keep drinking juice in front of him..... ...."* *(Hispanic, Single, Completed high school)*	Sweetened juice need to be clear to the respondents.

APPENDIX

4. Visual aid for the Food Frequency Questionnaire

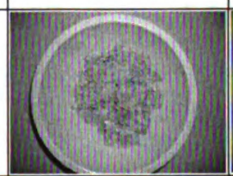
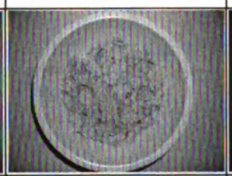
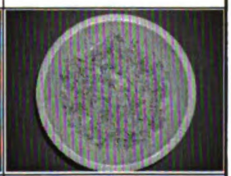
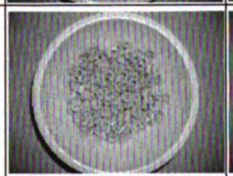
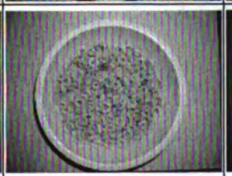
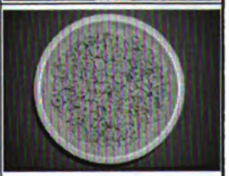
Block Kids Food Screener
Portion size visual aid

Parent Feeding Study 2009

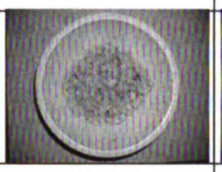
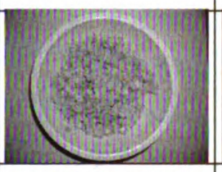
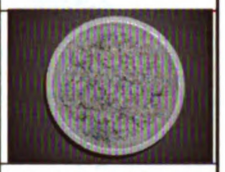
Dissertation research
Megumi Murashima
Michigan State University

Cereal

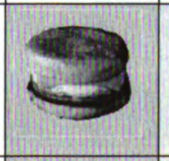
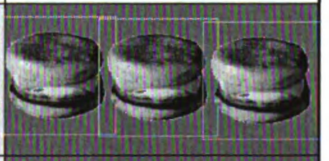
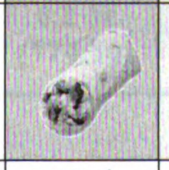
corn flakes, Frosted Flakes

	1 bowl	2 bowls	3 bowls
Kellogg's Frosted Flakes			
Plain Cheerios			
Weight	0.8 oz (21.3g)	1.5 oz (42.5g)	2.3 oz (63.8g)

Cooked cereal
oatmeal, rice

	A little	Some	A lot
Cooked oatmeal			
Weight	0.8 oz (21.3g)	1.5 oz (42.5g)	2.3 oz (63.8g)

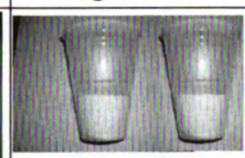
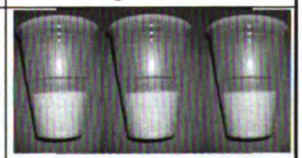
Eggs
in breakfast sandwiches or breakfast burritos

	1 egg	2 eggs	3 eggs
Egg muffin sandwich			
Breakfast burritos			
Weight	0.8 oz (21.3g)	1.5 oz (42.5g)	2.3 oz (63.8g)

Breakfast bars, granola bars, Protein bars

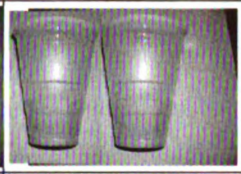
	1/2 bar	1 bar	2 bar
Cooked oatmeal			
Weight	0.6 oz (17.0g)	1.2 oz (34.0g)	1.8 oz (51.0g)

Glasses of milk

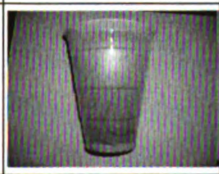
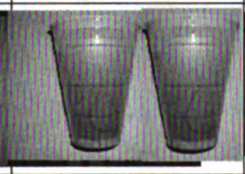
	1 glass	2 glasses	3 glasses
Milk			
Weight	6.2 oz (174.3g)	12.3 oz (348.7g)	18.5 oz (523.0g)

Real fruit juice

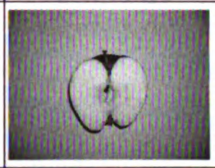
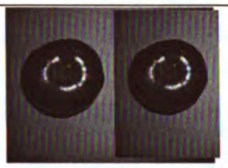
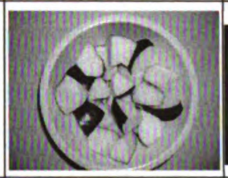
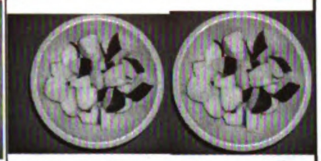
orange juice, apple juice, or licuados (Mexican juice)

	1 glass	2 glasses	3 glasses
Juice (in a cup)			
Juice (pack)			
Weight	4.2 oz (117.7 g)	8.3 oz (235.3 g)	12.5 oz (353.0 g)

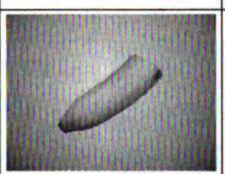
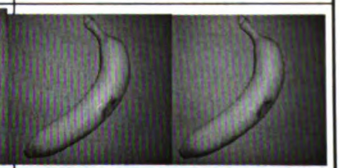
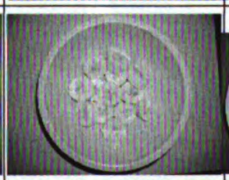
Drinks like Coke, or 7-Up, Sunny Delight, Hawaiian Punch, or aguas frescas

	1 bottle	2 bottles	3 bottles
Sugar sweetened beverage			
Weight	8.3 oz (235.5g)	16.6 oz (470.6g)	24.9 oz (705.9g)

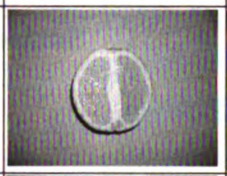
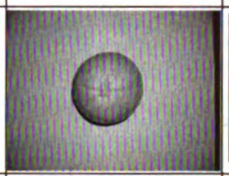
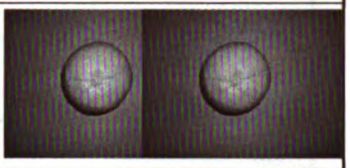
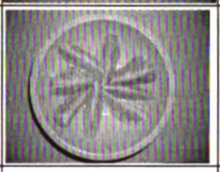
Apples, bananas or oranges

	1/2 apple	1 apple	2 apples
Apple (whole)			
Apple (cut)			
Weight	2.0 oz (56.7g)	4.0 oz (113.4g)	6.0 oz (170.1g)

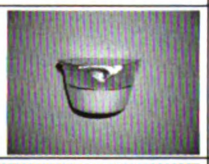
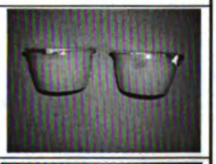
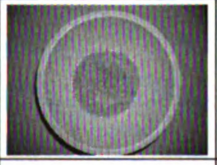
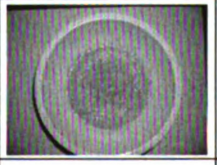
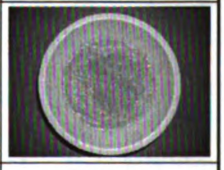
Apples, bananas or oranges

	1/2 banana	1 banana	2 bananas
Banana (whole)			
Banana (cut)			
Weight	2.0 oz (56.7g)	4.0 oz (113.4g)	6.0 oz (170.1g)

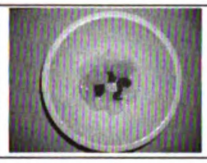
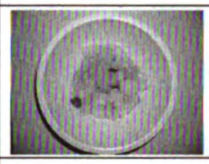
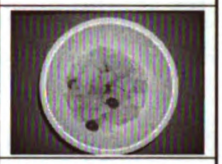
Apples, bananas or oranges

	½ orange	1 orange	2 oranges
Orange (whole)			
Orange (cut)			
Weight	2.0 oz (56.7g)	4.0 oz (113.4g)	6.0 oz (170.1g)

Applesauce, fruit cocktail

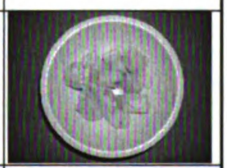
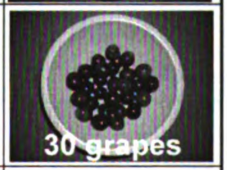
	A little	Some	A lot
Applesauce (in package)			
Applesauce (in bowl)			
Weight	2.1 oz (58.1g)	4.1 oz (116.2g)	6.2 oz (174.2g)

Applesauce, fruit cocktail

	A little	Some	A lot
Fruit cocktail			
Weight	2.1 oz (58.1g)	4.1 oz (116.2g)	6.2 oz (174.2g)

Fruits

other than apples, bananas, or oranges, like strawberries, grapes

	A little	Some	A lot
Pineapples			
Grapes			
Weight	1.7 oz (48.2g)	3.4 oz (96.4g)	5.1 oz (144.6g)

French fries, tater tots, hash browns, Fried potatoes

	A little	Some	A lot
French fries			
Weight	1.2 oz (32.6g)	2.3 oz (65.2g)	3.5 oz (97.8g)

Potatoes

other than French fries, tater tots, hash browns, Fried potatoes, like mashed or boiled

	A little	Some	A lot
Boiled potatoes			
Weight	1.8 oz (49.6g)	3.5 oz (99.2g)	5.3 oz (148.8g)

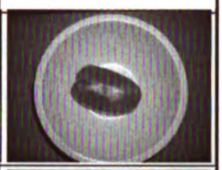
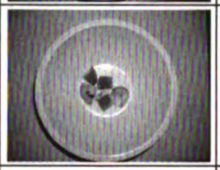
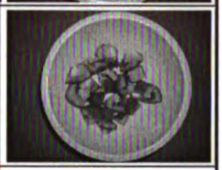
Ketchup or salsa

	A little	Some	A lot
Ketchup			
Salsa			
Weight	1/2 Tbsp 0.3 oz (7.1g)	1 Tbsp 0.5 oz (14.2g)	1.5 Tbsp 0.8 oz (21.3g)

Lettuce salad

	A little	Some	A lot
Lettuce salad			
Weight	1.2 oz (32.6g)	2.3 oz (65.2g)	3.5 oz (97.8g)

Tomatoes, including on salad

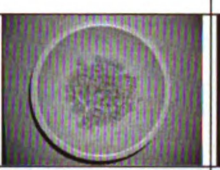
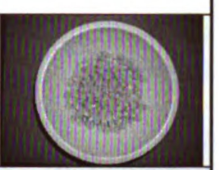
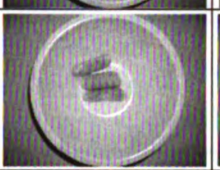
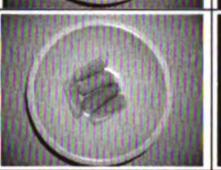
	1/4 tomato	½ tomato	1 tomato
Tomato (whole)			
Tomate (cut)			
Weight	0.7 oz (18.4 g)	1.3 oz (36.9 g)	2.6 oz (74.8 g)

Green beans or peas

	A little	Some	A lot
Green beans			
Weight	1.2 oz (32.6g)	2.3 oz (65.2g)	3.5 oz (97.8g)

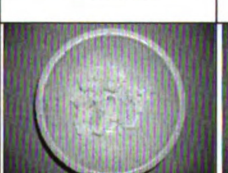
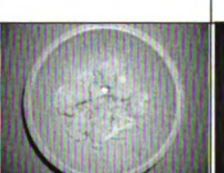
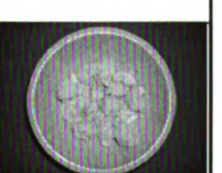
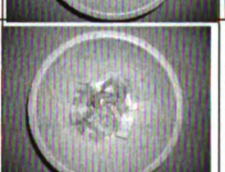
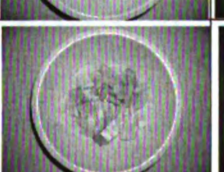
Vegetables

other than lettuce, tomatoes, green beans and peas

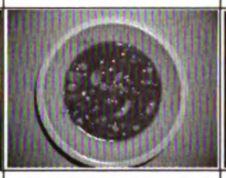
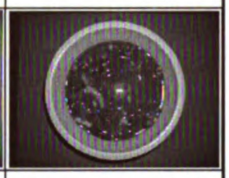
	A little	Some	A lot
Corns			
Carrots			
Weight	1.0 oz (26.9 g)	1.9 oz (53.9 g)	2.9 oz (80.8 g)

Vegetables

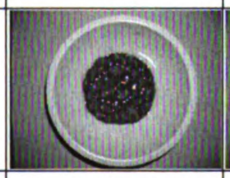
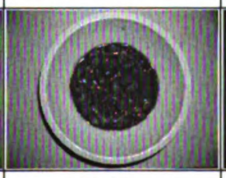
other than lettuce, tomatoes, green beans and peas

	A little	Some	A lot
Cauliflower			
Celery			
Weight	1.0 oz (26.9 g)	1.9 oz (53.9 g)	2.9 oz (80.8 g)

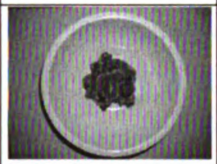
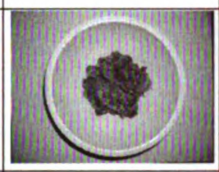
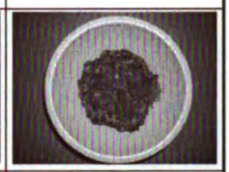
Vegetable soup, tomato soup, any soup or stew with vegetables in it

	A little	Some	A lot
Vegetable soup (canned)			
Weight	¼ can 3.2 oz (89.3g)	½ can 6.3 oz (178.6g)	1 can 9.5 oz (267.9g)

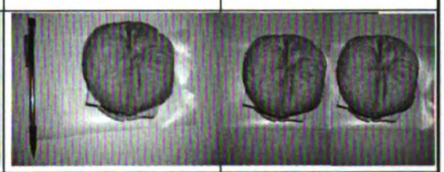
Chili beans, pinto beans, black beans, including in burritos

	A little	Some	A lot
Chili beans			
Weight	2.2oz (61.0g)	4.3oz (121.9g)	6.5oz (182.9g)

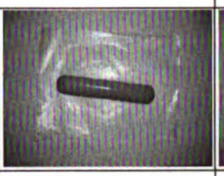
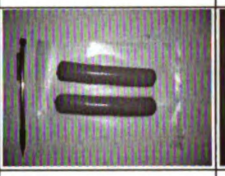
Refried beans

	A little	Some	A lot
Refried beans			
Weight	1.1oz (29.8g)	2.1oz (59.5g)	3.2oz (89.3g)

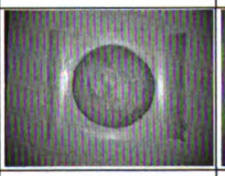
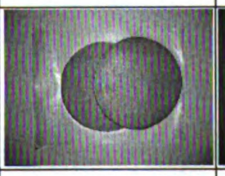
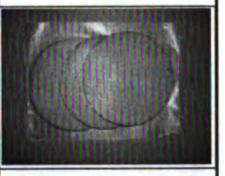
Hamburgers, cheeseburgers

	A little	Some	A lot
Cheese burger			
Weight	1.9 oz (52.4 g)	3.7 oz (104.9 g)	5.6 oz (157.3 g)

Hot dogs, corn dogs, or sausage

	1 hot dog	2 hot dog	3 hot dog
Hot dogs			
Weight	1.9oz (53.9g)	3.8oz (1.7.7g)	5.7oz (161.6g)

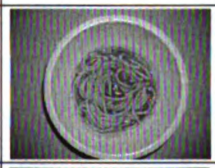
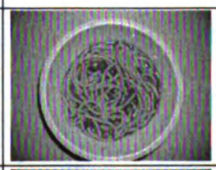
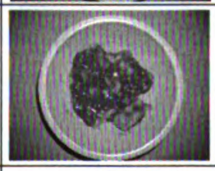
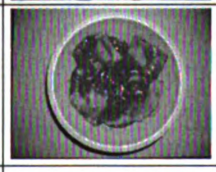
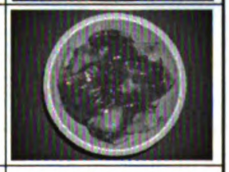
Lunch meat
boloney, ham, Lunchables

	1 slice	2 slices	3 slices
Boloney ham			
Weight	1.0oz (26.9g)	1.9oz (53.9g)	2.9oz (80.8g)

Pizza or pizza pockets

	A little	Some	A lot
Pizza rolls			
Weight	3 pieces 1.7 oz (48.2g)	6 pieces 3.4 oz (96.4g)	9 pieces 5.1 oz (144.6g)

Spaghetti or ravioli with tomato sauce

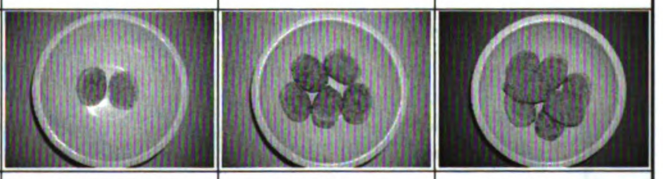
	A little	Some	A lot
Spaghetti			
Ravioli			
Weight	4.7 oz (133.2g)	9.4 oz (266.5g)	14.1 oz (399.7g)

Macaroni and cheese

	A little	Some	A lot
Macaroni and cheese			
Weight	3.2oz (90.7g)	6.4oz (181.4g)	9.6oz (272.2g)

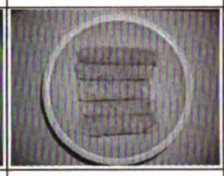
Chicken

including nuggets, wings, tenders, in sandwiches or stew

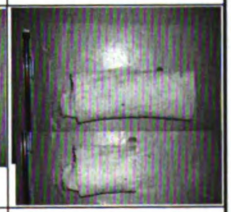
	A little	Some	A lot
Chicken nuggets			
Weight	2 pieces 1.4 oz (38.3 g)	5 pieces 2.7 oz (76.5 g)	7 pieces 4.1 oz (114.8 g)

Fish

fish sticks or sandwiches, tuna, shrimp

	A little	Some	A lot
Fish sticks			
Weight	2.5 pieces 1.5 oz (41.1g)	5 pieces 2.9 oz (82.2g)	7.5 pieces 4.4 oz (123.3g)

Burritos or tacos

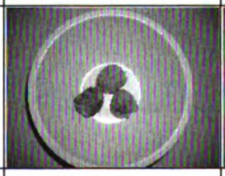
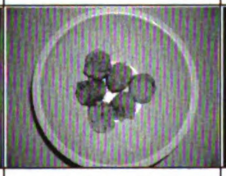
	A little	Some	A lot
Brritos			
Weight	½ burritos 2.4 oz (68.0g)	1 burritos 4.8oz (136.1g)	1.5 burritos 7.2 oz (204.1g)

Beef

roast, steak or in sandwiches

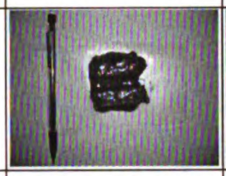
	A little	Some	A lot
Beef steak			
Weight	3 pieces 1.2 oz (32.6 g)	6 pieces 2.3 oz (65.2 g)	9 pieces 3.5 oz (97.8 g)

Meat balls, meat loaf, beef stew, Hamburger Helper

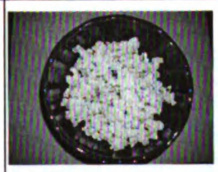
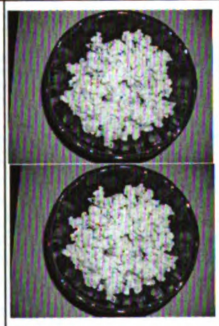
	A little	Some	A lot
Meat balls			
Weight	3 pieces 1.5 oz (41.1g)	6 pieces 2.9 oz (82.2g)	9 pieces 4.4 oz (123.3g)

Pork

chops, roast, ribs

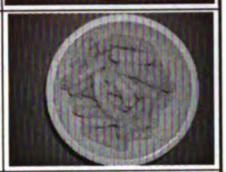
	A little	Some	A lot
Ribs			
Weight	1.1 oz (31.2 g)	2.2 oz (62.4 g)	3.3 oz (93.6 g)

Popcorn

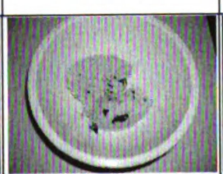
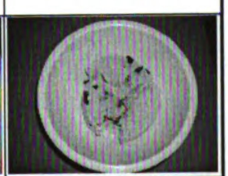
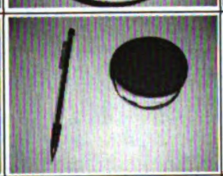
	A little	Some	A lot
Popcorn	 1 bowl	 2 bowls	 3 bowls
Weight	0.4oz (9.9g)	0.7oz (19.8g)	1.1oz (29.8g)

Snack chips

potato chips, Doritos, Fritos, tortilla chips

	A few	Small bag	Large bag
Potato chips			
Cheese puffs			
Weight	0.5 oz (12.8g)	0.9 oz (25.5g)	1.4 oz (38.3g)

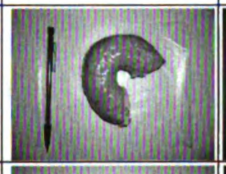
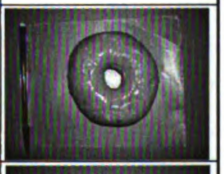
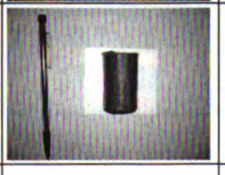
Ice cream

	1 scoop	2 scoops	3 scoops
Ice cream			
Ice cream sandwich			
Weight	1.7oz (48.2g)	3.4oz (96.4g)	5.1oz (144.6g)

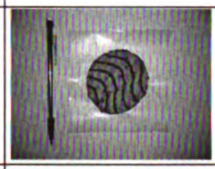
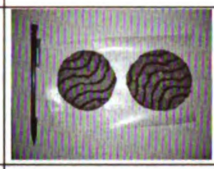
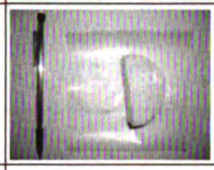
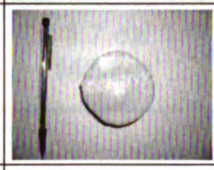
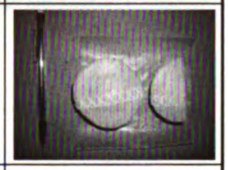
Candy, candy bars

	A little	Some	A lot
Mint candies			
Peanut butter cups			
Weight	0.4 oz (9.9 g)	0.7 oz (19.8 g)	1.1 oz (29.8 g)

Cookies, donuts, cakes like Ho-Hos

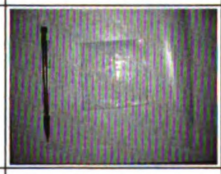
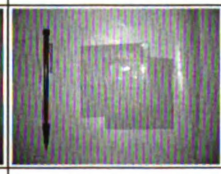
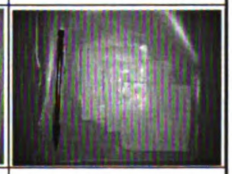
	A little	Some	A lot
Donut			
Little Debbie's Swiss cake rolls			
Weight	0.8oz (21.3g)	1.5oz (42.5g)	2.3oz (63.8g)

Cookies, donuts, cakes like Ho-Hos

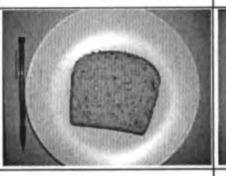
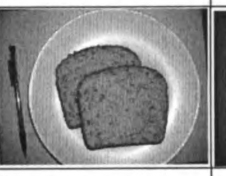
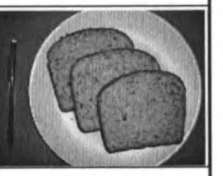
	A little	Some	A lot
Cookies			
Celery			
Weight	0.8oz (21.3g)	1.5oz (42.5g)	2.3oz (63.8g)

Cheese

in sandwiches or nachos with cheese or quesadillas

	1 slice	2 slices	3 slices
Cheese			
Weight	0.7 oz (19.8g)	1.4 oz (39.7g)	2.1 oz (59.5g)

Whole wheat bread or rolls (not white bread)

	1 slice	2 slices	3 slices
Whole wheat bread			
Weight	0.9 oz (24.1g)	1.7 oz (48.2g)	2.6oz (72.3g)

APPENDIX

5. Glossary

Child feeding: Practices which parents use to provide foods to their children. "Control" is a concept well studied in the research in child feeding. Food restriction, pressure to eat and food monitoring are practices that represent parental control of child feeding and have been widely used by researchers (Birch et al., 2001). This dissertation expands the concept and defines "control" in child feeding situations as practices that parents perform for the child to achieve a desired goal, specifically a healthy diet of eating recommended amounts of nutrient-dense and energy-dense foods. Three different types of control--directive control, non-directive control, and food environmental control--were proposed.

Diet quality: Generally diet quality refers to the character of the overall diet or dietary patterns as compared to some recommended criteria for food health with respect to an individual's age, gender and reproductive status (Kant, 1996). A diet with high diet quality consists of food, nutrients and eating behaviors that are recommended to optimize health and to prevent chronic diseases. However, a specific definition of diet quality depends on attributes selected by the investigator. This dissertation uses frequency and amount of selected nutrient-dense foods and energy-foods intakes to help evaluate the quality of the diet.

Dietary assessment: The process of obtaining information on the dietary intake of an individual or a group. The methods commonly used include a 24-hr food recall, food records and food frequency questionnaires (National Cancer Institute).

Directive control: This dissertation defines "directive control" as the visible and overt practices parents use to put external pressure on the child to eat a healthy diet. Pressure to eat, food rewards and punishments and food restriction are the examples of directive control practices.

Energy-dense food: Food and beverages with relatively high energy density, where energy density is the amount of available dietary energy per unit weight of a food or beverage (kcal/g or kJ/g). This dissertation operationalizes foods that contain ≥35% of the calories from fat and ≥20% of the calories from sugar, and that are commonly eaten by young children as energy-dense foods (i.e. sweets, high-fat meats, cheese, snack chips, sweetened beverages, etc) (US Department of Health and Human Services and US Department of Agriculture, 2005).

Feeding practice: A specific behavioral strategy employed by parents to control what, how much or when their children eat including behaviors such as pressuring children to eat, using food as a reward, restricting access to select foods or groups of foods, food modeling or use of food to pacify or control (Ventura and Birch, 2008).

Food environmental control: Practices where parents provide a healthy and organized home food environment and family rules around eating to help the child eat a healthy diet. This dissertation proposed that making food available at home, setting rules on mealtime behaviors and setting regular mealtimes are the examples of food environmental control practices.

Food Frequency Questionnaire: An instrument that assesses frequency and sometimes portion size of an individual's food intake over a defined period of time. The food items should be those that are commonly consumed by the target population.

Food-based approach: A method to evaluate dietary intake and diet quality of individuals or groups by using the amount or frequency of food as food groups consumed, as opposed to nutrients, as the indicator. The Healthy Eating Index is based, in part, on a food based approach.

Head Start: A national federally funded school readiness program for children 3-5 years old (National Head Start Association, 2010). The program provides comprehensive education, health, nutrition and parental involvement services to the children and their families. Head Start is required to provide full services to children with disabilities (10% total enrollment). See "Low income" for Head Start eligibility.

Low income (see also Poverty Threshold and Poverty guidelines): Household with income less than twice the federal poverty threshold (Churilla, 2008). This dissertation refers to Head Start eligible families (poverty guideline or threshold less than 130% gross) as low income. It should be noted that up to 10% of the enrollment can be families with higher income levels, if the child has a disability.

Non-directive control: This dissertation defines "non-directive control" as the practices where parents interact with the child to motivate him or her to eat a healthy diet by internalizing the goal. Examples include praise, encouragement, complimenting and modeling to motivate children to eat nutritious diet.

Nutrient-based approach: A method to evaluate the dietary intake of individuals or groups using an amount or frequency of nutrients consumed as the indicator of dietary intake and quality. Dietary Reference Intakes are often used as the reference values for each nutrient for the participant's age and gender (Institute of Medicine and Food and Nutrition Board, 2002a).

Nutrient-dense food: Food and beverages that contain substantial amounts of vitamins and minerals with relatively few calories as defined by the US Dietary Guidelines 2005 and MyPyramid (US Department of Agriculture and Center for Nutrition Policy and Planning, 2009; US Department of Health and Human Services and US Department of

Agriculture, 2005). This dissertation includes fruits, 100% fruit juice up to 6 fl oz/day, vegetables and milk as nutrient-dense foods. The Dietary Guidelines recommend low-fat milk, but this dissertation included milk with any fat contents because most children in the sample did not consume low-fat milk.

Obesity (2-19yr): A BMI-for-age percentile at or above the 95th percentile for children of the same age and sex on the CDC growth charts (Kuczmarski et al., 2002).

Overweight (2-19yr): A BMI-for-age percentile at or above the 85th percentile and lower than the 95th percentile for children of the same age and sex on the CDC growth chart (Kuczmarski et al., 2002).

Poverty guidelines: Federal poverty measure issued by the Department of Human Health and Services for administrative purposes (determining financial eligibility for certain programs) based on the poverty threshold. For example for family of four, to be eligible to participate in Head Start the family's income must be less than $22,050/year in 2009-2010 (http://aspe.hhs.gov/poverty/faq.shtml#differences).

Poverty threshold: A federal poverty measure issued by the Census Bureau for statistical purposes (counting number of people in poverty) (www.census.gov).

SoFAAS: Abbreviation for Solid Fat, Alcohol, and Added Sugar. Dietary Guidelines for Americans 2005 and MyPyramid recommend that calories consumed from SoFAAS should be limited to 8-20% of total calories, depending on one's age, gender and activity level (US Department of Agriculture and Center for Nutrition Policy and Planning; US Department of Health and Human Services and US Department of Agriculture, 2005).

Structural Equation Modeling: A statistical technique for testing and estimating causal relations using a combination of statistical data and quantitative assumptions.

Confirmatory factor analysis used in this dissertation are subsets of statistical methods under structure equation modeling.

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