GIVING CHILDREN A VOICE:
A NOVEL APPROACH TO REVEAL PRESCHOOL-AGE CHILDREN'S CONCEPTS RELATED TO FOOD AND THE ORGANIZATION OF THESE CONCEPTS

By

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DEDICATION

To the Children

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ABSTRACT

Childhood obesity affects nearly one in ten preschool-age children placing them at risk for adverse health consequences. Obesity is often attributed to behaviors of eating either a large quantity of food and/or energy dense, non-nutritious foods. Behavior, itself, is thought to be underpinned and motivated by beliefs/tacit knowledge. As such, what preschool-age children know about eating may partly be explained by their personal beliefs or their concepts about food. However, little is known about preschool-age children's personal concepts related to food or the organization of these concepts, particularly among those who are obese and those who are of healthy weight.

This dissertation represents a portion of a larger study exploring preschool-age children's beliefs about eating. Given this, this three manuscript dissertation presents: (1) a synthesis of the literature regarding children's knowledge of eating and nutrition, (2) results from the free lists and card sorts used to elicit preschool-age children's responses that revealed their concepts related to food and the organization of these concepts with those who are obese and those who are of healthy weight, and (3) an evaluation of the feasibility of using free lists and card sorts used with preschool-age children, and the dependability and confirmability of these methodologies and the data that they elicit.

CHAPTER I

Introduction

Childhood obesity has tripled over the past 40 years affecting nearly one in every ten preschool children (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010) placing them at risk for short- and long-term health consequences (Zappalla, 2010). While many factors have been identified as significant contributors, obesity is often attributed to behaviors associated with eating either a large quantity of food and/or calorically-dense, nutrient-poor foods (Blass, 2008). Behavior, itself, is thought to be underpinned and motivated by what an individual believes/tacitly knows to be true, i.e., their beliefs (Bartsch & Wellman, 1995). In other words, what children believe/tacitly know about food will in part direct and explain their eating behavior.

Researchers investigating children's knowledge about eating have primarily focused their attention on single concepts or factual knowledge of food, nutrition, the body, or health rather than examining the phenomenon of eating from a holistic perspective. Moreover, a majority of these studies have not included children less than six years old as primary informants when investigating childhood obesity, or children from minority populations or low socio-economic status groups. In addition, many of these studies have not presented the number of children who were obese or those who were of healthy weight. Lastly, ethnographic methods have not been utilized in any of these studies to elicit preschool-age children's responses to reveal their concepts related to food or the organization of these concepts that guide everyday eating behavior.

Statement of the Problem

As a result, little is known about preschool-age children's concepts related to food or the organization of these concepts, especially, the concepts of those who are obese and those who are of healthy weight. This lack of knowledge is not only due to the lack of inclusion of preschool-age children as primary informants in research, but also to the lack of methodological approaches that are best suited to elicit preschool-age children's responses for data collection.

Using ethnographic methods is a novel approach to elicit preschool-age children's responses to reveal their concepts related to food and the organization of these concepts that arise from personal experience; which in turn, may motivate their eating behavior. This information is critical since eating behaviors are thought to be established by four to six years of age (Blass, 2008). Moreover, preschool-age children who are obese at this age are likely to become obese in adulthood (Tucker, Irwin, He, Bouch, & Pollett, 2006).

In the end, eliciting responses from preschool-age children who are obese and those who are of healthy weight will help reveal the similarities, differences, and patterns in their concepts related to food and the organization of these concepts that underpin and direct their eating behaviors, which lead to obesity. In addition, knowledge gained from the evaluation of free lists and card sorts furthers the identification and development of an efficient methodology used for collecting data with preschool-age children. In turn, this knowledge will be utilized to develop future research to elicit preschool-age children's responses to reveal their concepts related to food and the organization of these concepts across cultures. Lastly, findings from this mixed-methods study will not only advance the science regarding methods used to elicit responses with preschool-age children, but will also create new possibilities in developing interventions that empower preschool-age children to eat healthy foods and assist parents with their child's eating behaviors during this critical cognitive period to prevent and reduce the incidence of obesity.

Theoretical Framework

Three theories were triangulated to create the theoretical framework that guided this dissertation. The theory of mind posits that children like adults organize their beliefs to interpret, explain, and predict human behavior (Bartsch & Wellman, 1989, 1995; Wellman & Bartsch, 1988). This conceptual framework, in turn, directs behavior (Bartsch & Wellman, 1989; Wellman & Bartsch, 1988) (see Figure A.1). To clarify, beliefs are concepts constructed by individuals in reference to meaning assigned to sensory-motor experiences (perceptions) that are regarded as being true (Bar-Tal, 2000; Bartsch & Wellman, 1995). These concepts are thought to represent what people *think* and have come to *know* through personal experience; in other words, **tacit knowledge** (Ajzen & Fishbein, 1973; Bartsch & Wellman, 1995; Fishbein & Ajzen, 1975). Tacit knowledge differs from **declarative knowledge** in that the latter is the acquisition of facts obtained during formal education (Dickson-Spillman & Siegrist, 2011; Mandler, 1983; Worsley, 2002).

Moreover, beliefs/tacit knowledge, are posited as being integral to reasoning, intentions, and behavior (action) (Malle, 2001; Malle & Knobe, 2001; Malle, Moses, & Baldwin, 2001; Mele, 2001). They serve as a mental foundation from which judgments, conclusions, and decisions are made (Malle & Knobe, 2001; Malle et al., 2001). Unlike beliefs/tacit knowledge, intentions are defined as "mental states directed toward a goal or about an object" (Wellman & Phillips, 2001, p. 127). However, it has been hypothesized that when intentions are consistently linked to beliefs/tacit knowledge, behavior is directed (Malle, 2001; Malle & Knobe, 2001).

Some scholars have also suggested that beliefs/tacit knowledge create one's reality (Pearce & Cronen, 1980; Solos, 2005). These scholars have proposed that what an individual tacitly knows and what they believe others' believe define their social boundaries and become their social reality (Pearce & Cronen, 1980). Given this, beliefs/tacit knowledge not only serve as the mental reality (foundation) from which reasoning occurs and behavior may be motivated (Bartsch & Wellman, 1989, 1996; Fazio, 1986), but also a social reality that may influence their personal behavior (Pearce & Cronen, 1980; Solos, 2005).

Like the theory of mind, the theory of naïve biology proposes that young children construct a simple conceptual framework to explain biological phenomena (Hatano & Inagaki, 1994, 1997; Inagaki, 1990; Inagaki & Hatano, 2004, 2006; Wellman & Gelman, 1992; Wellman & Inagaki, 1997). Results from studies testing this theory have shown that young children are able to distinguish living from non-living kinds (Gelman & Kremer, 1991; Inagaki & Hatano, 1987; Rosengren, Gelman, Kalish, & McCormick, 1991), distinguish biological, psychological, and social influences on bodily characteristics and function (Inagaki & Hatano, 1993), and provide explanations attributed to a source of energy or "vitalism" to account for biological occurrences (Inagaki & Hatano, 2004; Miller & Bartsch, 1997; Morris, Taplin, & Gelman, 2000).

The theory of naïve biology is essential to exploring preschool-age children's beliefs/tacit knowledge about eating, as eating is a complex phenomenon comprised of four concepts that are related to and involve biological processes that sustain and maintain life. These concepts include food (a substance which is edible), nutrition (what food provides the body), the body (what the body does with food), and health (what purpose does food serve) (Wellman & Johnson, 1982).

Lastly, general systems theory developed by von Bertalanffy (1968, p.48; 1975) proposes that a system is comprised of individual members that continuously interact as a unit to adapt and achieve a steady state of "equifinality." As such, the family environment serves as a system where young children and parents exchange and interpret verbal and non-verbal messages to communicate their beliefs/tacit knowledge during social interaction (Maccoby, 1980). Beliefs/ tacit knowledge may be communicated through direct instruction from parents, the acquisition of information from outside sources such as the media, and/or observation of the foods that parents eat, as well as the foods they provide for meals and snacks (McCaffee, 2003). Maccoby (1980) posits that children internalize these verbal and non-verbal messages while imitating others in the process of forming their own beliefs/tacit knowledge.

Children also contribute to the exchange of verbal and non-verbal messages through their language and their behavior: one of which is physiologically grounded in preferences for sweet and salty foods and another of resistance to the introduction of new foods (Blass, 2008). The outcome to the dynamic dialogue between children and their parent(s) not only communicates each individual's beliefs/tacit knowledge, but also leads to a culture of shared beliefs/tacit knowledge about eating within the context of the family environment (see Figure A.2).

Structure of the Dissertation

This manuscript-style dissertation represents a portion of a larger mixed-methods study that explored preschool-age children's beliefs about eating. Three manuscript style papers are presented in the next three chapters. Chapter II presents a synthesis of the literature about children's knowledge about eating and nutrition. Chapter III presents the results from free lists and card sorts used to elicit preschool-age children's responses with those who are obese and those who are of healthy weight revealing the similarities, differences, and patterns of their concepts related food and the organization of these concepts. Chapter IV evaluates the feasibility of using free lists and card sorts with preschool-age children, and the dependability and confirmability of these methodologies and the data that they elicit. The final chapter (Chapter V) concludes with a summary of the main findings, implications, and directions for future research.

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CHAPTER II

Children's Knowledge of Eating and Nutrition: A Review of the Literature

Abstract

Childhood obesity affects nearly one in every ten preschool children and is often attributed to behaviors associated with eating. Behavior is guided by what an individual believes/tacitly knows to be true. However, little is known regarding what preschool-age children know about eating and nutrition. **PURPOSE**: The purpose of this review is to synthesize the body of literature related to children's knowledge about eating and nutrition. **METHODS**: Literature searches were conducted in CINAHL, PsycINFO, Web of Science, and Google Scholar. Search terms included young children or preschool children or children, belief or beliefs or cognitive representations or knowledge, and eating or food or nutrition or body or health. Articles included in the review were empirical studies written in English and discussed young or school-age children's or adolescents' knowledge about eating and nutrition. **RESULTS**: The search resulted in a total of 548 articles. Thirty publications met the inclusion criteria. Preschool-age children understood edibleness, nutrition, and digestion as a result of their experience with food and eating. School-age children and adolescents had assimilated facts about food, nutrition, and health, and recognized factors that influenced their decisions about eating. **CONCLUSIONS**: Research has contributed to the body of knowledge regarding children's knowledge about eating and nutrition; however, several gaps exist. Children less than six-years-old have not been included as primary informants in studies focusing on childhood obesity. Children from minorities and/or low socio-economic status groups have not been

included as primary informants in studies investigating children's beliefs/tacit knowledge about eating and nutrition. Lastly, the number of children who were obese and the number of children who were of healthy has not been included in publications.

Literature Review

This chapter presents the theoretical background to beliefs/tacit knowledge and declarative knowledge, provides a definition and description of concepts related to eating (food, nutrition, the body, and health), and reviews the literature related to (a) children's beliefs/tacit knowledge about eating, (b) children's declarative knowledge of food, nutrition, and health, and (c) children's beliefs/tacit knowledge about eating relative to the concept of childhood obesity. Methodologies used in these studies and children's ages are included to highlight what children know, i.e., their cognitive representations/concepts and competencies. Gaps in the literature are also presented.

Theoretical Background

Beliefs

Beliefs are conceptualized as concepts constructed in reference to meaning assigned to sensory-motor experiences (perceptions) that are regarded as being true (Bar-Tal, 2000; Bartsch & Wellman, 1995). As such, beliefs represent what people *think* and come to *know* through personal experience, i.e., tacit knowledge (Ajzen & Fishbein, 1973; Bartsch & Wellman, 1995; Fishbein & Ajzen, 1975) and not facts that people know from receiving formal education, i.e., declarative knowledge (Dickson-Spillman & Siegrist, 2011; Mandler, 1983; Worsley, 2002). Moreover, beliefs/tacit knowledge play a critical role in reasoning, intentions, and behavior (action) (Bartsch & Wellman, 1989; Fazio, 1986). They do so by serving as the mental foundation from which judgements, conclusions, and decisions are made (Malle, 2001; Malle & Knobe, 2001; Malle, Moses, & Baldwin, 2001; Mele, 2001). Some psychologists have also suggested that beliefs/tacit knowledge create an individual's social reality (Pearce & Cronen, 1980; Solos, 2005). These scholars have suggested that what an individual believes/tacitly knows to be true and what an individual “believes about what others’ believe” define social boundaries and become an individual’s social reality that likely influences behavior (Pearce & Cronen, 1980, p. 21, 233).

Sometimes beliefs are considered to be analogous to perceptions, recognition, and concerns. These terms represent separate and distinct, yet interrelated concepts. Perceptions are postulated as the meaning that has been assigned to sensory-motor experiences including taste, touch, smell, seeing, and hearing (personal communication, H. Wellman, 10/26/11). Unlike beliefs or perceptions, recognition arises from the comparison between what is regarded as being true and what is real. Concerns, on the other hand, are judgments made in reference to that which has been recognized.

Beliefs/tacit knowledge are communicated during social interaction. For young children, this occurs primarily in the context of the family environment when verbal and non-verbal messages are dynamically exchanged with their parents (Maccoby, 1980). Beliefs/tacit knowledge are communicated directly through instructions when parents tell their children something and when information is acquired from outside sources like the media. Beliefs/tacit knowledge are also communicated vicariously through observation of the foods that parents provide for their family and the foods they eat (McCaffee, 2003). As such, beliefs/tacit knowledge are thought to be internalized when children emulate the behaviors they have observed (Maccoby, 1980).

Children contribute to this exchange of messages through their language, their resistance to the introduction of new foods, and their behavior, which is physiologically grounded in preferences for sweet and salty foods (Blass, 2008). It is therefore hypothesized that the reciprocal exchange of verbal and non-verbal messages between children and parents contributes to the development of children's beliefs/tacit knowledge about eating. This exchange also creates a culture of shared beliefs/tacit knowledge within the family about eating.

Eating

Eating consists of four interrelated concepts and is defined as a complex process by which a substance that has been deemed edible is consumed for the purposes of securing nutrients to meet physiologic requirements in maintaining and sustaining life, as well as fulfilling psychological and emotional desires (Rozin, 1990; Wellman & Johnson, 1982). These four concepts: food (what is edible/inedible), nutrition (what food provides), the body (what the body does with food), health (what purpose does food serve), and the relationships between these concepts (Wellman & Johnson, 1982) have served as constructs to frame much of the research related to eating.

Methods

Literature searches were conducted in CINAHL, PsycINFO, Web of Science, and Google Scholar. Search terms included young children or preschool children or children, belief or beliefs or cognitive representations or knowledge, eating or food or nutrition or body or health as shown in Table II.1. Articles were also retrieved from lateral searches of references in key publications. No restriction was placed on date of publication.

Table II.1

Search Terms and Databases Searched

Electronic Databases: CINAHL, PsycINFO, Web of Science, and Google Scholar		
	Search Terms:	
and		and
Young children or preschool children or children	Belief or beliefs or cognitive representations or knowledge	Eating or food or nutrition or body or health

Inclusion criteria

Articles in this review were included if they were empirical studies written in English and investigated preschool-age or school-age children's or adolescents' beliefs/tacit knowledge and declarative knowledge about eating and nutrition, and children's beliefs/tacit knowledge about eating relative to the concept of childhood obesity.

Exclusion criteria

Publications were excluded if they presented parental perceptions as their primary focus, discussed instrument development, feeding, feeding habits, feeding practices or dietary behaviors, eating behavior, eating disorders, food preferences, familiarity or practices, food insecurity, menu or meal planning and patterns, parenting style or roles, parental nutritional knowledge, and home environment.

Results

The search produced 548 publications. Three hundred sixty publications did not meet the inclusion criteria. One hundred three articles were descriptions or evaluations of intervention studies. Thirty-five publications were duplicates. Fourteen publications described instrument development. Five publications were reviews of the literature. One article presented lessons learned. The remaining articles described studies that addressed associations between preschool-age or school-age children's and adolescent's beliefs and/or knowledge of eating and nutrition (see Figure II.1).

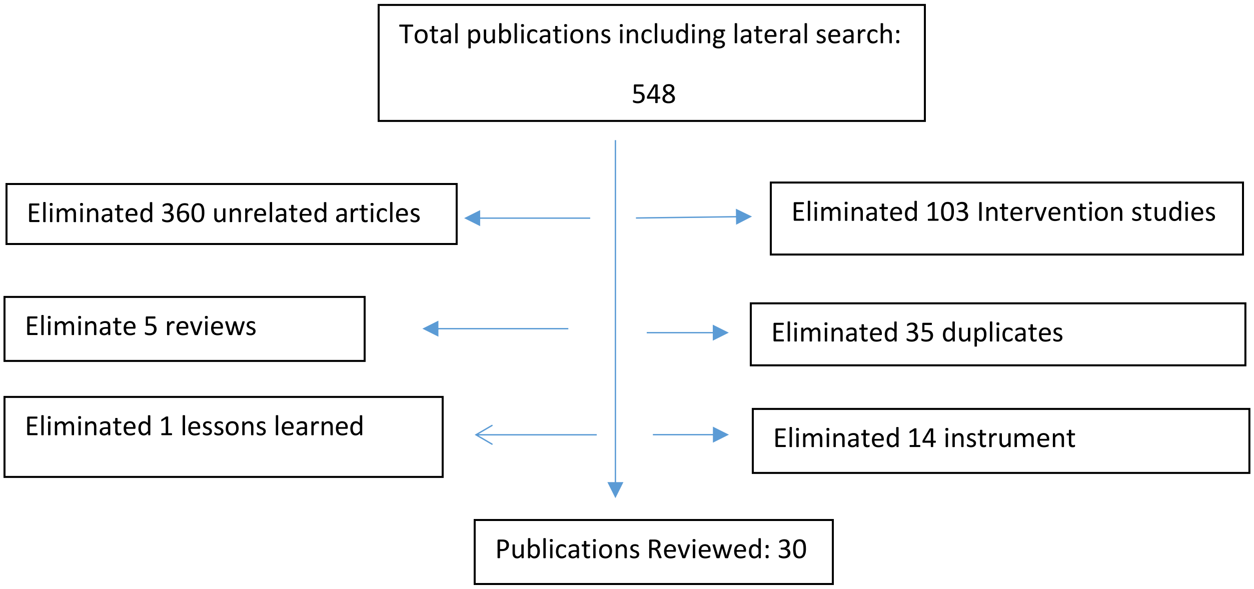

Figure II.1 Prisma Flowchart for Selected Studies

Thirty articles met the inclusion criteria. Three themes were identified among these publications: (1) preschool-age children's beliefs/tacit knowledge about eating, (2) children's declarative knowledge of food, nutrition, and health, and (3) children's beliefs/tacit knowledge about eating relative to the concept of childhood obesity. Preschool-age children's beliefs/tacit knowledge about eating were further subdivided into conceptual categories associated with eating: edible/inedible food (n = 7), nutrition (n = 3), and the body (n = 2). Children's declarative knowledge was subdivided by topic and age groups: preschool-age children's declarative knowledge of food and nutrition (n = 4), preschool-age and school-age children's declarative knowledge of health (n = 4), school-age children's and adolescents' declarative knowledge of food and nutrition (n = 7). Children's beliefs/tacit knowledge about eating relative to the concept of childhood obesity, was subdivided by school-age children's and adolescents' beliefs/tacit knowledge (n = 2), and external sources that influence school-age children's beliefs/tacit knowledge (n = 1).

Several theories were employed in this body of research. These included the theory of mind (n = 2), the theory of naïve biology (n = 5), Piagetian theory (n = 4), Angyl's theory of disgust (n = 5), categorization (n = 1), Bandura's Social Cognitive Learning Theory (n = 1), Bronfenbrenner's bioecological model (n = 1), cognitive dissonance (n = 1), and Transtheoretical model of behavior change (n = 1). There were six quantitative studies, six qualitative studies, and 18 mixed-methods studies. Study design included cross-sectional (Nowak & Buttner, 2002), cross-sectional with a randomized control trial (Dixon, Scully, Wakefield, White, & Crawford, 2007), experimental (Siegal & Share, 1990), qualitative (Hart, Bishop, & Truby, 2002), or descriptive (Contento, 1981; Slaughter & Ting, 2010). Subjects in these studies were 12-months-old to 18-years-old. Twenty-four studies included both boys and girls. Six studies did not report gender. Sample size ranged from 16 to 2417. Power was not stated in determining sample size in any of the quantitative studies. Two studies reported the number of participants who were obese and the number of participants who were of healthy weight (Nemet, Perez, Reges, & Eliakim, 2007; Reinehr, Kersting, Chahada, & Andler, 2003). Twenty-nine studies collected subjective data from interviews, focus groups, and/or questionnaires. One study collected data from observation. Five studies, which included three quantitative studies, reported the internal reliability of their measures. Three studies reported content validity of their measures. Ten studies, which included all of the qualitative studies, reported inter-rater reliability for coding data.

Preschool-age Children's Beliefs/Tacit Knowledge about Eating

Preschool-age children's beliefs/tacit knowledge about food.

Seven studies found that preschool-age children by the age of three can and do determine that a substance is edible if it is not physically contaminated (Fallon, Rozin, & Pliner, 1984;

Rozin, Fallon, & Augustoni-Ziskind, 1985, 1986; Rozin, Hammer, Oster, Horowitz, & Marmora, 1986; Siegal & Share, 1990), socially considered contaminated (Toyama, 2000a), or it appears to be dangerous (Krause & Saarnio, 1993). Five research teams extending Angyl's (1941) and Rozin's (1990) original work on disgust found that preschool-age children from middle class suburban families stated that foods or beverages, which were physically contaminated, were inedible and would make you sick if you ate them (Fallon et al., 1984; Rozin et al., 1985, 1986; Rozin et al., 1986; Siegal & Share, 1990). Another researcher explored Japanese children's understanding of food that was socially considered contaminated and found that children who were 12 months old and older (n = 40) thought that food that had fallen on the table, on their lap, or onto the floor at home was considered edible, but food which had fallen on the floor at preschool was considered inedible (Toyama, 2000a). Still another group explored the relationship between the appearance of food and edibility (Krause & Saarnio, 1993) with children between the ages of three and five (n = 48) who were from a middle class, metropolitan suburb. They found that this age group of children correctly identified objects that were not food items; however, children who were the youngest had difficulty identifying substances that were edible (Krause & Saarnio, 1993) (see Table II.2).

Preschool-age children's beliefs/tacit knowledge about nutrition.

Studies found that preschool-age children who were three-years-old could and did classify foods correctly as healthy or junk (Nguyen, 2007); and by the time they were in kindergarten, children understood the relationship between food, nutrition, and health (Slaughter & Ting, 2010; Wellman & Johnson, 1982). Nguyen (2007) found that nearly 60% of three-year-old children in her study with three-, four-, and seven-year-old children (n = 48) from Midwest and Southeastern university settings correctly classified photographs of food as healthy or junk.

She also found that approximately half of the four-year-old children explanations for classifying foods as healthy or junk included words related to health, having cavities, or a property needed for growth (Nguyen, 2007).

Wellman and Johnson (1982) found that five- and six-year-old children (n = 45) from middle class elementary schools who were read short stories about two children who differed in height, weight, activity, health, and strength explained how the differences in physical appearance were related to nutrition. As a group, children attributed growth, energy, strength, and health to the quantity and quality of food. Younger children often associated height with the quantity of food and activity with the quality of food (Wellman & Johnson, 1982). What's more, Slaughter and Ting (2010) extended this work to preschool-age children and found, like Wellman and Johnson (1982), that preschool-age children were more likely to associate growth with the quantity of food (see Table II.3).

Preschool-age children's beliefs/tacit knowledge about the body.

Two studies found that by the age of four, children understand processes associated with digestion (Teixeira, 2000; Toyama, 2000b). These studies were guided by evidence showing that children construct a naïve framework to explain, interpret, and predict biological processes and functions (Hatano & Inagaki, 1994, 1997; Inagaki, 1990; Inagaki & Hatano, 2004, 2006; Wellman & Gelman, 1992; Wellman & Inagaki, 1997). After giving four- to ten-year old Brazilian children (n = 45) a chocolate bar to eat, Teixeira (2000) asked the children to draw how food passes through the body, describe the organs involved in digestion, and explain how digestion works. All children identified the mouth, esophagus, stomach, and anus. Most three- and four-year-old children thought that food remains in the stomach and is not expelled, while children eight years and older reported that some of the food stays in the body and the remainder of the food is expelled (Teixeira, 2000). Teixeira (2000) attributed children's ability to complete the task and their understanding of digestion to their daily experiences with eating.

Another researcher asked four- to eight-year-old children (n = 165) to explain the importance of digestion and breathing, how these processes occur, and what "foods" or resources were necessary for living and non-living kinds (Toyama, 2000b). Like Teixeira, Toyama (2000b) found that children understood that food is transformed inside the body to become part of the body and provides the resources required for physical growth (see Table II.4).

Children's declarative knowledge of food, nutrition, and health

Preschool-age children's declarative knowledge of food and nutrition.

Four studies found that children who were four to six years old had attained enough factual knowledge about food and nutrition to classify food according to similarity and nutritional value (Contento, 1981; Michela & Contento, 1984; Nemet, Perez, Reges, & Eliakim, 2007; Zarnowiecki, Dollman, & Sinn, 2011). Two seminal studies conducted in the 80's explored middle class, urban, five- to 11.5-year-old children's concepts about food and eating. These researchers found that children understood that food remains the same regardless of preparation and they classified foods into eight categories reflecting their similarity: sweets, fruit, vegetables, drinks, dairy, breads, grain, and meat and fish. However, five- and six-year-old children could not explain fats, carbohydrates, proteins and vitamins (Contento, 1981; Michela & Contento, 1984).

Nearly two decades later, another study examined four- to six-year-old children's (n = 202) knowledge and preference for healthy and unhealthy food and physical activity using a laptop computer (Nemet et al., 2007). They found that nutritional knowledge and nutritional preference were correlated, and girls scored higher on nutritional knowledge than their male counterparts. However, there were no differences found in the nutritional knowledge scores of children who were overweight or children who were of healthy weight (Nemet et al., 2007). Results regarding the nutritional knowledge or nutritional preference scores for seven percent of the children in the study who were obese were not presented.

Like Nemet et al.'s 2007 study, Zarnowiecki, Dollman, and Sinn (2011) also used a laptop computer to explore five- to six-year-old children's (n = 192) knowledge of healthy or unhealthy food and to verify if they had previously eaten the food item (Zarnowiecki et al., 2011). Children from a metropolitan area in Australia correctly identified fruits and vegetables. Most of the children (80%) correctly categorized food as milk, bread, or cheese. Nearly all of the children (90%) correctly identified unhealthy food (Zarnowiecki et al., 2011). Definitions given by children as to why food was considered healthy or unhealthy, however, were not presented (see Table II.5).

Preschool-age and school-age children's declarative knowledge of health.

Four studies found that children as young as three years old were knowledgeable about health in relationship to eating ill (Almqvist, Hellnas, Stefansson, & Granlund, 2006; Eiser, Patterson, & Eiser, 1983; Goldman, Whittney-Saltiel, Granger, & Rodin, 1991; Maheady, 1986). Children in these four studies thought that eating good food was necessary for being healthy and returning to health after being ill (Almqvist et al., 2006; Eiser et al., 1983; Goldman et al., 1991; Maheady, 1986) (see Table II.6).

School-age children's and adolescents' declarative knowledge of food and nutrition.

Four studies explored school-age children's declarative knowledge of food and nutrition (Edwards & Hartwell, 2002; Hart, Bishop, & Truby, 2002; Lin, Yang, Hang, & Pan, 2007; Reinehr, Kersting, Chahada, & Andler, 2003). Topics in these studies covered multiple aspects of food and nutrition. One study found that most school-age children from Taiwan (n = 2147) were knowledgeable about nutrition and thought it was important (Lin et al., 2007). Another study found that school-age children from the United Kingdom (n = 221) readily identified and preferred fruits to vegetables and their knowledge of vegetables increased with age. This study also found that girls were more likely to identify the health benefits associated with food and the role that moderation plays in obtaining and maintaining health than were boys (Edwards & Hartwell, 2002). A different study also conducted in the United Kingdom (n = 114) found that school-age children recognized the influence that the media has on their decisions about the food(s) they to eat. School-age children in this study also recognized the association between food and nutrition, food and dental caries, and food and weight gain (Hart et al., 2002). Two other studies found that nutritional knowledge was associated with where children lived, i.e., poorer knowledge of nutrition was associated with living in remote areas (Lin et al., 2007) and the type of school they attended in Germany, i.e., nutritional knowledge was related to higher education (Reinehr et al., 2003). However, no association was found between body mass index and nutritional knowledge (Reinehr et al., 2003).

In comparison, three studies explored adolescents' declarative knowledge of food and nutrition (Giskes, Patterson, Turrell, & Newman, 2005; Gracey, Staley, Burke, Corti, & Beilin, 1996; Nowak & Buttner, 2002). The foci of these studies included health and nutritional beliefs; perceptions, attitudes, concerns or knowledge; sources of information; and food intake and habits. One study found that adolescents from diverse socio-economic groups in Australia (n = 480) defined their health in terms of their physical appearance and ability to function (Gracey et al., 1996). In another study, adolescents from Australia (n = 29) acknowledged that their health was related to their dietary and physical activity lifestyles (Giskes et al., 2005). Adolescents also identified the influence of parents, peers, advertising, and their own attitudes on their dietary habits (Giskes et al., 2005), as well as barriers to eating healthily, which included the lack of healthy food at home and at school, their own personal food preferences, and time constraints (Gracey et al., 1996). A third study found that girls enrolled in private and parochial schools in Queensland were more likely to eat fruits and vegetables, and drink less milk and eat less meat and cheese compared to boys. In contrast, older boys were more likely to eat meat, drink milk, and eat breakfast (Nowak & Buttner, 2002). Interestingly, Nowak and Buttner (2002) found significant relationships between their (adolescents') beliefs and concerns about food and the foods they ate. However, Nowak and Buttner (2003) also found, like other researchers, no relationship between nutritional knowledge and food intake (see Table II.7).

Beliefs/tacit knowledge about eating relative to the concept of childhood obesity

School-age children's and adolescents' beliefs/tacit knowledge about eating relative to the concept of childhood obesity.

Two studies found that school-age children and adolescents were concerned about their diet and barriers to being healthy, and what other people thought about their physical appearance (Power, Bindler, Goetz, & Daratha, 2010; Williams, Taylor, Wolf, Lawson, & Crespo, 2008). One study showed that middle class adolescents of European-American descent (n = 16) understood what healthy life styles entailed, but attributed their inability to achieve this goal to family schedules, availability of food, and lack of money. Surprisingly, teachers blamed parents for adolescents' for being overweight or obese, while parents blamed the adolescent (Power et al., 2010). Another study found that adolescents in Appalachia (n = 16) based their beliefs about their health on their physical appearance and other people's appraisal. Females, in particular, were more likely to be influenced by peer appraisal and television advertisements, potentially placing them at greater risk for eating disorders (Williams et al., 2008).

External sources of information that influence school-age children's tacit beliefs/ knowledge about eating.

One study found that school-age children's and adolescents' beliefs about eating could be modified by viewing healthy food advertisements (Dixon, Scully, Wakefield, White, & Crawford 2007). In a cross-sectional study with a randomized control trial with pre- and post-test questionnaires, several researchers examined food attitudes, beliefs, and perceptions of fifth and sixth grade students (n = 919) from Australia. Students viewed a familiar animated television program with a variety of healthy food advertisements embedded throughout four 20-minute video recordings. These researchers found that school-age children's and adolescents' beliefs and attitudes toward healthy eating increased after viewing healthy food advertisements. In addition, these newly acquired concepts about eating healthy food did not change when students watched "junk" and healthy food advertisements simultaneously (Dixon et al., 2007) (see Table II.8).

Discussion

The purpose of this manuscript was to synthesize the literature related to children's knowledge about eating and nutrition. Evidence in this review was primarily from psychology, public health, and nutrition/dietetics. Preschool-age and school-age children and adolescents in these studies were predominantly from middle class families in America, Australia, Japan, Queensland, Taiwan, and the United Kingdom.

Evidence from this review supports that prior to formal education, preschool-age children have had sufficient experience with eating that they know, can, and do determine what substances are edible and those that are inedible (Fallon et al., 1994; Krause & Saarnio, 1993; Rozin et al., 1985, 1986; Rozin et al., 1986; Siegel & Share, 1990; Toyama, 2000a) and they know how to classify food items as healthy or junk (Nguyen, 2007). Preschool-age children also associate the quantity of food with growth and the quality of food with energy (Slaughter & Ting, 2010; Wellman & Johnson, 1982), understand that food undergoes changes inside the body (Teixeira, 2000; Toyama, 2000b) and provides the resources necessary for growth, energy, strength, and health (Almqvist et al., 2006; Eiser et al., 1983; Goldman et al., 1991; Maheady, 1986). These findings are supported by other research grounded in naïve biology (Inagaki & Hatano, 1993, 2004; Miller & Bartsch, 1997; Morris, Taplin, & Gelman, 2000). Collectively, evidence from these studies has not only helped to establish the progression of preschool-age children's cognitive representations and their cognitive abilities, but also corroborates Ajzen and Fishbein (1973), Bartsch and Wellman (1995), and Fishbein and Ajzen (1975) work suggesting that beliefs/tacit knowledge evolves from inferences that are made in reference to the meaning that has been given to personal experiences, in this case, with food. Furthermore, cognitive processes make it possible for children to organize their beliefs/tacit knowledge and to explain their understanding of biological processes and outcomes in relation to eating. These findings, however, are contrary to those from studies framed by Piagetian theory, such as Carey's (1985), suggesting that not until children are approximately 10 years old, have they synthesized biological concepts sufficiently to account for physiologic processes like those given by adults.

Evidence from this review shows that after receiving formal education, preschool-age and school-age children correctly classified food items according to their similarity (Contento, 1981; Michaela & Contento, 1984), their nutritional value (healthy/unhealthy) (Nemet et al., 2007; Zarnowiecki et al., 2011), and their preference (Contento, 1981; Nemet et al., 2007). Yet, children under the age of seven could not explain fats, carbohydrates, protein, and vitamins (Michela & Contento 1984; Nguyen, 2007). This is not surprising given the fact that few studies have investigated what adults (Dickson-Spillman & Siegrist, 2011; Lin & Yen, 2010; Manios, Moschonis, Katsaroli, Grammatikai, & Tanagra, 2007) or those who are concerned with athletic performance (Spendlove et al., 2012) know about nutrition or macro- and micronutrients. These studies found that adults (Dickson-Spillman & Siegrist, 2011; Lin & Yen, 2010; Manios et al., 2007) and elite athletes (Spendlove et al., 2012) possessed little knowledge of nutrition and macro- and micronutrients.

Results from this review also found that school-age children correctly identified more fruits than vegetables and they recognized that fruits and vegetables were part of a healthy diet and necessary for health. In fact, girls, as young as four-years-old, were more knowledgeable about nutrition and health benefits associated with fruits and vegetables than their male counterparts (Edwards & Hartwell, 2002; Hart et al., 2002; Nemet et al., 2007). School-age children also recognized the role that the media play in their food choices (Hart et al., 2002). Their knowledge of facts regarding nutrition was also related to the community where children lived (Lin et al., 2007) and where they attended school (Reinehr et al., 2003). These findings are also supported by another study that found nutritional knowledge varied by gender (females were more knowledgeable at a young age), by occupation, and by education, including the type of school attended (Wardle, Parmenter, & Waller, 2000).

This review also found that adolescents who participated in studies defined their health by their physical appearance and their ability to perform (Gracey et al., 1996). Females, in particular, were susceptible to critical remarks made by their peers about their appearance and messages conveyed in television advertisements (Williams et al., 2008). Adolescents also recognized that their health was related to their dietary and physical activity lifestyle (Giskes et al., 2005), yet attributed their inability to achieve a healthy lifestyle to external influences such as the media, peers, and parents, their own attitudes, and a lack of access to and availability of healthy foods (Giskes et al., 2005; Gracey et al., 1996). Other studies conducted with adolescents have also found that the amount of food they eat is positively associated with the amount of time they spend viewing television and more so with the number of advertisements that they recognize (Banth & Nanglu, 2011; Halford, Gillespie, Brown, Pontin, & Dovey, 2004; Scully et al., 2012). Dixon, Scully, Wakefield, White, and Crawford (2007), however, found that school-age children's and adolescent's beliefs and attitudes toward healthy eating could be changed by viewing healthy food advertisements. Still, other investigators have found that adolescents are skeptical about food messages relative to their health (Dorey & McCool, 2009).

We identified a small number of studies that examined school-age children's and adolescents' beliefs/tacit knowledge about eating relative to the concept of childhood obesity. Results from three studies found that school-age children's and adolescents' beliefs were similar; that is, school-age children and adolescents based their health on their physical appearance, peer appraisal, and information from the media, and attributed their inability to achieve healthy lifestyles to family schedules, availability of and access to healthy food, and lack of money (Dixon et al., 2007; Power et al., 2010; Williams et al., 2008).

Evidence from this review also suggests that what adolescents believe about food may be more powerful in predicting eating behaviors than nutritional knowledge. Madeleine Nowak and Petra Buttner (2002), when comparing adolescent's nutritional (declarative) knowledge and their beliefs about food to their consumption of food, found that what adolescents ate was highly related to their beliefs about food. Nowak & Buttner (2002) also found no relationship between school-age children's and adolescents' nutritional knowledge and their food intake. This finding is supported by other studies conducted with adolescents and adults (Pirouznia, 2001), and adult consumers (Dickson-Spillman & Siegrest, 2011) that found no association between nutritional knowledge and dietary or eating behaviors. In addition, Nemet et al., (2007) and Reinehr et al., (2003) found no relationship between school-age children's and adolescents' nutritional knowledge and body mass index.

There are several strengths to this review. To the best of my knowledge, this is the first review to synthesize preschool-age and school-age children's and adolescent's beliefs/tacit knowledge and declarative knowledge of eating and nutrition. Studies presenting in this review were conducted in multiple countries providing a global view of preschool-age and school-age children's and adolescent's knowledge about eating, food, nutrition, and health. This review also covered a broad time period allowing for the retrieval of important foundational literature, as well as current literature.

There are a number of limitations to this review. This review is not exhaustive; the grey literature and medical databases were not searched. No publications in this review presented data regarding preschool-age children's beliefs/tacit knowledge about health in relation to eating or school-age children's and adolescents' declarative knowledge of the body. Topics in the studies investigating school-age children's and adolescents' declarative knowledge of food and nutrition were diverse creating a challenge in synthesizing the data in the review. In addition, the interchangeable use of beliefs, perceptions, concerns, and recognition created a challenge in determining which psychological concept was being measured.

There were also a number of limitations to the studies in this review. First, the majority of the studies were descriptive. This is to be expected when exploring a new phenomenon; and in and of themselves, they are valuable in building the body of knowledge. Yet, according to Brink and Wood (1998), they lack power. Second, few studies in this review, other than Rozin's and Nguyen's work, have been replicated to establish the reliability and validity of the quantitative studies and the trustworthiness of the qualitative studies. Third, most of the studies were conducted with children from middle class families. This may lead to bias when generalizing findings from these studies to other populations. Fourth, the composition of the samples in many of the studies was socio-economically, and ethnically and racially heterogeneous. This brings to question the influence that culture might have on the meaningful interpretation and validity of the results. Similarly, although having multiple global views may be advantageous, the question remains if the same variable or phenomenon was being measured across the different cultural groups. Fifth, many of the studies did not state the study design, the sampling method, or the internal reliability or validity of their measures, leaving the value of and confidence in the results of these studies open to interpretation. Lastly, none of the quantitative studies addressed power or effect size.

Conclusion

In summary, these studies demonstrate that preschool-age children have acquired concepts about food, nutrition, and the body relative to their sensory-motor experiences, which they believe/know are true. Their beliefs/tacit knowledge are further organized in such a manner, that it allows preschool-age children to explain, predict, and interpret biological processes and functions associated with eating. This review has also helped to differentiate tacit knowledge that is gained as a result of experience from declarative knowledge that is attained by the acquisition of facts about food, nutrition, and health.

Gaps are also present in the literature. First, data have not been collected from children less than six-years-old who are primary informants in studies focusing on childhood obesity. Second, the number of children who are obese and the number of children who are of healthy weight in many of these studies is unknown. Third, many studies regarding children's knowledge about eating have not included children from minority and low socio-economic groups. This limitation is supported by a review of the literature confirming the lack of studies related to beliefs/tacit knowledge about eating in children across cultural groups. Fourth, as Worsely (2002) has argued studies that have used predefined labels to classify food items by taxonomy or nutritive value to examine children's understanding of eating and nutrition has limited the data to declarative knowledge rather than revealing children's tacit concepts. These gaps support the need for further studies.

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Wellman, H. M., & Johnson, C. N. (1982). Children's understanding of food and its functions: A preliminary study of the development of concepts of nutrition. *Journal of Applied Developmental Psychology 3*, 135-148.

Williams, K. J., Taylor, C. A., Wolf, K. N., Lawson, R. F., & Crespo, R. (2008). Cultural perceptions of healthy weight in rural Appalachian youth. *Rural and Remote Health, 8*, 932-945.

Worsley, A. (2002). Nutrition knowledge and food consumption: can nutrition knowledge change food behavior? *Asia Pacific Journal of Clinical Nutrition, 11*(Suppl): S579-585.

Zarnowiecki, D., Dollmman, J., & Sinn, N. (2011). A tool for assessing healthy food knowledge in 5-6-year-old Australian children. *Public Health Nutrition, 14*(7), 1177-1183.

Table II.2

Summary of Studies: Preschool-age Children’s Beliefs/Tacit Knowledge about Food

Author/Year	**Population**	**Sample Size**	**Methods**	**Outcome Measures**	**Results**	**Critique**
Fallon, A. E., Rozin, P., & Pliner, P. (1984). The child’s conception of food: The development of food rejections with special reference to disgust and contamination sensitivity. *Child Development*, *55*, 566-575.	Upper middle class suburban families and mothers	29 children 3.5-12 years old (17 girls, 12 boys) and 13 adults	Visual analog scale rating the likelihood of drinking a beverage. Nine storybook scenarios illustrating a beverage contaminated with candy, food, distasteful food, leaf insect, poison, or dog feces. Recorded response to eating, after pouring the substance out or washing the glass, if the beverage could be drunk.	Rate of responses by age groups: 3.9-6.1 yrs, 6.4-7.8 yrs, 8.2-11.11yrs, and 13 and older	If the object was in, on top, spilled out, or the container was washed, would increase the differentiation in contamination sensitivity. Sensitivity increases with age. Removal of the object was sufficient for the youngest. For the middle group spilled out was sufficient and for the oldest group, washed was sufficient. Youngest seemed not to have a separate category for dangerous, disgusting, and	Strength: Theoretical background based on Angyl’s and Rozin’s work regarding disgust. Limitation: Verbal report may underestimate conceptual attainment compared to eliciting a judgmental response.

					inappropriate substances. Harm or sickness was a reason given for rejection by all subjects and distaste by almost all subjects.	
Krause, C. M., & Saarnio, D. A. (1993). Deciding what is safe to eat: Young children understanding of appearance, reality, and edibleness. *Journal of Applied Developmental Psychology, 14*, 231-244.	Middle class, Midwestern suburb	48 16 3-yr-olds (40-49 months), 16 4-yr-olds (51-59 months), and 16 5-yr-olds (61-69 months)	18 items: non-deceptive, non-deceptive non-food, deceptive non-food item. Children were asked about the appearance, reality, and edibleness of the object.	ANOVA to examine the general pattern of responses.	All children regardless of age correctly identified objects unrelated to food items. Three year olds less likely to correctly identify edible substances.	Strength: Theoretical background based on Rozin and Siegal and Share's works. Limitation: Gender of participants not presented.
Rozin, P., Fallon, A., & Augustoni-Ziskind, M. (1985). The child's conception of food: The development of	Suburban upper middle class in Philadelphia and inner city Italian neighborhood	67 3.5 to 12-year-olds	Interviewer placed a clean comb into a glass of apple juice and asked children if they would drink the juice. Then place a comb that she	Percentage of children accepting contaminated food.	Young children were less sensitive to contamination than older children.	Strength: Theoretical background based on Rozin and Angyl's work regarding disgust.

contamination sensitivity to “disgusting” substance. *Developmental Psychology, 21*(6), 10755.			used every day to comb her hair and asked children if they would drink the juice. Interviewer sprinkled sugar onto a cookie and asked children if they would eat the cookie. Sprinkled green colored flakes reported as ground-up grass-hopper on a cookie and asked the children if they would eat it. Last experiment, the interviewer placed a dead grasshopper into a glass of juice and asked the children if they would drink it.			Limitation: Gender of participants not presented. Sample from friendships and nursery school.
Rozin, P., Fallon, A., & Augustoni-Ziskind, M (1986). The child’s conception of food: The	Suburban upper middle class in Philadelphia and inner city Italian neighborhood	67 3.5- to 12.5-year-olds and 23 undergraduate students	23 pictures of substances sorted into 13 attributes	Responses coded as mixed beneficial and good taste, good taste,	Young children rejected the same foods as adults, but did not distinguish between disgust, distaste, or	Strength: Theoretical background based on Rozin and Angyl’s work regarding disgust.

development of categories of acceptable and rejected substances. *Journal of Nutrition Education*, *18*(2), 75-81.				beneficial, inappropriate, disgust, and danger.	danger. Children older than 7 categorized foods they rejected like those rejected by adults.	Limitation: Gender of participants not presented.
Rozin, P., Hammer, L., Oster, H., Horowitz, T., & Marmora, V. (1986). The child's conception of food: Differentiation of categories of rejected substances in the 16 months to 5 year age range. *Appetite*, *7*, 141-151.	Black (n = 52)	54 16- to 60-month-olds who had previously ingested a toxic substance, both sexes	Children were offered 32-37 different edible and inedible items classified as being disgusting, inappropriate, or dangerous.	Rate of acceptance	Younger children readily accepted items that were dangerous, disgusting, or inappropriate. There is a developmental trend to reject items that adults consider disgusting or dangerous.	Strength: Framed by Rozin and Angyl's work regarding disgust.
Siegal, M., & Share, D. L. (1990). Contamination sensitivity in young children. *Developmental*	Australia, middle class	48 36- to 47-month-olds	Tested if it were safe to drink a beverage into which a cockroach had fallen. Children were asked if moldy	Percentage of correct response	77% reported that the drink would make them sick. 83% reported that bread was not edible.	Strength: Responses were not related to age. Random assignment to

Psychology, 26(3), 455-458.			bread covered with vegemite would be edible.			experimental and control group. Limitation: Gender of participants not reported.
Toyama, N. (2000a). Young children's awareness of socially mediated rejection of food Why is food dropped at the table "dirty"? *Cognitive Development 15,* 523-541.	Japanese	Study 1 At home, 1-4 (n = 40) 1-2 yr-olds (n = 20) (10 boys, 10 girls) 3-4 yr-olds (n = 20) (10 boys, 10 girls) and mothers were observed at home and at preschool during lunch time 2-yr-olds (n = 65) (31 girls, 34 boys) 4-yr-olds (n = 70) (36 girls, 34 boys)	Study 1 observation at home and preschool Study 2 stories/vignettes Nine stories about physical contamination with a social context in which food is rejected for social reasons. Children were asked to predict bodily and emotional reactions. Two stories were non-contact and 2 stories were contact, and 4 stories were socially mediated rejections stories. 24 4-yr, 20 6-yr-	Coded if food that was dropped was edible, neutral, or inedible	Study 1 16/17 children considered food dropped at home edible, whereas 41% of children at school considered food dropped at school edible. Children at school determined edibility based on location where the item was dropped. For teachers, food that was dropped was inedible. Explanation given by teachers and parents included "dirty", germs,	Strength: Theoretical background based on theory of naïve biology. Inter-rater reliability established.

			olds were interviewed. If you were the character, would you pick up and eat the dropped food? Why?, Evaluated bodily and mental reaction.		or contaminant. Study 2 No effect by gender and age. Adults reported mental reaction rather than bodily reaction for contact. Children predicted bodily reaction more than mental reaction for contact. Eating physically contaminated food caused bodily and emotional reaction. Prediction by young children did not relate to social context, to bodily or mental reaction. The place where food landed determined bodily or emotional reaction. Adults respond to social	

					context with different bodily and emotional responses.	

Table II.3

Summary of Studies: Preschool-age Children's Beliefs/Tacit Knowledge about Nutrition

Author/Year	**Population**	**Sample Size**	**Methods**	**Outcome Measures**	**Results**	**Critique**
Nguyen, S. P. (2007). An apple a day keeps the doctor away: Children's evaluative categories of food. *Appetite, 38*, 114-118.	Participants from Midwest and Southeastern schools and universities	16 3-yr-old (3.1-3.9), 16 4-yr-olds (4.1-4.9), 16 7-yr-olds (6.9-7.7) and 16 adults	70 2.5 x 3 inch photo on 8.5 x 11 inch paper ranging in nutritional value. Labels appeared under the photos. The aim was to evaluate categorization of foods based on their nutritional value and provide reasons for doing so. Children were told they were playing a game to figure out which foods are healthy and junky. Children were provided with the following definitions: healthy foods are good for your body if you eat a lot of them for a long time, and junky foods	Coded for nutritional food properties, health outcomes, and miscellaneous	Nutritional value, health outcomes, and miscellaneous were scored 1 if correct and 0 incorrect. 3-yr-olds score 59%, 4-yr-olds scored 73%, 7-yr-olds scored 78%, and adult scored 94% correct. There were significant differences between 3- and 4-yr-olds: 50% of 4-yr-olds provided justification for their answers, while 94% of 7-yr-olds provided justification health outcomes, less for nutritional	Strength: Children 3-years-old and older able to accurately categorize food as healthy or junk and 4-yr-olds and older gave justification. Theoretical background based on categorization.

			are bad for your body if you eat a lot of them for a long time		food properties, and a decrease in justification for growth.	
Slaughter, V., & Ting, C. (2010). Development of ideas about food and nutrition from preschool to university. *Appetite*, *55*, 556-564.	Large private middle class school suburb Caucasian (83%), Asian (11%), other (6%)	19 Preschoolers 5-yr-olds (9 boys, 10 girls), 20 third graders 8-yr-olds (10 boys, 10 girls), 21 sixth graders 11-yr-olds (10 boys, 11 girls), 20 ninth graders 14-yr-olds (11 boys, 9 girls), and 20 adult university students (6 males, 14 females)	Individual interviews consisting of 13 open-ended questions regarding 4 components of food and nutrition: purpose, effects of different quantities, effects of specific foods, and effects of unbalanced diet. Questions ranged from general to specific and were linguistically and conceptually appropriate. Questions were followed by probes.	Answers were coded by themes: physiological, vitalistic, mechanical, psychological, biological associationism, and uncodable	5-yr-olds mentioned growth in relation to food. Young children provided biological associationism without causal mechanism for explanations, although mechanistical account may be given. At 8 yrs of age, children gave vitalistic explanation. At 11, children's reasoning was similar to adults.	Strength: Open-ended interviews captured multiple and simultaneous forms of reasoning. Theoretical background based on theory of mind and theory of naïve biology. Inter-rater reliability established. Criticism: Language comprehension and production may influence the quality of answer. Structured forced-choice questions used to

						discretely assess understanding.
Wellman, H. M., & Johnson, C. N. (1982). Children's understanding of food and its functions: A preliminary study of the development of concepts of nutrition. *Journal of Applied Developmental Psychology*, 3, 135-148.	Middle class elementary students from Pittsburgh	15 6.3-year-olds 15 9.4-year-olds 15 12.6-year-olds (7 boys, 8 girls in each group)	Short statement vignettes with drawings followed by questions to provide explanation in difference and prediction to nutritional input to a set of twins.	Responses coded: quantity of food, quality of food, specific foods, age, heredity, exercise, sleep	Children identified relationship between food and weight and height and health. Nutritional awareness increased with age. Young children linked quantity to changes in size and health. Older children more discriminant. Quality of food was associated with activity level. Vegetable consumption was healthier. More desserts made one sick, have a lack energy. A diet containing only 1 item had negative	Strength: Use of drawings facilitated communication of understanding. Children possess knowledge of relationship and process of nutrition. Task focused on specific set of conceptual relationships. Theoretical background based on the theory of naïve biology, theory of mind, and Piaget. Limitation: Sample limited to middle class. No information regarding height and weight.

					consequences. Young children had oversimplified understanding.	

Table II.4

Summary of Studies: Preschool-age Children's Beliefs/Tacit Knowledge about the Body

Author/Year	Population	Sample Size	Methods	Outcome Measures	Results	Critique
Teixeira, F. M. (2000). What happens to the food we eat? Children's conceptions of the structure and function of the digestive system. *International Journal of Science Education, 22*(5), 507-520.	Recife, Brazil	45 4-10-year-olds 4-yr-olds (7 boys, 5 girls), 6-yr-old (6 boys, 6 girls), 8-yr-olds (3 boys, 6 girls), 10-yr-olds (6 boys, 6 girls)	During an interview, children were given a bar of chocolate, and pencil and paper with an outline of a human body printed on it. Children were asked to eat the candy and draw how the food passes through the body. Children were asked to name the organs that the food passed through, how they worked, what happened to the food, and what it looked like.	Answers were coded by structure and function.	The organs mentioned in digestion were the mouth, pharynx-esophagus, abdomen, and anus. 89% of four-year-olds reported that the stomach was an empty space. Children who were 4-years-old knew that food is broken down by chewing. Three- and four-year-olds reported that food stays in the body and is not expelled.	Strength: Theoretical background based on the theory of naïve biology.
Toyama, N. (2000b). "What are food and air like inside our bodies?": Children's	Japanese	Experiment 1: 15 preschooler (4.3-5.9) (7 boys, 8 girls) and 15 second graders (7.3-8.1) (8 boys,	Young children's reasoning about digestion in living and non-living kinds. Explored children's	Prediction of not eating or breathing, changes in food and breath, and	Preschooler recognized negative effect of not eating 13/15 and breathing 11/15. Perceptual	Strength: Theoretical background based on the theory of naïve biology.

thinking about digestion and respiration. *International Journal of Behavioral Development, 24(2*), 222-230.		7 girls), Experiment 2: 40 preschooler (4.5-5.9) (19 boys, 21 girls), 40 second graders (7.3-8.1) (22 boys, 18 girls), Experiment 3: 20 4-yr-olds (4.4-4.11) (10 boys, 10 girls), and 20 5-yr-olds (5.4-6.2) (9 boys, 11 girls), Experiment 4: 15 4-yr-olds (4.2-4.9) (7 boys, 8 girls)	conceptualization of internal transformations of food and air and their beliefs about the digestive processes. Contain distinctive causalities. Experiment 1 3 open-ended questions to survive related to eating and breathing and what happens to food and air inside body. Experiment 2 and 2A Forced choice format incorporating dolls. Assessing for material, functional and perceptual explanations (alternative options). Experiment 3A based on child's spontaneous responses in exp. 1. Exp. 3A Question	explanations of changes in food and breath	explanation for breath (food changes color and gets warmed) to functional (something important for growth and health) and material (goes to parts of body and turns into flesh and blood). Changes in food; older children preferred functional and material over perceptual, preschoolers chose functional. Children recognized changes in living things vs non-living kinds. Functional-internal explanation rather than perceptual, functional, or	Limitations: Making sure the meaning of categories and words are clear. Open ended questions may meet with some confusion and options or alternatives may need to be offered.

			if food would undergo changes inside familiar living things, unfamiliar living things, and nonliving things.		external for tulip.	

Table II.5

Summary of Studies: Preschool-age Children's Declarative Knowledge of Food and Nutrition

Author/Year	**Population**	**Sample Size**	**Methods**	**Outcome Measures**	**Results**	**Critique**
Contento, I. R. (1981). Children's thinking about food and eating-A Piagetian-Based study. *Journal of Nutrition Education 13*(1 suppl.), S86-S90.	Urban, various ethnic groups, socio-economic status and religious backgrounds white 19, black 5 1 Asian-American	34 5- to 11-yr-olds (19 boys, 15 girls)	Interviews probed concept of food and process of eating and likes and dislikes	Responses classified by content and Piagetian stages	Food remains the same if cut, cooked, or mashed and cannot be returned to its original form. All edible items were food. Children did not distinguish between snacks and food. 71% of the children believed vitamins were pills. Preoperational children believed food goes to the stomach and is unchanged. Only 3 children could explain vitamin, protein, minerals, or other nutrients.	Strength: Framed by Piagetian stages. Inter-rater reliability established. Limitation: How were questions worded?
Michela, J. L., & Contento, I. R. (1984). Spontaneous classification of foods by elementary	Urban schools from metropolitan cities in the northeast, Black (n =	115 5-11 ½-year olds (56 boys, 59 girls)	Interviews were conducted with children who were asked to sort 71 cards into similar categories. 11 items were mixed	Frequency and multivariate statistical analyses, cluster analysis, and multidimensional scaling of	Data analyzed by major food groups. Number of groups ranged from 2-20. 2/3 of children had 5-9 groups and ½ of the children had 7-8	Strength: Theoretical background Inhelder and Piaget. Number of cards used in study and age group.

school-aged children. *Health Education Behavior, 11*, 57-76.	16) Hispanic (n = 20) White (79)		food. Children were asked to reclassify foods and provide explanations for proteins, vitamins, carbohydrates, and fats.	response, and descriptions	groups. The average was 8.7. Foods were grouped by sweets, fruits, vegetables, drinks, dairy, and breads and grains. They used functional, nutritional or healthful criteria to classify food items.	Limitation: Predefined labels to categorize responses vs identification of domains/taxonomies, and heterogeneous group.
Nemet, D., Perez, S., Reges, O., & Eliakim. A. (2007). Physical activity and nutrition knowledge and preferences in kindergarten children. *International Journal of Sports Medicine, 28*, 887-890.	middle to upper SES	202 4-6 year-olds (109 boys, 93 girls) 71 healthy 22% BMI > 85% and 7% obese	15 Photo-pair food (healthy/unhealthy) on lap top computer and 15 photo exercise-pairing questionnaire, provided with age appropriate definition of health and asked to choose a doll which they were to help stay healthy	Total score of knowledge and preference of physical activity and nutrition, paired t-tests	Nutritional scores higher than PA scores. Nutritional preference scores were lower than PA preference. There was a significant difference between nutrition knowledge and preference. No differences in PA knowledge and PA preference. Significant correlations between nutrition knowledge and preference, and PA knowledge and preference. No differences in knowledge between those who were	Strength: Technology and identified weight status of participants. Limitation: Knowledge defined by healthy/unhealthy. Knowledge regarding eating/nutrition broader than healthy/unhealthy. No correlations between bmi and factual knowledge score.

					overweight and those who were obese. Female had higher knowledge scores and lower PA scores.	
Zarnowiecki, D., Dollman, J., & Sinn, N. (2011). A tool for assessing healthy food knowledge in 5-6 year old Australian children. *Public Health Nutrition*, *14*(7), 1177-1183.	Australia, public primary school in Adelaide metropolitan area	192 5- to 6-year-olds (110 boys, 82 girls)	Knowledge of healthy food and activity. 30 photos viewed on laptop computer. Children were asked to define healthy and unhealthy food, name the food, if they had eaten if before, and asked if food was healthy or unhealthy.	Descriptive statistics, t-tests	Average score was 23 out of 30. Children categorized fruit and vegetables correctly and 80% categorized milk, cheese and bread correctly. Unhealthy food was correctly classified 90% of the time. There were no differences by gender.	Strength: Tool developed for use with young children to access knowledge. Internal reliability established. Limits: Study does not capture cognitive constructs associated with eating and did not include anthropometric measures.

Table II.6

Summary of Studies: Preschool-age and School-age Children's Declarative Knowledge of Health

Author/Year	**Population**	**Sample Size**	**Methods**	**Outcome Measure**	**Results**	**Critique**
Almqvist, L., Hellnas, P., Stefansson, M., & Granlund, M. (2006). 'I can play!' young children's perceptions of health. *Pediatric Rehabilitation,* *9*(3), 275-284.	Sweden preschool in mid-size community	68 4- to 5-yr-olds (38 boys, 30 girls)	Interview Tell me of some friends that you think feel well. Why do you think these friends feel well? Tell me what you think one should especially do to feel well. What can you do when you feel well? Tell me what you think can happen so that you don't feel well. What can you do when you don't feel well?	Content analysis	Well was being absent of disease and being active, playing, and playing with others. Health was related to eating and drinking and playing. You can play when you are well. Illness couched in terms of body – cough, pain, not laughing a lot, or sore throat.	Strength: Inter-rater reliability.
Eiser, C., Patterson, D., & Eiser, J. R. (1983). Children's knowledge of health and illness:		20 6-yr-ods 20 8-yr-olds 20 9-yr-olds 20 11-yr-olds (equal number of boys and	Interviewed about being healthy, illness, if he/she had been sick, injections, diet,	What does it mean to be healthy, prevention of illness, prevention of	Healthy was defined as not being ill, eating good food, taking exercise, and being strong or	Strength: Inter-rater reliability established.

implication for health education. *Child: care, health and development, 9,* 285-292.		girls)	and dental care.	specific illnesses, injections, diet, and dental care?	full or energy. Eating the right food was most important in preventing illness. Others mentioned avoiding others with illness, keeping warm and not going out in bad weather. Injections contained medicine to cure illness or prevent illness. Food was important in being healthy. Food leads to strength, growth or health and those that don't contain sugar.	
Goldman, S. L., Whitney-Saltiel, D., Granger, J., & Rodin, J. (1991). Children's representations of "everyday" aspects of health and illness. *Journal of Pediatric*	New Haven Connecticut Caucasian, 1 Black, 1 Indian	14 children from preschool and their parents, 13 recruited by posters 4- to 6-yr-olds (13 boys, 14 girls)	Interviewed with opened-questions, and asked to pack a healthy and unhealthy lunch	Illness conception, nutritional knowledge, general understanding of routine medical procedures. Perrin and	Illness viewed as phenomenalistic – being in the sun too long. Over 60% packed a healthy lunch. 61% identified characteristics of healthy foods. Eating good food	Strength: Piagetian theory of intellectual development. Inter-rater rater reliability established.

Psychology, *16*(6), 747-766.				Gerrity's coding scheme.	helps you get better. Illness was defined by a finite number of days. Inherent qualities of food were associated with healthful effects.	
Maheady, D. C. (1986). Health concepts of preschool children. *Pediatric Nursing, 12*(3), 195-197.	Private preschool Buffalo, NY	10 3-yr-olds, 20 4-yr olds, parents of participating children	Interviewed using modified Gorman questionnaire	Answers compared between child and parent percentage of agreement	3-yr-olds correct 100% of time on how often are you sick and how is child sick. 4-yr-old greater accuracy on medications taken. 3-yr-olds more accurate on eating special foods and allergies. 4-yr-olds more accurate if anyone in family was ill. 3-year-olds more accurate about anyone being hospitalized. Sited special food when they were ill to make them well.	Limitation: Gender of participants not presented.

Table II.7

Summary of Studies: School-age Children's and Adolescents' Declarative Knowledge of Food and Nutrition

Author/Year	**Population**	**Sample Size**	**Methods**	**Outcome Measures**	**Results**	**Critique**
Edwards, J. S. A., & Hartwell, H. H. (2002). Fruit and vegetables- attitudes and knowledge of primary children. *Journal of Human Nutrition and Dietetics, 15,* 363-374.	Primary school South Coast UK	221 Children age 8-11	Questionnaire to elicit information regarding recognition (photographs of food), acceptability (likert 1-5 like/dislike tagged with smiley faces) and consumption of fruits, and vegetables. Pupil's perception of issues and healthy eating.	ANOVA, Tukey's HSD, and Scheffe post hoc, Independent t-test to test differences in gender	Qualitative data was collated and sorted by age. Fruit more readily recognized. Vegetable recognition increased with age. Fruits were rated higher than vegetables on acceptability. Healthy eating was associated with eating a balanced diet, with fruits and vegetables. Importance of eating fruit and vegetables; to be healthy and provide the vitamins needed to have a healthy life.	Strength: Content validity of measures established. Limitation: Older age group. Categories were predefined. Gender of participants not presented.
Giskes, K., Patterson, C., Turrell, G., & Newman, B. (2005). Health	Brisbane, Australia	29 13- to 15-year-olds (16 boys, 13 girls)	Face-to-face semi-structured interview. Following the completion of the	Chi-square and Nudist Body and functional notions of	Health was related to physical body and functional capabilities. Health influenced by	Strength: Get's at cognitive constructs related to diet and health.

and nutrition beliefs and perceptions of Brisbane adolescents. *Nutrition and Dietetics, 62,* 69-75.			interview guide, children were asked to provide justification for their answers.	health. Health as an outcome of behavior. Importance of the individual. Describing a healthy diet: characteristics of the whole diet, describing a healthy diet: foods or food groups, describing a healthy diet: nutrient intact, Barriers to healthy eating	lifestyle behaviors. Exercise and dietary factors important influences. Influence of parents, social networks, and advertising, and own attitude. Healthy diet characteristics of the whole diet, food or food groups, and nutrient intake, balance and moderation. Fruit and vegetables important. Low-fat intake. Barriers included personal, social, and structural factors (taste and convenience).	Inter-rater reliability established (> 70% agreement). Limitation: Age group.
Gracey, D. Stanley, N., Burke, V., Corti, B., & Beilin, L. J. (1996). Nutritional knowledge, beliefs and	Australia	391 15- to 16-years-old 110 low SES 120 private school 202 High SES (191 boys, 200 girls)	Questionnaire 83 items 16 item food intake 22 item food variety 1 item body image 1eating habits 6 point Likert	Mann-Whitney U or Kruskal-Wallis to compare interval data between groups, Chi-square for categorical	391 completed questionnaires Weight control, improving appearance, lowering cholesterol, increasing energy, feeling good and	Strength: Theoretical background based on transtheoretical model of behavior change. Internal reliability of measures

behaviors in teenage school students. *Health Education Research, 11*(2), 187-204.				data, Cronbach's alpha to determine internal reliability	improving health were important health values. Barriers included availability of healthy food at home and school canteen. Lack of control over food at home. Ignorance about nutrient content for girls.	established. Identifies differences by SES
Hart, K. H., Bishop, J. A., & Truby, H. (2002). An investigation into school children's knowledge and awareness of food and nutrition. *Journal of Human Nutrition and Dietetics*, *15*, 129-140.	Surrey, UK	114 7- to 11- year-olds (equal number of boys and girls)	Focus groups with semi-structured discussion: imposition of food rules in the home, children's understanding of classification as good or bad, concepts of food grouping schemes, recognition of diet-disease links (tooth decay and obesity)	Thematic analysis of four topic areas	Food rules had 7 categories including no rules, restrictions, and food deals. Boys had more restrictions. Younger children had food deals. Older children had restrictions. Four food classifications - food-health link, and preference/taste. More girls identify good foods correctly than boys, and moderation, and marketing. Accurate	Strength: States design is qualitative. Inter-rater reliability established by resolving disagreement to have final total agreement. Limitation: Adult criteria used to evaluate information, heterogeneity within age groups.

					identification of foods that damage teeth, and knowledge of foods regarded as energy dense good. Girls more accurate in food identification. Food grouping scheme inconsistent.	
Lin, W., Yang, H-C., Hang, C. M., & Pan, W. H. (2007). Nutritional knowledge, attitude, and behavior of Taiwanese elementary school children. *Asia Pacific Journal of Clinical Nutrition, 16*(S2), 534-546.	Taiwan 9 strata	2417 1st-3rd (654 boys, 545 girls) and 4th-6th graders (642 boys, 576 girls)	Trained interviews collected questionnaire information regarding nutrition knowledge, attitude, nutrition-related eating behavior, restraint eating behavior and general eating habits. Children's Eating Attitude Test, 24 hour recall, nutrition knowledge: nutrients in four food groups, nutrition-disease, nutrient content, balanced diet, attitude 3 point	ANOVA to compare nutrition knowledge, attitude, and behavior among children of different grades, gender, and residence	67.3 – 71.4% correct responses regarding knowledge about nutrition. Favorable attitudes toward nutrition. Restraint was limited. Dietary quality: 9.1-21.2% meet daily requirements. Breakfast consumed by 77.2% to 82.4% of the children. No differences in gender related to knowledge, but by residence. No difference in behavior, attitudes, restraint. Lowest in dietary quality	Strength: Internal reliability and content validity of measures established. Identifies gap between knowledge, attitude, and eating behavior. Limitation: Concern for social desirability in responses. No correlation to height and weight.

			Likert with smiley faces, eating behavior 3 point Likert scale caring about nutrition and external/emotional-cued eating, FFQ		mountain area.	
Nowak, M., & Buttner, P. (2002). Adolescents' food-related beliefs and behaviours: a cross-sectional study. *Nutrition and Dietetics, 59*(4), 244-252.	Children from 4 of 6 private and parochial schools in Townsville Qld.	902 8th (n= 254) (144 boys, 110 girls), 10th (n = 254) (123 boys, 131 girls), 11th (n = 251) (135 boys, 116 girls), 12th (n = 143) grades (85 boys, 58 girls)	Questionnaires regarding food intake, food habits, food and nutrition related beliefs, attitudes, concerns, sources of information about food and nutrition, food and nutrition, nutrition knowledge	Statistical analysis of food intake, beliefs about food and nutrition, food related attitudes, food related attitudes of students who had attempted weight loss, sources of information about food and nutrition, knowledge of minimum food requirement for health	Girls had higher intake of fruits and vegetables than boys. Boys ate breakfast and drank milk more than girls. Older girls ate less cereal and milk and meat. Boy ate high fat savoury foods more than girls. Younger girls ate these foods more often than older girls. Boys ate more sugary foods than girls. 90% believed that food was important to their health. Younger boys also held this belief. No difference in beliefs about fat, sugar, and salt. Students tried to select healthy	Strength: States design of study as cross-sectional. Broad examination of variables around nutrition, association between negative emotions and eating, identification of sources. Theoretical background based on theory of cognitive dissonance. Limitation: No bmi or correlation with weight or height status.

					foods. Significant differences between those who attempted weight loss and those who did not. No difference for nutritive/non-nutritive concern. TV major source of information, as well as parents, class, magazines, and friends. 6% correctly identified requirement from any one of the food groups. Concern for constituents of food related to consumption. Beliefs about food and consumption high. Low consumption of meat. Strong relationship between weight beliefs and weight loss. 31% were trying to loose weight. Belief in reducing meat	

					intake consumed less meat. Beliefs may be more important than knowledge. Food intake related to beliefs and not knowledge.	
Reinehr, T., Kersting, M., Chahada, C., & Andler, W. (2003). Nutritional knowledge of obese compared to non obese children. *Nutrition Research*, *23*, 645-649.	Endocrinology clinic	101 non-obese (48 boys, 53 girls) and 173 obese children 8- to 15-years-old (83 boys, 90 girls)	Questionnaire 22 items energy and fat content of foods, energy requirements and sweetened food	Multiple regression, matched for age, gender, type of school, years of schooling	Obesity and type of school correlated with higher education. No correlation between nutrition knowledge and bmi or gender. Nutrition correlates with age.	Strength: Study includes age, gender, type of school, years of school, bmi, and the degree of overweight is standardized. Behavior not influenced by knowledge. Internal reliability and content validity of measures established. Limitation: Study of facts not mental constructs related to beliefs.

Table II.8

Summary of Studies: School-age and Adolescent Beliefs/Tacit Knowledge about Eating relative to the Concept of Childhood Obesity

Author/ Year	Population	Sample Size	Methods	Outcome Measures	Results	Critique
Dixon, H. G., Scully, M. L., Wakefield, M. A., White, V. M., & Crawford, D. A. (2007). The effects of television advertisements for junk food versus nutritious food on children's food attitudes and preferences. *Social Science & Medicine, 65*, 1311-1323.	Australia	919 5th and 6th grade (453 boys, 466 girls)	Randomized control trial with pre- and post-test questionnaires. Viewed 20 minute recordings with healthy food advertisements.	Affect to attitude, beliefs and behaviors about health and junk food by TV advertisement	Pre-test cumulative exposure to TV adds. Pre- and post-test after simulation found an increase in attitudes toward healthy food. Attitudes did not change if done at the same time.	Strengths: Study design reported as cross-sectional with randomized control trial. Theoretical background based on Social cognitive theory. Internal reliability of measures reported.
Power, T. G., Bindler, R. C., Goetz, S., & Daratha, K. B. (2010). Obesity prevention in early adolescence: Student, parent, and teacher	Middle school Pacific Northwest, urban, middle class, European-American	7th and 8th grades (5 boys and 11 girls), teachers and parents, 5 boys, 11 girls, 11 teachers, 2 fathers 4 mothers	Qualitative, focus groups	Beliefs about behavior and health: physical activity, preferences, and barriers: dietary habits. preferences, and barriers,	Adolescent understands about health and behavior. Those who ate right, were active and got enough sleep were healthy. Healthy foods were fruits and	Strength: Theoretical framework based on Bronfenbrenner's bioecological model. Inter-rater reliability

views. *Journal of School Health*, *80*(1), 13-19.					vegetables. Identified unhealthy foods. Adolescent attribute their unhealthy behavior to situation. Teachers blame parents, and parents blame teen.	
Williams, K. J., Taylor, C. A., Wolf, K. N., Lawson, R. F., & Crespo, R. (2008). Cultural perceptions of healthy weight in rural Appalachian youth. *Rural and Remote health, Research, Education, Practice and Policy*, *8*(2), 932-945.	Appalachian	16 students in the 9th grade and parents/ caregivers (7 boys, 9 girls)	Qualitative study, focus groups	Cultural perceptions of healthy weight	Physical appearance and input by others influenced perception of health. Adolescents recognized lifestyle contribution to health. They also underestimated weight issue, concern for teasing and eating disorders.	Strength: Inter-rater reliability established.

CHAPTER III

Eliciting Preschool-Age Children's Responses to Reveal their Concepts related to Food and the Organization of these CONCEPTS with those who are obese and those who are of healthy weight

Abstract

PURPOSE: Childhood obesity is often attributed to behaviors related to eating. However, little is known regarding what preschool-age children believe/tacitly know about eating. The purpose of the larger mixed-methods study was to explore preschool-age children's beliefs/tacit knowledge about eating. **BACKGROUND AND SIGNIFICANCE**: Childhood obesity affects nearly 10% of preschool-age children placing them at risk for adverse health consequences. Obesity is often attributed to behaviors associated with eating. Behavior may be partly explained by beliefs/tacit knowledge. However, little is known about what preschool-age children know about eating, or their personal beliefs or concepts related to food that may motivate their eating behavior. This insight is critical given that eating behaviors are established by preschool and being obese at that age is predictive of becoming obese as an adult. **RESEARCH AIMS**: This study aimed to describe the similarities, differences, and patterns in preschool-age children's concepts related to food and the organization of these concepts with those who were obese and those who were of healthy weight. **METHODS**: Free lists and card sorts embedded within an ethnographic interview were used to elicit children's responses. Data from the free lists and cards sorts underwent multiple analyses to examine patterns of similarity and dissimilarity among the children within and between the two groups, as well as the patterns of similarity and dissimilarity among the food items within and between the two groups.

RESULTS: Sixty four- to six-year-old Caucasian children, 30 who were obese and 30 with healthy weight, participated in the study. There were no significant differences in what preschool-age children from both groups typically knew about food. However, there were modest differences in the food items that were representative of each group and there were differences in the organization of each group's concepts related to food. **CONCLUSIONS:** To the best of my knowledge, this is the first study to have combined free lists and card sorts to elicit preschool-age Caucasian children responses to reveal concepts related to food and the organization of these concepts with those who were obese and children who were of healthy weight. Findings from this study have implications for future research, education, and clinical practice.

Introduction

Childhood obesity has tripled over the past 40 years affecting nearly one in ten preschool-age children (Ogden, Carroll, Kit, & Flegal, 2012). Evidence suggests that being obese in childhood places children at risk for adverse health outcomes (Blass, 2008). Obesity is often attributed to behaviors related to eating (Blass, 2008). Behavior is thought to be underpinned and directed by beliefs/tacit knowledge. Eliciting preschool-age children's responses about their beliefs/tacit knowledge will provide insight to concepts related to food and the organization of these concepts that may in part direct and explain their eating behavior.

Researchers investigating children's knowledge about eating and nutrition have focused primarily on factual knowledge of food, nutrition, the body, or health as single concepts, rather than conceptualizing eating as a holistic (social-cultural) event known through personal experience. In addition, the number of children who were obese or the number of children who were of healthy weight who participated in studies has not been reported. Studies focusing on childhood obesity have not included children less than six-years-old as primary informants. Lastly, children from minority populations and low socio-economic status groups have not been included in studies. As a result, little is known about what preschool-age children who are obese and children who are of healthy weight know about eating or their beliefs and concepts related to food. Understanding what preschool-age children believe/tacitly know about eating and food is critical since eating behaviors are established by preschool and being obese at this age is predictive of becoming obese as an adult.

This study aimed to describe the similarities, differences, and patterns of preschool-age Caucasian children's concepts related to food and the organization of these concepts with those who were obese and those who were of healthy weight.

Background and Significance

According to the National Health and Nutrition Examination Survey, childhood obesity, a condition where the child's body mass index (BMI) exceeds the 95th percentile for age and gender (Ogden & Flegal, 2010), has tripled in the last four decades and now affects nearly 16.9% of all children between the ages of two and 19. Moreover, one in every 10 preschool-age children is considered obese (Ogden, et al., 2012). As such, obesity places children at risk for short- and long-term comorbidities that will likely worsen in adulthood (Blass, 2008; Ogden, Carroll, Curtin, Lamb, & Flegal, 2010; Zappalla, 2010).

Many factors have been identified that contribute to the development of childhood obesity; however, obesity is often attributed to behaviors of eating either large quantities of food and/or consuming calorically dense nutrient poor foods (Blass, 2008). Given that behavior is thought to be underpinned and motivated by a person's beliefs/tacit knowledge suggests that what preschool-age children believe/know about food will in part direct and account for their eating behavior.

Beliefs

Beliefs are cognitive representations (concepts) constructed in reference to meaning that has been given to personal experiences, which are regarded as being true (Bar-Tal, 2000; Bartsch & Wellman, 1995) and represent what people think and come to know, i.e., tacit knowledge (Ajzen & Fishbein, 1973; Bartsch & Wellman, 1995; Fishbein & Ajzen, 1975). As such, beliefs/tacit knowledge play a critical role in reasoning, intentions, and behavior (action) (Bartsch & Wellman 1989; Fazio, 1986; Malle, 2001; Mele, 2001) by serving as a foundation from which judgments, conclusions, and decisions are made (Malle & Knobe, 2001; Malle, Moses, & Baldwin, 2001). Some scholars have also suggested that beliefs/tacit knowledge create one's social reality, which in turn, will likely influence their behavior (Pearce & Cronen, 1980; Solos, 2005).

Beliefs/tacit knowledge are communicated primarily within the context of the family environment when children and their parents exchange verbal and non-verbal messages during social interaction (Maccoby, 1980). Beliefs/tacit knowledge can be communicated directly through instruction when parents tell their children something and also when information is acquired from outside sources, like the media. Beliefs/tacit knowledge are also communicated vicariously through the observation of others' behaviors, such as watching parents eat, as well as by noting the foods that parents provide for their family to eat (McCaffee, 2003). In the end, beliefs/tacit knowledge are thought to be internalized when children imitate what they have observed (Maccoby, 1980).

Children also contribute to the exchange of messages through their language and behavior physiologically grounded in preferences for sweet and salty foods, as well as their resistance to the introduction of new foods (Blass, 2008). It is therefore hypothesized that the reciprocal exchange of verbal and non-verbal messages between children and their parent(s) contributes to the child's acquisition of beliefs/tacit knowledge about eating (see Figure A.2).

Eating

Eating is a complex phenomenon comprised of four interrelated concepts and is defined as a process by which an edible substance (food) is consumed for the purposes of obtaining nutrients (nutrition) to meet physiologic requirements (the body) in maintaining and sustaining life (health), as well as fulfilling psychological and emotional desires (Rozin, 1990; Wellman & Johnson, 1982). These concepts have provided a framework for much of the research on eating; however, it is unclear whether these concepts associated with eating, and their relationships, or the organization of these concepts are similar for children who are obese and children who are of healthy weight.

To determine the ability of children to distinguish a substance as edible, developmental psychologists have tested three theories suggesting that edibleness is based on categorizing a substance as disgusting: (a) defined by its taste, as a consequences of having eaten it, or the meaning associated with the origin of the substance (Fallon, Rozin, & Pliner, 1984; Rozin, 1990; Rozin & Fallon, 1980; Rozin, Fallon, & Augustoni-Ziskind, 1985, 1986; Rozin, Hammer, Oster, Horowitz, & Marmora, 1986), (b) being contaminated (Siegal & Share, 1990; Toyama, 2000a), or (c) appearing to be dangerous (Krause & Saarnio, 1993). Children by the age of three were found to determine edibleness by classifying food as disgusting (Fallon et al., 1984; Rozin, 1990; Rozin et al., 1985, 1986; Rozin & Fallon, 1980) or physically contaminated (Siegal & Share, 1990) and by the age of four, children determined edibleness by what was socially considered contaminated (Toyama, 2000a) or having the appearance of being dangerous (Krause & Saarnio, 1993).

Preschool-age Children's Beliefs/Tacit Knowledge about Eating

Researchers have studied preschool-age children's beliefs/tacit knowledge and their understanding of food, nutrition, the body, health, and the relationships between these constructs by comparing their responses and explanations to those given by adults. Children as young as three-years-old were shown to understand the nutritional value of food (Nguyen, 2007a, b) and to associate the quantity of food with growth and the quality of food with energy (Slaughter & Ting, 2010; Wellman & Johnson, 1982). Similarly, children in kindergarten were found to recognize the relationship between food, growth, and health (Wellman & Johnson, 1982). Lastly, four-year-old children were shown to recognize that food undergoes changes within the body and provides the resources needed for growth (Toyama, 2000b). Teixeira (2000) concluded that children in this age group were able to provide these explanations due to their daily experiences with eating.

Preschool-age and School-age Children's, and Adolescent's Declarative Knowledge about Food, Nutrition, and Health

Unlike studies focusing on beliefs/tacit knowledge, research has been conducted to determine preschool-age and school-age children's, and adolescents' factual knowledge of food, nutrition, and health. Children who were four years old and older were found to correctly classify food according to its nutritional value (healthy/ unhealthy) (Nemet, Perez, Reges, & Eliakim, 2007; Zarnowiecki, Dollman, & Sinn, 2011) and similarity (Contento, 1981; Michela & Contento, 1984). School-age children and adolescents were more likely to identify fruits than vegetables and they preferred fruits to vegetables (Edwards & Hartwell, 2002). Interestingly, girls of all ages were shown to be more knowledgeable about nutrition and its relationship to health than were boys (Hart, Bishop, & Truby, 2002; Nemet et al., 2007). Moreover, preschool-age and school-age children were found to associate eating good food, such as fruits and vegetables, with being healthy (Almqvist, Hellnas, Stefansson, & Granlund, 2006; Eiser, Patterson, & Eiser, 1983; Goldman, Whittney-Saltiel, Granger, & Rodin, 1991; Maheady, 1986). In contrast, adolescents defined their health based on the physical appearance and peer appraisal (Giskes, Patterson, Turrell, & Newman, 2005; Gracey, Stanley, Burke, Corti, & Beilin, 1996). Lastly, nutritional knowledge was found to be associated with the community where children lived (Lin, Yang, Hang, & Pan, 2007) and the type of school they attended (Reinehr, Kersting, Chahada, & Andler, 2003).

Beliefs/tacit Knowledge relative to the Concept of Childhood Obesity

Few studies have investigated school-age children's and adolescents' beliefs/tacit knowledge relative to the concept of childhood obesity. Results from these studies are similar to those examining children's factual knowledge of food, nutrition, and health; that is, adolescents were shown to define their health based on their physical appearance and peer appraisal (Giskes et al., 2005; Gracey et al., 1996). In addition, school-age children and adolescents were shown to recognize the role that peers (Williams, Taylor, Wolf, Lawson, & Crespo, 2008) and the media play in influencing their eating behaviors (Dixon, Scully, Wakefield, White, & Crawford, 2007). This age group also recognized barriers to eating healthily. Barriers they identified included the availability of and access to healthy food, as well as a lack of money to purchase healthy food (Gracey et al., 1986; Powers, Bindler, Goetz, & Daratha, 2010). Lastly, school-age children and adolescents were also found to recognize the relationship between their diet and obesity (Power et al., 2010; Williams et al., 2008).

Evidence from the literature has contributed to having a better understanding of preschool-age and school-age children's and adolescents' beliefs/tacit knowledge and declarative knowledge about eating and nutrition. However, there are several gaps. Data have not been collected from children less than six-years-old as primary informants in studies addressing childhood obesity. The number of children who were obese and the number of children who were of healthy weight have not been included in the description of the sample or analysis of the data in many of these studies. Studies have also not included children from minority and low socio-economic groups. A review of the literature confirmed a lack of studies regarding children's beliefs/tacit knowledge and declarative knowledge about eating across cultural groups. These gaps support the need for further studies.

Theoretical Framework

Three theories have been brought together to serve as the theoretical framework that guides this exploratory mixed-methods study.

Theory of Mind

The theory of mind posits that children like adults construct a conceptual framework of beliefs and desires to interpret, explain, and predict human behavior (Bartsch & Wellman, 1989, 1995; Morris, Ames, & Knowles, 2001; Wellman & Bartsch, 1988) (see Figure A.1). Beliefs are cognitive representations or inferences (concepts) made in reference to sensory-motor experiences (perceptions) (H. Wellman, personal communication, October 26, 2011) that are regarded as being true (Bar-Tal, 2000; Bartsch & Wellman, 1995). As such, they represent what people *think* and come to *know* through their personal experiences (**tacit knowledge**) (Ajzen & Fishbein, 1973; Bartsch & Wellman, 1995; Fishbein & Ajzen, 1975). In fact, children use the words, *think* and *know,* in their everyday language by 34 months of age (Bretherton & Beeghly, 1982; Shatz, Wellman, & Silber, 1983) and comprehend their meaning between 36 and 48 months of age (Johnson & Maratsos, 1977; Macnamara, Baker, & Olson, 1976). Notably, beliefs/tacit knowledge play a critical role in reasoning by serving as a foundation from which judgments, conclusions, and decisions are made (Malle & Knobe, 2001; Malle et al., 2001). Some scholars have also suggested that, in addition to being the foundation for reasoning, beliefs/tacit knowledge define an individual's social reality (Pearce & Cronen, 1980; Solos, 2005).

Theory of Naïve Biology

The theory of naïve biology proposes that young children construct a skeletal conceptual framework to explain biological phenomena (Hatano & Inagaki, 1994, 1997; Inagaki, 1990; Inagaki & Hatano, 2004, 2006; Wellman & Gelman, 1992; Wellman & Inagaki, 1997). For example, research testing this theory has shown that young children are able to distinguish living from non-living kinds (Backsheider, Shatz, & Gelman, 1993; Gelman & Gotfried, 1996; Gelman & Kremer, 1991; Rosengren, Gelman, Kalish, & McCromick, 1991), distinguish biological, psychological, and social influences on bodily characteristics and functions, as well as provide explanations for biological events (Inagaki & Hatano, 1993, 2004; Miller & Bartsch, 1997; Morris, Taplin, & Gelman, 2000; Schult & Wellman, 1997). Having a basic cognitive framework of biology is essential to understanding eating, as eating is defined by concepts that are related to and involve biological processes.

General Systems Theory

Lastly, general systems theory developed by von Bertalanffy (1968, p.48, 1975) proposes that a system is comprised of "individual elements and these individual elements collectively interact dynamically to adapt and achieve a steady state." For young children, the family environment serves as a system where parents and children exchange and interpret verbal and non-verbal messages that communicate their beliefs/tacit knowledge during social interaction (Maccoby, 1980). Beliefs/tacit knowledge may be communicated through direct instruction from parents, the acquisition of information from outside sources such as the media, and observation of parental eating behaviors and/or the foods that they provide for their family (McCaffee, 2003). It has been hypothesized that children internalize these beliefs/tacit knowledge during imitation (Maccoby, 1980).

Children also contribute to the exchange of messages through their language and behavior physiologically grounded in preferences for sweet and salty foods, as well as their resistance to the introduction of new foods (Blass, 2008). In the end, the dynamic exchange of messages between children and parents not only communicates each individual's beliefs/tacit knowledge, but also leads to a culture of shared beliefs/tacit knowledge within the family (see Figure A.2).

Pilot Study

A pilot study was conducted and confirmed the feasibility of using free lists and cards sorts with preschool-age children to elicit responses that reveal their concepts of food and the organization of these concepts.

Research Design and Methods

Design

The design of this study is exploratory mixed-methods. Free lists and cards sorts embedded in an ethnographic interview were combined with quantitative analytic procedures (a) to more fully explore and describe (Giddings, 2006) an area not previously studied (Burns & Grove, 2009; Patton, 2002) and (b) to help assure the objectivity, accuracy, and credibility of the findings (Knafl & Howard, 1984; Patton, 2002; Weller & Romney, 1988). Combining these qualitative methods also helped to strengthen the study as the techniques used in ethnography reveal tacit words voiced in everyday life (Molzahn & Shields, 1997; Sandelowski, 2000) that reflect not only the cognitive representations of individuals, but also the structure of these representations, as well as those shared by a group of individuals (culture). These representations, such as beliefs, in turn, are thought to guide their everyday personal and social behavior (Aamodt, 1982; Burns & Grove, 1995; Hammersley & Atkinson, 1993; Leininger, 1987; Robinson, 2013; Romney, Boyd, Moore, Batchelder, & Brazil, 1996; Spradley, 1979).

Dependability (reliability) and confirmability (validity) were assured in this study through systematic and rigorous processes of data collection and data analysis, comparison of the study's findings to prior research (Appleton, 1995; Burns, 1988; Burns & Grove, 2009;

Sandelowski, 1986), audit trails (Lincoln & Guba, 1985; Rodgers & Cowles, 1993), and theoretical, methodological, and analytic triangulation (Miles & Huberman, 1994; Patton, 2002; Sandelowski, 1986).

Transferability is not the goal of qualitative or ethnographic studies. Nonetheless, the themes that emerge when qualitative and ethnographic methods are used should be sufficiently broad and dense to explain the specific conditions and context of the sample and its phenomenon (Denzin & Lincoln, 1994; Maxwell, 1992; Patton, 2002). Transferability of these themes may be achieved after studying multiple applications to similar conditions and context (Maxwell, 1992; Wilson, 1977).

Setting

This study was conducted at a private pediatric health care office located in northwest Ohio. This practice provides health care to children who reside in surrounding rural, urban, and suburban communities. The race and ethnicity of the constituents residing in northwest Ohio are .8-24.8% Black, 1.2-1.5% Asian, 68.9-95.8% White, and 3.3-6.4% Hispanic; while the race and ethnicity of the constituents of southeast Michigan are 2.1-2.4% Black, .5-.64 Asian, 92.3-94.4% White, and 3.1-7.6% Hispanic (http://quickfacs.census.gov/qfd/states).

Interviews were scheduled and conducted in the kitchen area of the pediatric office. This location was not only convenient for parents, but was also familiar to the children. This setting provided a consistent physical and contextual environment to conduct the interview.

Sample

A purposive sample of 60 four- to six-year-old Caucasian children who met the inclusion criteria was recruited for this study. This study was open to children who spoke English, were four- to six-years-old, Caucasian, and had a body mass index (BMI) greater than the 95th percentile for age and sex (n = up to 30) and those who had a BMI less than the 85th percentile for age and sex (n = up to 30). Children who had an underlying genetic syndrome such as Prader-Willi, trisomy 21, or an endocrine disorder, e. g., hypothyroidism, or who were on medications that influences appetite such as periactin, stimulants, antidepressants, or glucose regulating medications, had a social-cognitive communication deficit such as autism or Asperger's syndrome, communication limited to sign language, unintelligible speech, or food allergy were excluded from the study. Children with a BMI between the 85th and 95th percentile for age and sex were also excluded from the study to avoid confusion caused by the potential overlap with tacit beliefs/knowledge held by those who are of healthy weight or those who are obese. Children from minority groups were also excluded to limit the variability in dietary habits to a single cultural group. Inclusion of children from multiple cultural groups would also (1) impact the development of the card sort by requiring that familiar and typical food items for each ethnicity and race be included and (2) the meaningful analysis and interpretation of data to isolate discrete concepts related to food shared by children who are obese and children who are of healthy weight rather than concepts related to food influenced by ethnicity and race. In addition, based on the ethnic and racial composition of constituents in northwest Ohio and southeastern Michigan, it was unlikely that sufficient numbers of children from minorities groups would be achieved to conduct valid and meaningful statistical analysis. Lastly, no studies to date have been conducted with Caucasian children in this age range with those who are obese and those who are of healthy weight to discover and describe their concepts related to food, or describe the similarities, differences, and patterns of these concepts.

Sample size in qualitative and ethnographic studies is based on the depth and quality of the data. Recruitment continued until data collection and saturation was reached (Patton, 2002;

Wilson, 1977). Data obtained from 30 preschool-age children between the ages of four and six for each group also supported basic statistical analysis of the data (Borgatti, 1996; Kruskal, 1964; Pallant, 2007).

Parents were not the primary participants in this study. However, they were involved in the study by providing permission for their child to participate, providing the ethnicity and race of their child, and verifying their child's school attendance and the type of community where they lived.

Measurements and Instruments

Measurements used in this exploratory mixed-methods study included demographic information, and free lists and card sorts that were embedded within an ethnographic interview.

Demographic information included the child's age and birthdate, gender, height, weight, blood pressure, waist circumference, school attendance (kindergarten, preschool, day-care, or not attending), residence (urban, suburban, rural), and ethnicity and race. Height was obtained using a permanently mounted stadiometer by Secca. The stadiometer provides accurate measurement to the nearest half centimeter (www.quickmedical.com). Weight was obtained using a Detecto manual scale. The Detecto manual scale measures weight to the nearest .1 kilogram (www.detecto.com). Blood pressure was obtained using an appropriate size Welch-Allyn aneroid pediatric sphygmomanometer. The Welch-Allyn aneroid pediatric sphygmomanometer accurately measures blood pressure and has a 20-year calibration warranty (www.welchallyn.com). Waist circumference was measured using a non-stretch fiberglass 60 inch (152.6cm) measuring tape (www.perfectmeasuringtape.com) placed half way between the lower rib cage and superior iliac crest (Gopinath et al., 2011). Studies have shown that blood pressure and waist circumference are correlated with body mass index (Gopinath et al., 2011).

The ethnographic interview followed a semi-structured format and incorporated two ethnographic methodologies, free lists and card sort. Free lists, a technique developed by and widely used in the field of anthropology, have been used by multiple disciplines to identify items or semantic and cognitive representations that groups of individuals assign to a category or cultural domain (Brewer, 2002; Schrauf & Sanchez, 2008; Smith, 1993). These lists are analyzed to determine the frequency, order, and salience of each term listed. The total number of items reported is also tallied. Two free lists were generated: a list of food items that preschool-age children thought of and another of the food items they ate (see Appendix B for Ethnographic Interview).

Card sorts are thought to reflect the organization of an individual's cognitive constructs such as beliefs, values, or attitudes around a domain (Bernard, 2002). Cards bearing images or words serve as visual representations to cue recall. Cards are also physical objects that can be manipulated enabling individuals to express their thoughts more easily and clearly (Bowen & Howie, 2002; Fivush, 1994; Nelson & Fivush, 2004). Bowen and Howie (2002) have shown that combining an interview with cards enables young children to express and communicate their thoughts more easily and fully. An unconstrained card sort was used in this study, which allowed preschool-age children to sort cards any way they liked. The unconstrained card sort was followed by the identification of food items on the cards that preschool-age children in the study liked and disliked.

Cards of food items for the unconstrained card sort were developed from free lists generated by Nguyen and Murphy (2003) in their study that examined children's ability to cross-classify foods. Children and parents in their study were asked to list foods based on the classification of food as taxonomy (dairy, fruit), script (breakfast food), or evaluative categories (healthy/junk) (Nguyen & Murphy, 2003). These free listed items were combined with items from Ross and Murphy's study (1999) producing 102 items. Pictures of food items for their study were obtained from the Internet and food products (Nguyen & Murphy, 2003). Ten adults were asked to rate the 102 food items on a scale of 1 (low) to 7 (high) for being familiar and typical. Statistical analysis showed no significant differences between taxonomy, script, or evaluative categories suggesting that the items were both typical and familiar. An additional five adults were asked to rate the visual similarity of items on a scale of 1 (not at all visually similar) to 7 (very visually similar). Results from their responses found that there was no visual similarity between items (Nguyen & Murphy, 2003). Cards of food items for this study consisted of the 73 food items presented in Nguyen and Murphy's 2003 publication. Forty-five (61.6%) of the 73 food items had been used in the pilot study, thus helping to assure dependability.

To create the cards, images of foods were obtained from the Internet. Images were pictures of a single food item presented on a white plate, in a white bowl, or on a white background to control for the influence of color. Fruits were depicted in their natural state, while meats and vegetables were prepared. Each picture was similar in size and centered on a 3 x 5 inch card. Pictures were laser printed onto the cards and laminated. In addition, numbers appeared on the back of the cards to facilitate recording of the pile sort. The final number of cards totaled 73 (see Appendix B for Cards for Sorting Task).

Procedures

Recruitment and Informed Consent

After obtaining approval from the private pediatric office and the University of Michigan Institutional Review Board (IRB), recruitment of children and their parent/primary caregiver began. One hundred forty-four parents with four-to-six year old Caucasian children were invited to participate in the study. Sixty-eight of the children were obese, and 76 children were healthy weight. Twenty-eight mothers and two fathers of children who were obese gave permission for their child to participate in the study. Twenty-nine mothers and one father of children with healthy weight did so. Written permission was obtained from a parent for the child's participation in the study (see Appendix B for Parental Permission). Verbal assent was obtained from the child prior to conducting the research (see Appendix B for Child Assent). Children were provided with information they could understand about the research in accordance with the University of Michigan IRB. Fifteen dollars was given only to children who completed the interview in compensation for their time.

Data Collection and Recording

After obtaining parental permission for their child to participate in the study, the interview was scheduled at the convenience of the child and parent. Parents were present during the interview to support their child. They were requested to remain seated behind their child and not to provide their child with answers to the questions. Data collection commenced at the time of the scheduled interview.

All children participating in the study had their height, weight, blood pressure, and waist circumference measured by the principal investigator at the beginning of the scheduled interview. Prior to collecting any measurements, the manual scale was zeroed and children were asked to remove their shoes. While standing in bare or stocking feet, the child's height was measured twice. The two measurements were then averaged and recorded to the nearest one half centimeter. While still in bare or stocking feet, each child was weighed twice. The two measurements were averaged and recorded to the nearest .1 kilograms. Body mass index was calculated by dividing weight in kilograms by height in meters squared (Ogden et al., 2012). An appropriate size Welch-Allyn aneroid pediatric sphygmomanometer was placed on the child's left arm to obtain each child's blood pressure while standing. Each child's waist circumference was measured twice by placing a 152.3 cm (60 inch) non-stretch fiberglass measuring tape horizontally half way between the lower rib and superior iliac crest over light clothing. The two measurements were averaged and recorded to the nearest .1 centimeters. Calculating the average of repeated measurements is one method to reduce error in assuring reliability of the measurement (Waltz, Strickland, & Lenz, 2010). Children were asked their age and birthdate, and if they attend day care, preschool, or kindergarten, or if they were not attending school. Children were also asked where they lived, in suburban, rural, or urban areas. Parents were asked to provide the ethnicity and race of their child and to verify their child's school attendance and the type of community where they lived.

The interview was estimated to last one hour and could be divided into two sessions for participants' convenience. Only one participant chose to divide their interview into two sessions. After obtaining parent informed consent, verbal assent was obtained from the child. The ethnographic interview was then conducted. The initial prompt of the ethnographic interview asked children to free list all the foods that they could think of. The second prompt asked children to list the foods that they ate. The children were also asked to sort 73 cards containing a picture of a single food item into piles any way they liked. Cards were arranged in the same random order for each of the following interviews. The unconstrained card sort was followed by a prompt asking the children to identify the foods in the card sort that they liked and disliked. Data from all sixty ethnographic interviews were audio-recorded and transcribed verbatim. The number appearing on the back of each card corresponding to each pile was recorded. Schematic drawings of each card sort were sketched. Demographic information, transcribed interviews, free lists, field notes, numbers assigned to cards corresponding to each of the piles, and schematic drawings were maintained in a contextual journal (Rodgers & Cowles, 1993)**.**

Data Management

All data were de-identified. Logs of material with personal identifiers were stored separately from materials with code numbers. After all the data including the ethnographic interviews are transcribed and recorded, the original data will be destroyed. All data were uploaded into a password secure computer file and will be kept indefinitely for future data analysis. No breeches in confidentiality occurred due to identification of abuse or neglect.

Data Analysis

Demographics.

To describe the two groups of children, i.e., those who were obese and those who were of healthy weight, univariate and bivariate descriptive statistics were computed in the Statistical Package for the Social Sciences (SPSS 21). Measures of central tendency (mean, median, mode, and standard deviation) were calculated for age and anthropometric measurements. Frequencies were calculated for gender, the type of community where they lived, and school attendance. Independent-samples t-tests were conducted to compare the mean age and mean anthropometric measurements of male and female children in each group. Chi-square tests for independence (with Yates Continuity Correction) were conducted to assess the association between gender and type of community, gender and schooling, the two groups and type of community where they lived, and the two groups and schooling.

Free lists of food items and lists of foods eaten.

Data preparation.

To prepare the data from free lists for analysis, data were entered in participant-to-item matrices in Excel spreadsheets as ones and zeros (reported and not reported) and as the order (rank, e.g., 1st, 2nd, 3rd) in which the food item had been listed. Food items from both free lists were **normalized** by dividing the rate of being reported as a 1 or 0 by the number of food items in each child's respective list. Lastly, the **salience** or importance or representativeness of each food item was calculated for each child and collectively for each group. Salience was calculated using Smith's equation $((\sum (L-R_j + 1))/L)/N$ (Smith & Borgatti, 1998).

Food items from both free lists were also **reduced** by classifying the food items according to the Euro Food Groups classification system (Ireland et al., 2002). The Euro Food Groups classification system consists of 33 categories in which foods can be classified. This classification system was chosen for three reasons. The Euro Food Groups classification system had a greater number of categories to classify food items compared to the classification system used by the United States Department of Agriculture, which identifies five categories (www.choosemyplate.gov/food-groups), or the University of Michigan Healing Foods Pyramid 2010, which lists 12 healthy food categories (www.umich.edu/umim/food-pyramid). Secondly, the Euro Food Groups classification system was more consistent with the food items that had been listed or listed as eaten by preschool-age children in this study. Lastly, the number of categories presented by the Euro Food Groups classification system supported statistical analysis.

To assure the dependability and confirmability of classifying the free listed food items using the Euro Food Group system, the following modifications were made after being reviewed by a doctoral prepared nurse scientist with expertise in childhood obesity. Twelve categories were eliminated that were inappropriate or not mentioned. These included flour, sugar, sugar excluding chocolate, vegetable oil, margarine, pulses (legumes), beer, wine, alcoholic beverages, offals (organ meats), other milk, and special foods. Four categories were combined: chocolate was combined with sweets/goodies category; roots/potatoes were combined with vegetables; eggs were combined with breakfast food; and cheese was combined with milk to be consistent with the context in which children had talked about these food items. Nine categories were created to accommodate for food items that had been listed by children, but not included in the classification system. These additional categories included non-foods, ethnic foods, combined foods/meals, fast/convenience foods, snacks, healthy, unhealthy, food, and drinks. The final reduced classification system consisted of 28 categories (see Appendix B for Food Classification System).

After each food item was classified into only one category, data were entered into participant-to-item matrices in Excel spreadsheets for each group. Categories were normalized by dividing the number of items in a category by the length of each child's list. These files are referred to as reduced normalized files.

Analysis within each group.

Univariate, bivariate, and multivariate statistical procedures were conducted in SPSS 21 to explore the raw data from both free lists. The mean, median, and mode and frequency of the items in each child's list from both free lists were calculated for the two groups, i.e., list length. Frequencies and mean frequencies for all food items from both free lists were calculated for the two groups. Data from both free lists as raw shared, salience, salience shared, reduced normalized, and reduced normalized shared were uploaded in SPSS 21 and underwent the same analyses.

Exploratory factor analysis using principal component analysis with varimax and direct oblimin rotation was conducted to explore the patterns of relationships between the food items in each group's free lists (food items listed and food items listed as eaten) (Gorsuch, 1988; Nunnally & Bernstein, 1994; Pallant, 2007; Tabachnick & Fidell, 2007) and to determine agreement among the members of each group (Romney, 1999; Romney, Batchelder, & Weller, 1987; Romney, Weller, & Batchelder, 1986; Schrauf, 2002; Schrauf & Sanchez, 2008).

Hierarchical agglomerative cluster analysis, a heuristic technique, was conducted to explore the similarity between the food items that had been listed by each group and the similarity between the children in each group (Bratchell, 1989; Clatworthy, Buick, Hankins, Weinman, & Horne, 2005; Fraley & Raftery, 1998; Gower, 1967; Milligan, & Cooper, 1987). Euclidean and Minkowski methods with single, between, and complete linkage were used to conduct cluster analysis. Minkowski methods with between linkage were selected because Euclidean distance is a special case of Minkowski methods and between linkage accommodates for the analysis of nominal and ordinal data by using the arithmetic mean of the cluster. This is unlike Ward's methods that minimize the variance by using the sum of squared error. Minkowski methods also accommodate quantitative and qualitative data (Blashfield & Aldenderfer, 1988; Cha, 2008; Ichino & Yaguchi, 1994). Lastly, between linkage helped to preserve the structure of the shape, size, and dispersion of data in space (Blashfield & Aldendefer, 1988). Dendrograms, tree diagrams, were also produced to provide visual images of clustering between items, as well as clustering between the children in the two groups (Gower & Ross, 1969; Nunnally & Bernstein, 1994).

Multidimensional scaling was performed using PROXSCAL to explore the dissimilarities in the relationships between food items and the dissimilarities in the relationships between the children in each group. Dis/similarities in relationships between objects are calculated numerically from coefficients in similarity or dissimilarity proximity matrices and then are represented as a point in two-dimensional space (Jaworska & Chupetlovska-Anastasova, 2009; Kruskal, 1964; Torgeson, 1952). Minkowski measurement was also employed to accommodate nominal data by using non-Euclidean distance (MacCallum, 1988).

Analysis between the two groups.

Several analyses were conducted to describe the similarities, differences, and patterns in preschool-age children's concepts of food at both the individual and group level. Independent-samples t-test using the square root of the list length and chi-square tests for independence were conducted to compare the length of the lists between the two groups. Multivariate analysis of variance for Hotelling's t-test (Bernard, 1981; Tabachnick & Fidell, 2007) was conducted to compare the mean frequency of each food item listed in each of the two group's free lists. Independent-samples t-tests with Bonferroni correction (McDonald, 2014) were also conducted to compare the mean frequency of each food item listed in each of the two group's free lists. Chi-square tests for independence (with Yates Continuity Correction) were conducted to compare the frequency of each food item listed in each of the two group's free lists.

Results from exploratory factor analysis of each group were compared heuristically. This included comparing the number of components identified, the amount of variance explained by components with eigenvalues greater than one, the amount of variance explained by the first component, and food items that loaded onto the first, second, and last component.

Results from cluster analysis of preschool-age children in each group and the food items from both free lists were compared heuristically. Dendrograms were visually examined for similarity/dissimilarity in the number of clusters, the food items or children comprising each cluster, and food items or children who differed from a final single cluster (an entity/item). For consistency, the final single cluster and any separate entity/item were used to compare the results of cluster analyses between the two groups.

Results from multidimensional scaling of each group were compared heuristically. This included comparing the spatial relationships of the children in both groups and the spatial relationships of the food items that children from both groups had listed in both free lists.

Another approach to exploring similarities and differences between the two groups was to subtract the mean frequency of each food item listed by children who were of healthy weight from the mean frequency of each food item listed by children who were obese. This calculation represented an index to describe the difference in familiarity.

Reduced normalized files.

Data from reduced normalized files for categories of food items in both free lists underwent additional analyses to identify patterns of association between the categories of food items listed by children in both groups. Reduced normalized data from both free lists for each group were first transposed into category-to-category matrices in Excel. Correlation coefficients from these matrices were converted to z scores by using Fisher's z transformation (1/2 log (1 + r/1 – r) (Silver & Dunlap, 1987). Z scores of children who were of healthy weight were subtracted from the z scores of children who were obese and then divided by the square root of 1/n – 3 + 1/n – 3 (Meng, Rosenthal, & Rubin, 1992; Steiger, 1980). Z scores that were plus or minus 2 standard deviations or greater than ± 1.96 were considered significant.

Scatter plots comparing the two groups were also created using the correlation coefficients from category-to-category matrices for both free lists. These visual representations helped to display patterns of category associations between the two groups that were not apparent in other statistical analyses. Scatter plots were examined for direction, form, strength, and outliers (Math Tutorial: Interpreting Scatter plots, www.youtube.com/watch?v=PE_BpXTyKCE).

Card sort.

Data preparation.

Piles from the unconstrained card sort were initially recorded in schematic drawings and reduced by entering the food items within the piles into cells of tables corresponding to the spatial layout of the card sort. Labels assigned to the piles by the children, as well as their likes and dislikes were recorded. Data from the unconstrained card sort were then entered into American Standard Code for Information Interchange (ASC II file) and uploaded into Anthropac 4.0, a computer software program, for analysis (Borgatti, 1996).

Analysis within each group.

Cluster analysis, multidimensional scaling, and consensus analysis were conducted in Anthropac 4.0 using an ASCII file of data from the unconstrained card sort.

Analysis between the two groups.

Results from consensus analysis, cluster analysis, and multidimensional scaling were compared heuristically.

Foods identified as liked and disliked.

Data preparation.

Food items in the card sort that were identified as liked or disliked were entered as ASCII files for analysis in Anthropac 4.0 and in participant-to-item matrices as ones or zeros (reported, not reported) in Excel files for analysis in SPSS 21.

Analysis within each group.

The mean, median, and mode of the number of items reported by each child as liked or disliked were calculated for both groups. Frequencies and mean frequencies were calculated for all food items that were identified as being liked or disliked for each group.

Food items identified as liked or disliked underwent consensus analysis in Anthropac 4.0 and exploratory factor analysis using principal component analysis with varimax and direct oblimin rotation in SPSS 21 to explore the patterns of relationships between food items for each group (Nunnally & Bernstein, 1994; Pallant, 2007) and to determine agreement among the members of each group. Schrauf and Sanchez (2008) along with others (Romney, 1999; Romney et al., 1986; Romney et al., 1987; Romney et al., 1996; Schrauf, 2002) have suggested that agreement or consensus among the members of a group is met when the data load onto one factor and a 3:1 or greater ratio is present between the first and second factor.

Cluster analysis was conducted in Anthropac 4.0 and SPSS 21 to explore similarities between preschool-age children in each group, as well as the food items they had identified as liked or disliked (Bratchell, 1989; Clatworthy et al., 2005; Fraley & Raftery, 1998; Gower, 1967; Milligan & Cooper, 1987). Euclidean and Minkowski methods with single, average, and complete linkage were used to conduct cluster analysis. Minkowski methods and between linkage were chosen to present the results. Dendrograms were also produced to provide visual representations of clustering between items, as well as clustering between children in each group (Gower & Ross, 1969; Nunnally & Bernstein, 1994).

Multidimensional scaling was conducted in Anthropac 4.0 and SPSS 21 using PROXSCAL to explore the dissimilarities in the relationships between the food items identified as liked and disliked, and the dissimilarities in the relationships between the children in each group.

Analysis between the two groups.

Separate chi-square tests for independence (with Yates Continuity Correction) were conducted to compare the number of items in each child's list that were identified as liked and those that were identified as disliked between the two groups. Separate independent-samples t-tests were conducted to compare the mean list length of food items that were identified as liked and those identified as disliked between the two groups. Independent-samples t-tests with Bonferroni correction were conducted to compare the mean frequency of each of the food items that had been identified as liked and disliked between the two groups. Chi-square tests for independence (with Yates Continuity Correction) were also conducted to compare the frequency by which each food item had been listed as liked and disliked between the two groups.

Results from exploratory factor analysis for each weight status group were compared heuristically. This included comparing the number of components that were factored, the amount of variance explained by components with eigenvalues greater than one, the ratio between the first and second factor, and the food items loading onto the components.

Results from cluster analysis of preschool-age children in both groups and the food items that were identified as liked and those that were identified as disliked were compared heuristically. Dendrograms were visually examined for similarity/dissimilarity in the number of clusters, the food items or children comprising each cluster, and food items or children who were different from the final cluster (an entity/item). For consistency, the final single cluster and any separate entities/items were used to compare the results of cluster analyses between the two groups.

Results from multidimensional scaling of each group were compared heuristically. This included comparing the spatial relationships of the children in both groups and the spatial relationships of the food items that children from both groups had identified as liked and disliked.

Differences in the mean frequency of each food item identified as liked or disliked for each group were calculated by subtracting the mean frequency of each food item identified as liked or disliked by children who were of healthy weight from the mean frequency of each food item listed by children who were obese. This calculation represented an index to describe the difference in preference.

Ethnographic Interview.

Results from the ethnographic interview will be presented elsewhere.

Results

Setting and Sample

The study was conducted from a single pediatric practice located in northwest Ohio from January 23, 2014 to November 24, 2014. The sample was comprised of 60 four-to-six year old Caucasian children of whom 30 (n = 18 males, n = 12 females) were obese and 30 (n = 19 males, n = 11 females) were healthy weight. All parents were present during their child’s interview.

Demographics and Anthropometric Measurements

Nearly one-half (n = 14) of the preschool-age children who were obese resided in urban areas; another 20% (n = 6) lived in rural areas (see Table III.1).

Table III.1 Relationship between Type of Community Where Children Lived and the two Groups

	Obese (n = 30)[a]	Healthy (n = 30)[b,c]
	n (%)	n (%)
Urban	14 (46.7%)	6 (20%)
Suburban	10 (33.3%)	17 (56.7%)
Rural	6 (20%)	7 (23.3%)

[a] χ^2 (2, n = 30 = .073, p = .924, phi .073) gender/residence of children who were obese
[b] χ^2 (2, n = 30 = .268, p = .312, phi .279) gender/residence of children with healthy weight
[c] χ^2 (2, n = 60 = .280, p = .078, phi .279) comparison between the two groups

Thirteen children in this group were enrolled in kindergarten, 11 attended preschool, and four were not participating in any form of schooling (see Table III.2).

Table III.2 Relationship between School Attendance and the two Groups

	Obese (n = 30)[a]	Healthy (n = 30)[b,c]
	n (%)	n (%)
Elementary	13 (43.3%)	9 (30%)
Preschool	11 (36.7%)	17 (56.7%)
Day care	2 (6.7%)	2 (6.7%)
Not attending	4(13.3%)	2(6.7%)

[a] χ^2 (3, n = 30 = .154, p = .87, phi .155) gender/school attendance children who were obese
[b] χ^2 (3, n = 30 = .218, p = .682, phi .224) gender/school attendance children with healthy weight
[c] χ^2 (3, n = 60 = .207, p = .444, phi.211) comparison between the two groups

On average, children who were obese were 62.43 months old (SD = 10.9), were 114.2 centimeters tall, and weighed 28.6 kilograms. The mean waist circumference for this group was 66.9 centimeters. Their mean blood pressure was 94.7/57.2 (see Table III.3). More than one third of preschool-age children who were obese (n = 11, 7 males, 4 females) had a systolic blood pressure reading at or above 100 mm Hg. The National Heart, Lung, and Blood Institute (www.nhlbi.gov/health-pro/guidelines/current/hypertension-pediatric-jnc-4/blood-pressure-tables) identifies a reading above 94, 96, and 98 for four-, five-, and six-year old girls of average height and 97, 98, and 100 for boys of average height as pre-hypertensive.

Table III.3 Comparison of Anthropometric Measurements of the two Groups

	Obese			Healthy		
	Group M (SD) (n = 30)	Male M (SD) (n = 18)	Female M (SD) (n = 12)	Group M (SD) (n = 30	Male M (SD) (n = 19)	Female M (SD) (n = 11)
Age in months	62.45(11.1)	62.11(10.4)	63.25(12.4)	62.70(8.9)	61.95(8.9)	64.00(9.0)
Weight in kg	28.63(8.3)[a]	29.71(10.1)	27.00(4.9)	19.45(2.3)[a]	19.67(1.9)	19.08(2.9)
Height in cm	114.12(8)	114.71(8.5)	113.23(7.3)	110.83(6.3)	111.57(1.3)	109.53(6.9)
Waist circ cm	66.89(10.5)[b]	68.07(12.9)	65.11(5.4)	53.46(2.4)[b]	53.65(1.9)	53.13(3.1)
Systolic BP	94.73(10.1)[c]	95.78(10.1)	93.17(10.4)	83.00(5.7)[c]	83.47(5.5)	82.18(6.1)
Diastolic BP	57.2(10.8)[d]	56.22(8.6)	58.67(13.7)	49.93(8.6)[d]	48.74(7.3)	52.0(10.5)
BMI	21.61(3.6)[e]	22.07(4.4)	20.92(1.8)	15.74(.8)[e]	15.84(.8)	15.79(.9)
BMI percentile	98.30(1.9)[f]	98.44(2.1)	98.08(1.7)	58.73(22.1)[f]	57.00(22.7)	61.7(21.8)
BMI z-score	2.44(.7)[g]	2.6(.8)	2.21(.4)	.23(.6)[g]	.17(.7)	.33(.6)

[a] t (33.264) = 5.786, p = .000 (two-tailed), mean difference = 9.17479, 95% CI: 5.949 to 12.40
[b] t (32.037) = 6.821, p = .000 (two-tailed), mean difference = 13.43, 95% CI: 9.42 to 17.44
[c] t (45.663) = 5.549, p = .000 (two-tailed), mean difference = 11.73, 95% CI: 7.48 to 15.99
[d] t (58) = 2.878, p = .006 (two-tailed), mean difference = 7.27, 95% CI: 2.21 to 12.32
[e] t (31.886) = 8.636, p = .000 (two-tailed), mean difference = 5.86, 95% CI: 4.48 to 7.25
[f] t (29.435) = 9.767, p = .000 (two-tailed), mean difference = 39.57, 95% CI: 31.29 to 47.85
[g] t (58) = 13.024, p = .000 (two-tailed), mean difference = 2.21, 95% CI: 1.87 to 2.55

More than half or 56.7% (n = 17) of the preschool-age children who were of healthy weight lived in suburban areas. Seven children (23.3%) in this group lived in rural communities (see Table III.1). Nine children were enrolled in kindergarten, 17 attended preschool, and two were not participating in any form of schooling (see Table III.2). Preschool-age children who were of healthy weight on average were 62.7 months old, were 110.8 centimeters tall, and weighed 19.5 kilograms. The mean waist circumference of this group was 53.5 centimeters. Their mean blood pressure was 83/49.9 (see Table III.3). No children who were of healthy weight had a systolic blood pressure at or above 100 mm HG.

Independent-samples t-tests of preschool-age children's mean age and mean anthropometric measurements found no significant differences between male and female children in each group. Similarly, chi-square tests for independence for the type of community where children lived (with Yates Continuity Correction) (see Table III.1) and school attendance (see Table III.2) did not find significant differences between male and female children in each group or between the two groups. Results from independent-samples t-tests to compare the mean age between the two groups also found no significant differences. However, independent-samples t-tests to compare the mean anthropometric measurements of each group were significantly different. (See Table III.3) Therefore, each group was treated as a whole.

Free lists

Food items listed.

***Within each group*.**

Preschool-age children who were obese listed a total of 114 food items. The average list length was 8.2 food items (range 0-22, mode 12). Of the 114 items, 53 (46.5%) were core items, i.e., items listed more than once, and 61 (53.5%) items were idiosyncratic, i.e., items listed only once (Borgatti & Everett, 1999).

Preschool-age children who were of healthy weight listed a total of 100 food items. The average list length was 7.9 food items (range 0-22, mode 5). Of the 100 items, 45 (45%) were core items and 55 (55%) were idiosyncratic. (See Table III.4)

Table III.4 Description of Food Items Listed by Children who were obese and Children who were of healthy weight

	Children who are obese	Children who were of healthy weight
Total Number of Food Items Listed	114	100
List Length	Mean 8.2 (range 0-22, mode 12)	Mean 7.9 (range 0-22, mode 5)
Number of Core Items	53	45
Total Number of Idiosyncratic Items	61	55

All food items listed by preschool-age children who were obese and preschool-age children who were of healthy weight underwent principal component analysis. None of the files met the criteria for adequacy, i.e., having a Kaiser-Meyer-Olkin (KMO) greater than 0.6 and a significant Bartlett's sphericity (Pallant, 2007).

Cluster analysis of preschool-age <u>children who were obese</u> using the food items they had listed revealed a final single cluster of 29 children and a separate entity/item comprised of a single child. This child had listed the greatest number of food items (n = 22).

Cluster analysis of preschool-age <u>children who were of healthy weight</u> using the food items they had listed revealed a final single cluster of 29 children and a separate entity/item comprised of a single child. This child had listed the greatest number of food items (n = 22).

Cluster analysis of the <u>food items</u> that preschool-age children who were obese had listed found a final single cluster of 151 food items and three separate entities/items comprised of five food items. Carrots and pizza were each separate items. Bananas, apple, and oranges formed a third separate entity/item.

Cluster analysis of the food items that preschool-age children who were of healthy weight had listed identified a final single cluster of 155 food items and a separate entity/item comprised of a single food item. This food item was pizza. (See Table III.5)

Table III.5 Summary of Findings from Cluster Analysis of Listed Food Items

	Children who were obese	Children who were of healthy weight
Number of Clusters: Children	1 final single cluster of 29 children 1 entity/item – 1 child who had listed 22 items	1 final single cluster of 29 children 1 entity/item – 1 child who had listed 22 items
Number of Clusters: Food Items	1 final single cluster of 151 food items 3 entities/items – carrots; pizza; and bananas, apple, and oranges	1 final single cluster of 155 food items 1 entity/item – pizza

Multidimensional scaling of preschool-age children who were obese relative to the food items they had listed explained 90.1% of the variance and showed that the dis/similarity between children was evenly distributed across two-dimensional space (see Figure B.1).

Multidimensional scaling of preschool-age children who were of healthy weight relative to the foods they had listed did not met the criteria for multidimensional scaling (Normalized raw stress .10463, Tucker's Coefficient of Congruence .94624, dispersion accounted for .89537) (see Figure B.2).

Multidimensional scaling of food items listed by preschool-age children who were obese met the criteria (Normalized raw stress .07662, Tucker's Coefficient of Congruence .961) and showed that 151 food items were centrally distributed which explained 92.5% of the variance.

Pizza, apple, banana, carrots, and broccoli were outliers located at the outer most edges of the configuration (see Figure B.3).

Multidimensional scaling of food items listed by preschool-age children who were of healthy weight met the criteria (Normalized raw stress .06449, Tucker's Coefficient of Congruence .967) and found that some foods appeared to form concentric rings radiating outward from the center. Pizza was the only item outside this central distribution. This model explained 87.5% of the variance (see Figure B.4 and Table III.6).

Table III.6 Summary of Findings from Multidimensional Scaling of Listed Food Items

	Children who were obese	Children who were of healthy weight
Number of outliers: Children	Evenly distributed	Did not meet criteria
Number of outliers: Food items	5 outliers - Pizza, apple, banana, carrots, broccoli	1 outlier – pizza

***Between the two groups*.**

Preschool-age children from both groups free listed a total of 156 food items. No significant differences were found in the length of their lists using either an independent-samples t-test using the square root of the list length, t (58) = -.865, p = .391 or chi-square test for independence (with Yates Continuity Correction), χ^2 (17, n = 60) = 20.18, p = .27, phi = .58.

Visual inspection of the food items that were listed revealed that 58 food items (37.2%) were shared between the two groups; the remaining 98 food items were not shared. Multivariate analysis of variance for Hotelling's t-test did not meet the assumption for homogeneity of variance (Box's Test) (Pallant, 2007, p. 286) and could not be run. Independent-samples t-tests with Bonferroni correction found no statistically significant differences in the mean frequencies of the food items listed by children in each group. Chi-square test for independence (with Yates

Continuity Correction) could not be conducted with 156 items; however, chi-square test for independence of the 58 food items shared between the two groups found that cheese was significantly different, $\chi^2(2, n = 60) = 4.01, p = .045$. Nine children who were of healthy weight had listed cheese, while only two children who were obese had done so.

Cluster analysis of preschool-age children from both groups revealed a final single cluster and a separate entity/item comprised of a single child. These children had listed the most food items. Cluster analysis of food items within the group of children who were obese revealed five separate entities/items: oranges, bananas, apples, carrots, and pizza. Cluster analysis of food items within the group of children who were of healthy weight consistently identified one food item, pizza.

Multidimensional scaling of preschool-age children who were obese were evenly distributed in two-dimensional space. Multidimensional scaling of food items listed by children who were obese located pizza, bananas, apple, carrots, and oranges as outliers. Multidimensional scaling of food items listed by children who were of healthy weight located pizza consistently as an outlier.

Differences in the mean frequency by which food items were listed by preschool-age children who were obese and those who were of healthy weight found that 92 food items were mentioned more often by children who were obese compared to 64 food items that were listed by children who were of healthy weight (see Table B.7).

Food items listed as eaten.

***Within each group*.**

Preschool-age children who were obese listed a total of 101 food items they had eaten. The average list length of foods that were listed as eaten was 6.4 (range 1-11, mode 10). Of the 101 items, 39 (38.6%) were core items and 62 (61.4%) were idiosyncratic.

Preschool-age children who were of healthy weight listed a total of 86 items as food items they had eaten. The average list length of foods that were listed as eaten was 5.2 (range 2-15, mode 4). Of the 86 items, 36 (41.9%) were core items and 50 (58.1%) items were idiosyncratic) (see Table III.7).

Table III.7 Description of Food Items Listed as Eaten by Children who were obese and Children who were of healthy weight

	Children who were obese	Children who were of healthy weight
Total Number of Food Items Listed	101	86
List Length	Mean 6.4 (range 1-11, mode 10)	Mean 5.2 (range 2-15, mode 4)
Total Number of Core Items	39	36
Total Number of Idiosyncratic Items	62	50

All food items listed as eaten by preschool-age children who were obese and preschool-age children who were of healthy weight underwent principal component analysis. None of the files met the criteria of having a KMO greater than .06 and a significant Bartlett’s sphericity (Pallant, 2007, p. 185).

Cluster analysis of preschool-age <u>children who were obese</u> using the food items they had listed as eaten revealed a final single cluster of 29 children and a separate entity/item comprised of a single child. This child had listed the greatest number of foods eaten (n = 11).

Cluster analysis of preschool-age <u>children who were of healthy weight</u> relative to the food items that had been listed as eaten found a final single cluster of 29 children and a separate entity/item comprised of a single child. This child had listed the greatest number of foods eaten (n = 15).

Cluster analysis of the food items that preschool-age children who were obese had listed as eaten revealed a final single cluster of 133 food items and a separate entity/item comprised of one food item. This food item was pizza.

Cluster analysis of the food items that had been listed as eaten by preschool-age children who were of healthy weight revealed a final single cluster of 133 food items and a separate entity/item comprised of one food item. This food item was pizza (see Table III.8).

Table III.8 Summary of Findings from Cluster Analysis of Food Items Listed as Eaten

	Children who were obese	Children who were of healthy weight
Number of Clusters: Children	1 final single cluster of 29 children 1 entity/item – 1 child who had listed 11 items	1 final single cluster of 29 children 1 entity/item – 1 child who had listed 15 items
Number of Clusters: Food Items	1 final single cluster of 133 food items 1 entity/item – pizza	1 final single cluster of 133 food items 1 entity/item – pizza

Multidimensional scaling of preschool-age children who were obese relative to the food items they had listed as eaten met the criteria (Normalized raw stress .00118, Tucker's Coefficient of Congruence .9994) and explained 99.8% of the variance. Multidimensional scaling of children who were obese relative to foods listed as eaten revealed that children who were obese were distributed along the x-axis. Two children were outliers. One child had listed nine food items; the other child had listed three food items (see Figure B.5).

Multidimensional scaling of preschool-age children who were of healthy weight relative to the food items they had listed as eaten did not meet the model criteria for multidimensional scaling (see Figure B.6).

Multidimensional scaling of food items listed as eaten by preschool-age children who were obese met the model criteria (Normalized raw stress .082, Tucker's Coefficient of Congruence .958) and explained 91.7% of the variance. Multidimensional scaling of food items listed as eaten by children who were obese were scattered across two-dimensional space. Water, pizza, and cereal were located outside the central cluster (see Figure B.7).

Multidimensional scaling of food items listed as eaten by preschool-age children who were of healthy weight met the model criteria (Normalized raw stress .07622, Tucker's Coefficient of Congruence .96114) and explained 92.4% of the variance. Multidimensional scaling of food items listed as eaten by children with healthy weight found that food items were centrally located with some food items appearing to form rings radiating from the center. One food item, pizza, was an outlier (see Figure B.8) (see Table III.9).

Table III.9 Summary of Findings from Multidimensional Scaling of Food Items Listed as Eaten

	Children who were obese	Children who were of healthy weight
Number of outliers: Children	2 outliers – 1 child had listed 9 items, 1 child had listed 3 items	Did not meet criteria
Number of outliers: Food items	3 outliers – water, pizza, cereal	1 outlier – pizza

Between the two groups.

Preschool-age children free listed a total of 134 foods that they had eaten. Independent-samples t-test using the square root of the list length found no significant difference in list length for either group, t (59) = 1.44, p = .16. Chi-square for independence was significant, χ^2 (10, n = 60) = 18.81, p = .04, phi = .560; however, 22 cells had expected counts less than five.

Visual inspection of the two lists showed that 51 food items (38.1%) that had been listed as eaten were shared between the two groups; the other 83 food items were not shared.

Multivariate analysis of variance for Hotelling's t-test did not meet the criteria for equality of covariance matrices or error variances to conduct (Box's Test) (Pallant, 2007, p. 286) and could not be run. Independent-samples t-tests with Bonferroni correction found no statistically significant differences in the mean frequencies of the food items listed by children in each group. Chi-square test for independence (with Yates Continuity Correction) using the 51 shared items found no significant differences in the frequencies of the food items listed as eaten.

Cluster analysis of preschool-age children from both groups relative to the food groups they had eaten revealed a final single cluster and a separate entity/item comprised of a single child. These children had listed the most food items that were eaten. Cluster analysis of the food items listed as eaten by children from both groups revealed a final single cluster and a separate entity/item comprised of a single food item. This item was pizza.

Multidimensional scaling of preschool-age children who were obese relative to the food items they had listed as eaten located two children as an outlier. One child had listed nine food items and the other child listed three. Multidimensional scaling of preschool-age children who were of healthy weight relative to the foods they ate did not meet the model criteria.

Multidimensional scaling of data regarding the food items that had been listed as eaten by preschool-age children who were obese identified three food items as outliers. These included water, pizza, and cereal. Multidimensional scaling of food items listed as eaten by preschool-age children who were of healthy weight identified pizza as the only outlier.

Differences in the means by which food items had been listed as eaten by preschool-age children who were obese and preschool-age children who were of healthy weight found that 83 food items were mentioned more often by children who were obese, whereas 51 food items were mentioned more often by children who were of healthy weight (see Table B.11).

Results from the analysis of raw shared, salience, salience shared, reduced normalized, and reduced normalized shared data were not significantly different than those from the analysis of raw data and are not presented in the body of this manuscript. The results are presented in Appendix B. (See Table B.3, Table B.4, Table B.5, Table B.6, Table B.7, Table B.8, Table B.9, Figure B.9, Table B.10, Table B.11 and Figure B.10)

Card Sort

Unconstrained

***Within each group*.**

Preschool-age children who were obese created a mean of 8.6 piles (range 1-58, mode 2) in the unconstrained card sort. Over half of the children (n = 18, 60%) assigned labels to each of the piles they had sorted. Six children who were obese (20%) labeled their piles according to likes and dislikes. One child who was obese (3.3%) labeled the piles as doesn't eat and eats. Two children combined the labels of like and dislike with doesn't eat and eats. Five children who were obese (16.7%) labeled the piles they had sorted using a combination of color, shape, physical property (liquid) of the food, taxonomy (fruit, snack, or dessert), script (a classification associated with familiar events such as breakfast, lunch, and dinner), and/or plating of food (how food is served, e.g., in a bowl). Four children who were obese (13.3%) labeled their piles as healthy and unhealthy. Twelve children who were obese (40%) did not assign labels to the piles they had sorted.

Preschool-age children who were of healthy weight created a mean of 7.8 piles (range 1-39, mode 2) in the unconstrained card sort. Over half of the children (n = 16, 53.3%) assigned labels to the piles they had created. Seven children who were of healthy weight (23.3%) labeled their piles as healthy and unhealthy. Three children who were of healthy weight (10%) labeled the piles as liked and disliked. Four children who were of healthy weight (13.3%) labeled the piles in the card sort using a combination of classifications including taxonomy, association with significant individuals, food preparation (cook), script, and what the foods in the piles were made with, of, or from such as wheat or peanuts. One child who was of healthy weight (3.3%) labeled the piles according to the effort required to eat the food (soft/hard to chew), while another child who was of healthy weight (3.3%) labeled the piles in association with their mother, father (for grown up's), and themselves. Fourteen children who were of healthy weight (46.7%) did not assign a label to the piles they had sorted (see Table III.10).

Table III.10 Number of Children who assigned Labels to Piles in Unconstrained Card Sort

Labels	Number of children who were obese who assigned the label	Number of children who were of healthy weight who assigned the label
Healthy/Unhealthy (good for you)	4	7
Liked/Disliked Eats/Doesn't eat	9	3
Color, shape, physical property, script, plating, and taxonomy	5	0
Taxonomy, script, association with significant individuals, food preparation, made with, of, or from	0	4
For grown ups	0	1
Soft to eat/hard to eat	0	1
Unlabeled piles	12	14

Using Anthropac 4.0, cluster analysis of food items from the card sorts by preschool-age children who were obese and preschool-age children who were of healthy weight found that the majority of items clustered together. Multidimensional scaling of the food items met the model criteria (stress .112, .146 respectively) and showed that items ten through 73 were centrally located in two-dimensional space. The first nine food items, however, appeared separately. These food items included cream cheese, pancakes, oranges, peanut butter, candy, eggs, brownie, spinach, and bagels.

Analysis for agreement or consensus among preschool-age children in both groups relative to their card sort in Anthropac 4.0 did not meet the model criteria.

***Between the two groups*.**

An independent-samples t-test with Bonferroni correction found no statistically significant difference in the mean number of piles that each child from both groups had sorted the 73 cards, t (58) = .262, p = .794.

Cluster analysis of the food items from the card sort had similar results for both groups, as did the multidimensional scaling. Analysis for agreement among preschool-age children in both groups relative to their card sorts was not met.

Food items identified as liked and disliked.

***Within each group*.**

All preschool-age children who were obese and all preschool-age children who were of healthy weight identified the food items in the card sort that they liked and those they disliked.

The mean number of food items in the card sort identified as liked by preschool-age children who were obese was 57.3 (range 39-73, mode 50). The mean number of food items in the card sort identified as disliked by children who were obese was 14.8 (range 0-34, mode 9).

The mean number of food items in the card sort identified as liked by preschool-age children who were of healthy weight was 50.1 (range 6-73, mode 71). The mean number of food items in the card sort identified as disliked by children who were of healthy weight was 22.9 (range 0-67, mode 2) (see Table III.11).

Table III. 11 Description of food items liked and disliked by Children who were obese and Children who were of healthy weight status

Number of food items	Children who were obese	Children who were of healthy weight
Number of foods items liked	Mean 57.3 (range 39-73, mode 50)	Mean 50.1 (range 6-73, mode 71)
Number of foods items disliked	Mean 14.8 (range 0-34, mode 9)	Mean 22.9 (range 0-67, mode 2)

Frequencies were calculated for all food items that were identified as liked and disliked by each weight status group (see Table B.12 and Table B.13). Food items most frequently liked by preschool-age children who were obese as liked included pancake, corn, banana, apple, and Cheetos, which were listed by all 30 preschool-age children; brownie, crackers, strawberries, cookie, pizza, grapes, and toast were mentioned by 29 preschool-age children; and muffin, watermelon, chips, and orange juice were mentioned by 28 preschool-age children.

Food items most frequently identified as liked by preschool-age children who were of healthy weight included fruit loops, which was mentioned by 27 preschool-age children; pancake, strawberries, watermelon, chips, and chocolate were mentioned by 26 preschool-age children; and pretzels, ice cream, chicken nuggets, crackers, cookie, pizza, and apple were mentioned by 25 preschool-age children. No single food item was identified by *all* preschool-age children who were of healthy weight as being liked.

Food items most frequently identified as disliked by preschool-age children who were obese included stuffing and salmon, which was reported by 19 children, and spinach, mentioned by 17 children.

Food items most frequently identified as disliked by preschool-age children who were of healthy weight included stuffing, mentioned by 19 children, potato, mentioned by 18 children, and pie, cheese cake, green beans, and salmon, mentioned by 17 children.

Using Anthropac 4.0, cluster analysis of food items in the card sort identified as liked or disliked by preschool-age children who were obese and preschool-age children who were of healthy weight found that the majority of food items (n = 64) were centrally clustered. The first nine food items in the card sort were located away from the central cluster.

Cluster analysis of preschool-age children who were obese relative to the foods they liked or disliked using SPSS 21 revealed a final single cluster of 28 children and a separate entity/item comprised of two children. These children had identified a large number of food items that they liked that were disliked by other preschool-age children in their group.

Cluster analysis of preschool-age children who were of healthy weight relative to the foods they liked or disliked using SPSS 21 revealed a final single cluster of 27 children and a separate entity/item comprised of three children. These children had listed 10, 32, and 34 food items that they disliked.

Cluster analysis of the food items identified as liked or disliked by preschool-age children who were obese using SPSS 21 produced a dendrogram containing two clusters. These clusters clearly indicated the food items that were identified as liked and those that were disliked by children who were obese. This dendrogram revealed that stuffing, salmon, spinach, pop, celery, gravy, cream cheese, butter, pie, oatmeal, chocolate pudding, chicken, steak, ham, salad, broccoli, green beans, honey, potatoes, Twinkies, cheese cake, and hamburger were disliked. The remaining 51 food items that formed the second cluster had been identified as liked (see Figure B.11).

Cluster analysis of the food items identified as liked or disliked by preschool-age children who were of healthy weight using SPSS 21 produced a dendrogram containing a final single cluster and a sperate entity/item. This dendrogram clearly identified food items that were liked and those that were disliked by children who were of healthy weight. The only food item that was disliked by children in this group was potato. The remaining 72 food items were liked (see Figure B.12 and Table III.12).

Table III.12 Summary of Cluster Analysis of Food items Liked and Disliked

	Children who were obese	Children who were of healthy weight
Number of clusters: Children	1 final single cluster of 28 children 1 entity/item comprised of 2 children who had listed the most items disliked by other children	1 final single cluster of 27 children 1 entity/item comprised of 3 children who listed 10, 32, and 34 items they disliked
Number of clusters: Food items	1 cluster of 51 items that were liked 1 cluster of 22 items that were disliked	1 final single cluster of 72 items that were liked 1 entity/item consisting of 1 item that was disliked

Consensus analysis of preschool-age children who were obese in Anthropac 4.0 met the model criteria (stress .109) showing that preschool-age children who were obese agreed on the foods that they liked and those they didn't like.

Consensus analysis of preschool-age children with healthy weight in Anthropac 4.0 met the model criteria (stress .100) showing that preschool-age children who were of healthy weight were in agreement regarding the foods that they liked and the foods they disliked.

Multidimensional scaling of preschool-age children who were obese relative to their food preferences in SPSS 21 met the model criteria (normalized raw stress .08792, Tucker's Coefficient of Congruence .955503) and explained 91.2% of the variance. Children who were obese were scattered across two-dimensional space with two children presenting as outliers. These children had listed 31 and 32 food items that were identified as disliked. Twenty of these items were shared between the two children.

Multidimensional scaling of preschool-age children who were of healthy weight relative to their food preferences in SPSS 21 met model criteria (Normalized raw stress .07031, Tucker's Coefficient of Congruence .96420) and explained 92.9% of the variance. Children who were of healthy weight were scattered across two-dimensional space. There were no outliers.

Multidimensional scaling of preschool-age children who were obese relative to the food items they had identified as liked or disliked in Anthropac 4.0 revealed that children were located as points in two-dimensional space. These points were consistent with the labels that the children had assigned to their respective piles. These labels included healthy/unhealthy; like/dislike; color, shape, physical property, script, plating, and taxonomy; and piles that were not labeled. Piles labeled good for you were considered to be equivalent to healthy/unhealthy and were treated as being given a healthy/unhealthy label. Piles labeled eats and doesn't eat were interpreted as being integral to likes and doesn't like and were counted as such. Points were color coded to aid in visually distinguishing the location of clusters in two-dimensional space. Although the label eats and doesn't eat was considered equivalent to likes and dislikes, this label appears in a separate color to add clarity to the graphic display (see Figure B.13).

Multidimensional scaling of preschool-age children who were of healthy weight relative to the food items they identified as liked or disliked revealed that children were located as points in two-dimensional space. These points were consistent with the labels that the children had assigned to their respective piles. These labels included healthy/unhealthy; like/dislike; for grown up's; soft to eat/hard to eat; combination of taxonomy, food preparation, script, association with significant individuals, and made with, of, or from; and piles that were not labeled. Piles labeled good for you were considered equivalent to healthy and unhealthy and were treated as healthy/unhealthy. Labels for the clusters were color coded to aid in visually distinguishing where the clusters were located in two-dimensional space (see Figure B.14).

Multidimensional scaling of the food items identified as liked and disliked by preschool-age children who were obese using SPSS 21 met the model criteria (Normalized raw stress .08762, Tucker's Coefficient of Congruence .955139) and explained 91.2% of the variance. Food items were scattered across two-dimensional space. No outliers were identified.

Multidimensional scaling of the food items identified as liked and disliked by preschool-age children who were of healthy weight using SPSS 21 did not met the model criteria (Normalized raw stress .10493, Tucker's Coefficient of Congruence .04608). This model explained 89.5% of the variance. Food items were scattered across two-dimensional space.

***Between the two groups*.**

Food items identified as liked by both groups included pancake, crackers, strawberries, watermelon, cookie, pizza, apple, and chips. Several other food items with similar frequencies identified as liked by both groups included sausage, broccoli, gravy, chicken nuggets, hamburger, raisins, celery, and chocolate.

Food items identified as disliked by both groups included stuffing and salmon. Other food items with similar frequencies identified as disliked by both groups included spinach, broccoli, chicken nuggets, butter, and chocolate.

A chi-square test for independence (with Yates Continuity Correction) found no significant differences in the number of food items in each child's list identified as liked by both groups, χ^2 (35, n = 60) = 36.33, p = .406, phi = .778. A chi-square test for independence (with Yates Continuity Correction) comparing the number of food items in each child's list identified as disliked by both groups found no significant differences, χ^2 (33, n = 60) = 33.67, p = .435, phi = .749.

Independent-samples t-test comparing the mean list length for food items identified as liked by children from both groups found no significant differences, t (43.51) = 1.788, p = .081. An independent-samples t-test comparing the mean list length for food items identified as disliked by children both groups found no significant differences, t (44.15) = -1.99, p = .053.

A chi-square test for independence (with Yates Continuity correction) comparing the frequency by which each food item was identified as liked and disliked by both groups, however, found ten food items that were significantly different. These food items included peanut butter, brownie, yogurt, muffin, corn, banana, noodles, rolls, Cheetos, and toast (see Table III.13).

Table III.13

Significant Differences in Food Preferences of Children who were obese and Children with healthy weight

Item	Degrees of freedom	n	χ^2	p	phi
Peanut butter	1	60	5.25	.022	-.33
Brownie	1	60	4.71	.03	-.37
Yogurt	1	60	5.25	.02	-.33
Muffin	1	60	6.29	.012	-.364
Corn	1	60	5.88	.015	-.358
Banana	1	60	11.13	.001	-.474
Noodles	1	60	6.05	.014	-.357
Rolls	1	60	5.253	.022	-.333
Cheetos	1	60	8.37	.004	-.420
Toast	2	60	7.12	.008	-.388

An independent-samples t-test with Bonferroni correction comparing the mean frequency of each of the food items that were identified as liked and disliked found two food items that were significantly different between the two groups. Those items were banana, $t(29) = 4.1$, $p = .000$, mean difference .367, 95% CI: .120 to .613, and Cheetos, $t(29) = 3.525$, $p = .001$, mean difference .300, 95% CI: .065 to .535.

Cluster analysis of preschool-age children from both groups relative to the food items they identified as liked and disliked revealed a final single cluster of 28 children who were obese and a separate entity/item comprised of two children. These children had identified several food items they liked that were disliked by other children in their group. Cluster analysis of preschool-age children who were of healthy weight revealed a final single cluster and a separate entity/item comprised of three children. These had identified 10, 32, and 34 food items that they disliked.

Cluster analysis in Anthropac 4.0 of the food items that were liked and disliked was similar. Cream cheese, pancakes, oranges, peanut butter, candy, eggs, brownie, spinach, and bagels were located separately from the remaining food items for both groups. However, in SPSS 21, cluster analysis of the food items that were liked and disliked for both groups clearly showed two distinct groups. Twenty-two items were disliked by preschool-age children who were obese, whereas only one item, potato, was disliked by preschool-age children who were of healthy weight.

Consensus analysis conducted in Anthropac 4.0 found that preschool-age children in both groups were in agreement with other children in their group with regard to the food items they liked and disliked.

Multidimensional scaling of the preschool-age children from both groups in SPSS 21 met the model criteria. Multidimensional scaling of children who were obese identified two children as outliers. These children had identified a similar number of food items that were disliked. Of these food items, they disliked the same 20 items. Multidimensional scaling of children with healthy weight in SPSS 21 were scattered across two-dimensional space.

Multidimensional scaling of preschool-age children from both groups with regard to the food items they identified as liked and disliked in Anthropac 4.0 located the children as points across two-dimensional space. These points were consistent with the labels that had been assigned to piles by both groups in the initial card sort. Both groups used healthy/unhealthy and liked/dislike labels; however, the frequency of healthy/unhealthy was greater for children who were of healthy weight than those who were obese. Conversely, the frequency of liked/disliked was greater among children who were obese. Both groups used food taxonomy (fruit, vegetable) and script as labels; however, children who were obese also used color, shape, plating, and physical property as labels. In contrast, children who were of healthy weight used labels reflecting the association of food with significant individuals, foods for grown- up's, the effort associated with eating foods, food preparation, and made with, of, or from. Lastly, compared to the children who were obese, more children who were of healthy weight did not assign labels to the piles in the card sort (see Table III.10).

Multidimensional scaling of the food items identified by children from both groups were scattered across two-dimensional space. No outliers were identified for either group.

Differences in the mean frequency of the food items identified as liked found that 66 food items were liked by a greater number of preschool-age children who were obese than those identified by preschool-age children who were of healthy weight. Four food items were liked by a greater number of children who were of healthy weight. These food items included stuffing, broccoli, pop, and salmon. No differences were found in the number of children from either group that liked fruit loops, bacon, or butter (see Table B.14).

Differences in the means of food items identified as disliked found that 65 food items were disliked by a greater number of preschool-age children who were of healthy weight than those identified by preschool-age children who were obese. Four food items were disliked by a greater number of children who were obese. These food items included spinach, corn, pop, and salmon. No differences were found in the number of children from either group that disliked sausage, stuffing, fruit loops, and bacon (see Table B.14).

Discussion

This is the first study to have combined free lists and card sorts within an ethnographic interview to elicit preschool-age Caucasian children's responses to reveal their concepts related to food and the organization of these concepts who were obese and children who were of healthy weight. Results from the analysis of free lists in this study found that there were no significant differences in what preschool-age children from both groups typically knew about food and the food they ate. However, there were modest differences in the food items that were representative of each group. Results from the analysis of the card sorting task suggest that children who are obese and children who were of healthy weight organize their concepts related to food differently.

Free lists

Results from this study found no significant differences in what children from both groups typically knew about food or the foods they ate. For example, there were no differences in the two group's mean list length (individual knowledge) or mean frequency of the food items they knew or ate. This is also supported by the fact that the majority of children in both groups were shown to cluster together in cluster analysis and preschool-age children who were obese were evenly distributed across two-dimensional space in multidimensional scaling. Multidimensional scaling of preschool-age children with healthy weight did not meet the criteria suggesting that there be more dimensions or reasons for dissimilarities, or differences in their knowledge of food than what is explored by this method (Groenen & van de Velden, 2004; Kruskal, 1964; Kruskal & Wish, 1978; Sturrok & Rocha, 2000), their knowledge lacks cohesion, other exploratory methods may be more useful in assessing their knowledge, or the sample size was too small. Cluster analysis and multidimensional scaling also revealed that children who were more knowledgeable than other members of the group were present in both groups. The number of children who were more knowledgeable in each group was similar.

However, the food items identified in cluster analysis and multidimensional scaling differed for the two groups. For example, food items identified in cluster analysis for preschool-age children who were obese included oranges, bananas, apples, carrots, and pizza, whereas the food item identified for preschool-age children who were of healthy weight was pizza. In other words, children who were obese listed five items comprised of two fruits, a vegetable, and a combined food, whereas children with healthy weight listed one item comprised of a combined food. These findings not only support the breadth of knowledge regarding food items among children who are obese compared to preschool-age children who were of healthy weight (Borgatti, 1998; Ross, 2004), but they may also suggest that the later group's knowledge is somehow constrained (Hatano & Inagaki, 2000).

One possible explanation for this constraint may be that expectations and sanctions or rules had been established about eating food for children who were of healthy weight. Alternatively, this may suggest that few or no boundaries about eating food had been established for children who were obese. These findings are also contrary to eating behaviors often been cited as contributing to obesity, i.e., the consumption of non-nutritious, energy dense foods (Blass, 2008). Another interesting observation is the fact that one food item, pizza, was common to both groups. Finding that pizza was salient to both groups, yet the other food items for children who were obese and those who were of healthy weight differed, may underscore the variability in the food items that children know and eat. These differences suggest the need for further study.

Another plausible reason for the modest differences in knowledge held by preschool-age children who were obese about food items may be explained by familiarity. Familiarity has been described as knowledge about an object, event, or person that has been attained through experiences with that object, event, or person (Aldridge, Dovey, & Halford, 2009; Zajonc, 2001). Knowledge about an object (familiarity) is also attained through language used by individuals in everyday social interaction, (Boster, 1986; Hatano & Inagaki, 2005; Ross, 2004; Ross, Medlin, Coley, & Atran, 2003). As such, individuals who have had more personal and social experiences are likely to be knowledgeable and culturally competent (Borgatti, 1998; Ross, 2004). Translating this premise to the current study's findings suggests that children who were obese were more likely to have had more experiences with food. It also suggests that exploring what parents talk about in relationship to food and eating, and the context in which they do, may reveal how children learn to think about eating and the food they eat in response to what they have learned.

Other reasons for the modest differences in the food items that were representative of each group are unclear. It is uncertain if this may be due to being exposed to a greater number and variety of food items during the introduction of solid foods or the lack there of, the number of individuals present at meals, the number and variety of items presented at a meal, portion size, or if this is in response to parental concerns about their child's weight status. Moreover, this may be due to any number of combinations of the aforementioned possibilities, or none of them. For example, several studies since Davis's seminal study in 1928 have shown that when food is presented with an array of foods or food items of various shapes, food intake is increased regardless of food preferences (Davis, 1928; Nicklaus, Boggio, Chabanet, & Issanchou, 2005; Rolls, 1886; Rolls et al., 1981; Skinner, Carruth, Bounds, Ziegler, & Reidy, 2002). However, no studies have been located that investigated the number of food items presented at mealtimes to children who are obese. Other studies have shown that parents pressure children to eat certain foods (Costa, Pino, & Friedman, 2011; Hennessy, Hughes, Goldberg, & Hyatt, 2010; Jansen, Roza, & Jaddoe, 2012; Joyce & Zimmer-Gembeck, 2009; Mallan et al., 2014; Rodgers et al., 2013), they monitor their child's eating behavior (Sealy & Farmer, 2011), they restrict foods (Rifas-Shiman et al., 2011), or they control what and when their child eats (Cachelin & Thompson, 2013; Johannsen, Johannsen, & Specker, 2012; McPhie et al., 2011; Polfus & Frenn, 2012; Webber, Cooke, Hill, & Wardel, 2010) when they are concerned about their child's weight. These parental behaviors, in turn, have been shown to negatively impact children's body mass index. Lastly, a limited number of studies have shown that increased portion size does not increase the amount of food consumed by three-year-old children; however, increased portion size does increase the amount of food consumed by five-year-old children (Birch, Engell, & Rolls, 2000; Fisher, Rolls, & Birch, 2003). These possibilities also indicate the need for further research.

Findings from this study also suggest that there was no relationship between body mass index and what children in either group typically knew about food. These findings are somewhat similar to those found by others (Nemet et al., 2007; Reinehr et al., 2003) suggesting that there was no association between declarative knowledge of eating and nutrition and body mass index.

Card sort

Results from this study suggest that preschool-age children who were obese and preschool-age children with healthy weight organize their concepts related to food differently. Each group's conceptual organization was comprised of labels that represented the attributes children had assigned to or associated with the food items in each of the piles in the unconstrained card sort. In other words, these attributes reflected what children had inferred from their experience with food, i.e., their beliefs. Some of the labels, such as healthy/unhealthy, like/dislike, taxonomy, and script, were shared between the two groups, while other labels were not.

Labels used by children in this study are similar to those identified by Michela and Contento (1984) in their study where children were asked to group similar food items together. Children's responses were then coded using categories that they had developed from their prior work. These categories included taxonomy, texture, function (script), nutritional quality (healthy/unhealthy), food unknown/never tasted, preference (like/dislike), and miscellaneous (made with, baked things). Children in the current study, however, also used color, shape, plating, physical property, food as soft/hard to chew, food preparation, the association of food with significant individuals, for grown-ups, and food is made with, of, or from. Results from the current study are supported by Michela and Contento's (1984) findings and also extend their work.

The way in which children assigned labels to each pile in the card sort is to some extent contrary to prior anthropological conclusions regarding how individuals use abstract concepts to categorize information. Anthropological researchers have suggested that individuals who are culturally competent or experienced use general or special classification, functional, or utilitarian concepts, while individuals with less experience use goal-oriented and morphological concepts or superficial qualities (Boster & Johnson, 1989; Chi, 1983; Johnson, Mervis, & Boster, 1992; Medin, Ross, Atran, Burnett, & Blok, 2002; Ross, et al., 2003) in determining the strength and similarity between objects (Roach & Lloyd, 1978; Solomon, Medin, & Lynch, 1999). In this study, preschool-age children who were obese used color, shape, and physical property (general classification of morphological concepts) in addition to healthy/unhealthy, like/dislike, taxonomy, script, and plating in constructing their cognitive map related to eating. Preschool-age children who were of healthy weight also used healthy/unhealthy, like/dislike, taxonomy, and script as labels; however, they included labels that conceptualized food items as being associated with significant individuals, for grown-ups, the effort in eating, its preparation (cooking), and what food is made of, with, or from. These later five conceptualizations seem to be utilitarian or thematic concepts or special classifications, which are contrary to what anthropologists have proposed.

Gobo and Chi (1986) have also suggested that the use of multiple labels may reflect a lack of cohesiveness in the organization of concepts used by children who lack experience. They suggest that children who are experienced possess and use concepts that are cognitively linked together, whereas children with less experience may use a variety of perceptual features and concepts that are loosely related to describe their knowledge of a domain (Murphy & Wright, 1984). As such, color, shape, and physical property are visual morphological cues that are likely to be conceptually linked and were used by children who were obese. Other plausible reasons for the assignment of labels may be explained by the progression of children's cognitive development from concrete or specific to abstract categorization (Bahn, 1989; Davidson & Freebody, 186; Matheson, Spranger, & Saxe, 2002), domain specific constraints (Hatano & Inagaki, 2000; Hatano & Inagaki, 2005; Vosniadou & Brewer, 1987), the use of basic, subordinate, and superordinate classification, or the use of basic, taxonomic, script, evaluative, or thematic categorization (Nguyen, 2007a,b, 2008; Nguyen & Murphy, 2003; Ross & Murphy, 1999).

A review of the literature relative to the abstract attributes used by preschool-age children who were of healthy weight found few relevant studies. Several studies were found that had been conducted regarding the rite of passage in relation to drinking, but not in relation to the consumption of specific foods. One study did, however, include texture in determining children's preference for lamb chops, rump steak, or sausage (Rose, Laing, Oram, & Hutchinson, 2004). No studies were found that investigated children's preference in relation to making food or to their beliefs. These gaps suggest the need for further research.

Results from this study also found conflicting evidence as to whether or not children who are obese are picky eaters. For example, the dendrogram showed that children who were obese disliked 22 items. This was corroborated by results from cluster analysis which identified two children who had listed the most items not liked by others and results from multidimensional scaling which identified two children who had listed 31 and 32 items that they disliked. Yet, the differences in the mean frequency of food items found that children who were of healthy weight disliked more items than children who were obese. Interestingly, during office visits, mothers with children who are obese often complain that their child is a picky eater. This finding seems contrary to the evidence that children who were obese listed more food items that they knew and ate than children who were of healthy weight. This finding may suggest that familiarity may not be the only factor that contributes to the development of food preferences. In fact, as Zajonc (2001) points out, other factors such as inherent properties of an object, conditioning, imitation, and social pressure to conform are likely to influence preferences. Results from this study also suggest that children within each group were so similar that they were in agreement with the other members of their group with regard to their preferences.

Numerous studies have shown that food preference is related to the number of experiences that a child as an infant, toddler, or preschooler has had with a food item (Birch, 1979; Birch, 1999; Birch & Doub, 2014; Birch & Marlin, 1982). Preference is also an affective reaction at some cognitive level, i.e., an automatic response or an inference with an emotion that is linked to that which is familiar. These reactions are often difficult to put into words; and yet, they are trusted and believed to be true (Lazarus, 1982; Zajonc, 1980).

As Zajonc (2001) has also noted, preferences may also be influenced by other factors, notably sensory input. Numerous studies have been conducted regarding the influence of color, texture, portion size, packaging, shape, flavor, taste, odor, and preparation on the development of food preferences; however, most of these studies have been conducted with adults and only a few have been conducted with preschool-age children. In general, studies with young children have found that portion size (Mathias et al., 2012; Smith, Conroy, Wen, Rui, & Humphries, 2013), the color of packaging (Marshal, Stuart, & Bell, 2006), the color of food (Walsh, Toma, Tuveson, & Sondhi, 1990), the association of color with flavor (Oram et al., 1995), and food preparation (Poelman & Delahunty, 2011; Zeinstra, Koelen, Kok, & de Graaf, 2010), but not shape (Boyer, Laurentz, McCabe, & Kranz, 2012) influence preference and intake. Given these potential challenges, it is even more important to understand the origin of young children's food preferences due to the increasing prevalence of childhood obesity. These challenges may also help to explain why childhood obesity is recalcitrant to interventions.

Lastly, the fact that more children who were obese labeled their piles according to preference and more children who were of healthy weight labeled their piles as healthy/ unhealthy echoes the thorny question that has been raised about factors that underlie the motivation to eat. Is eating more likely to be motivated by preference or goal-orientation for preschool-age children who are obese? Or, is their (children who were obese) preference related to more exposures to a variety of food items or the words that are used within the context of the family to describe food and eating? These questions suggest the need for further research.

There are several strengths to the current study. First, to the best of my knowledge, this is the first study to have combined two ethnographic methodologies to elicit responses from preschool-age children for data collection regarding their concepts related to food and the organization of these concepts. Second, preschool-age children were able to perform both tasks. Third, confirmability, dependability, and neutrality of the findings from this research were assured through theoretical, methodological, and analytical triangulation, audit trails, systematic and rigorous data collection and analysis, and comparing the results of this study to prior research. Lastly, this study has shown that research can be conducted through the primary care setting.

There are several limitations to this study. From a quantitative perspective, had the sample been larger, statistically significant differences may have been found in the type of community where children lived, their list lengths, the number of food items they listed, and the individual food items they listed. The sample, although it was purposive and lent to data saturation, could also be interpreted as a sample of convenience, which can lead to bias. Another limitation to this study is the subjectivity involved in the analysis and interpretation of cluster analysis and multidimensional scaling. This limitation was minimized by triangulating the finding from data analysis and maintaining an audit trail. Lastly, given that the goal of qualitative research is not transferability, but the in-depth and broad description of a phenomenon, findings from this study are not generalizable. Transferability of this study's findings may occur after several replications of the study.

Implications for Practice and Future Research

Results from this study have implications for practice. Implications based on the premise that children learn through language and experience include involving preschool-age children in discussions about eating and urging parents to encourage their preschool-age child help select food items while shopping for groceries and participate in food preparation.

Results from this study also have implications for future research. Future research needs to include replicating this study with another sample with similar demographic characteristics and recruiting a family member who is in charge of meal preparation. Future studies also need to further explore the combined effect of sensory cues that influence preschool-age children's food preference, as well as the language that families use when talking about food and eating. In addition, future studies need to elicit the beliefs/tacit knowledge of preschool-age children from diverse ethnicities and race to reveal their concepts related to food and the organization of these concepts. Ultimately, findings from these studies addressing beliefs/tacit knowledge need to be incorporated into interventions to help young children eat healthfully and assist parents' with their child's eating behaviors.

Conclusions

The purpose of this study was to elicit preschool-age children's responses to reveal their concepts related to food and to describe the similarities, differences, and patterns of these concepts among those who were obese and those with healthy weight. This study found that there were no significant differences in what preschool-age children who were obese or preschool-age children who were of healthy weight typically knew about food. However, the food items that were representative of each group were modestly different and the organization of their concepts related to food also differed.

Analysis of the data also revealed children who were more knowledgeable than other members within each group, as well as the food items that were representative of each group. Contrary to popular beliefs about particular foods being associated with or contributing to the development of obesity, the food items representative of preschool-age children who were obese included fruits, vegetable, and combined food. In contrast, a combined food was the only item representative of preschool-age children with healthy weight.

Lastly, this study found that the organization of concepts related to food of preschool-age children who were obese and those who were of healthy weight differed. Reasons for the differences in the organization of their concepts may be attributed to how children's concepts related to food are influenced by familiarity, preference, stage of conceptual abstraction, classification, and categorization of food.

In conclusion, this was an initial study eliciting preschool-age children's responses to reveal their concepts related to food and the organization of these concepts with those who were obese and children who were of healthy weight. Given the findings from this study and the prevalence of childhood obesity, future research needs to be developed to further investigate children's concepts and beliefs/tacit knowledge within similar and diverse populations, determine sensory factors that influence and predict their preferences, explore the language that families use in talking about food, and develop interventions to promote eating healthfully among preschool-age children who are obese. Findings from this research also need to be incorporated into practice by actively involving preschool-age children who are obese and their parents in discussions and decision-making about food selection and food preparation.

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Chapter IV

An Evaluation of the Feasibility of Using Free Lists and Card Sorts with Preschool-age Children, and the Dependability and Confirmability of these Methodologies and the Data

Introduction: Free lists and card sorts are two elicitation techniques used to reveal the components and structure of a domain. However, few studies have used these techniques with preschool-age children to explore their concepts related to food or the organization of these concepts.

Background: Seven studies found that children were able to complete both tasks revealing their knowledge of food items and their ability to categorize food according to predefined criteria. Two studies used free lists with children eight years old and older to reveal their knowledge of fruits and vegetables. Four studies used card sorts with children three years old and older to determine their ability to sort foods according to preference, nutritional value, or taxonomy. Another study used a card sort to explore how children classified food items according to their similarity.

Research Aims: The purpose of this paper is: (1) to evaluate the feasibility of using free lists and card sorts with preschool-age children, and the dependability and confirmability of these methodologies and the data that they elicit.

Results: Free lists and card sorts were easily completed by preschool-age children. Both methodologies produced a wealth of rich, dependable, and confirmable data. Free lists revealed

the food items that were salient to and representative of this group of children, while the card sorts revealed the organization of their concepts related to food.

Conclusion: Free lists and card sorts are two simple, yet powerful, trustworthy, and complimentary elicitation techniques that can be used with preschool-age children to gain insight into their concepts related to food and the organization of these concepts. Knowing that both methodologies are dependable and confirmable, one can have confidence in the findings from this study.

Introduction

Free lists and card sorts are two elicitation techniques used by multiple disciplines to discover words and/or concepts that reflect the elements, items, or members belonging to a cultural domain (Bernard, 2002; Weller & Romney, 1988), as well as the structure that individuals use to organize their concepts about a domain. These cognitive structures, in turn, guide every day behavior (Aamondt, 1982; Burns & Grove, 1995; Hamersley & Atkinson, 1993; Leininger, 1987; Robinson, 2013; Romney, Boyd, Moore, Batchelder, & Brazill, 1996; Spradley, 1979).

Background Literature

A total of seven studies have used free lists or card sorts with preschool-age and school-age children and adolescents to explore concepts related to food. Two studies used free lists to explore school-age children's and adolescents' knowledge of fruits (Hough & Ferraris, 2010) and vegetables (Morizet, Depezay, Masse, Combris, & Giboreau (2011). One study used a card sort to determine how preschool-age and school-age children spontaneously classified food items according to their similarity (Michela & Contento, 1984). Four studies used card sorts to determine preschool-age and school-age children's ability to classify food items according to predefined criteria, such as nutritional value, the category to which a food item belongs, or personal preference (Nemet, Perez, Reges, & Eliakim, 2007; Nguyen, 2007; Nguyen & Murphy, 2003; Zarnowiecki, Dollman, & Sinn, 2011).

Collectively, investigators who used free lists in their studies found that most children eight years old and older completed the task without any problem. They also found that this method revealed the fruits and vegetables that were familiar to children in this age group (Hough & Ferraris, 2010; Morizet et al., 2011). Researchers who used card sorts found that children who were five to 11 ½ years old could sort pictures of food according to their similarity. Other researchers who also used this methodology found that children who were three years old could correctly classify food items according to the category to which they belonged, their association with special events, and their nutritional value (Nguyen, 2007; Nguyen & Murphy, 2003). Two other research team used pictures of food items displayed on laptop computers. They also found that children between the ages of four and six could classify food items according to their nutritional value (Nemet et al., 2007; Zarnowiecki et al., 2011). In one of these studies, the investigators compared boys' and girls' knowledge of nutrition and found significant differences, i.e., girls obtained higher nutritional scores than boys (Nemet et al., 2007). These investigators also compared children's nutritional knowledge to their body mass index and found no significant differences in the knowledge of children who were of healthy weight and children who were overweight (Nemet et al., 2007).

There are some limitations to these studies. First, there was little or no description of the process in generating, selecting, and presenting food items for the card sorts. One study described the process of generating food items from children's books and free lists. Another team of researchers generated and selected food items from their prior work. Generation, selection, and presentation of food items is critical to assure that the items presented in card sorts are representative of food items that participants are familiar with and are typical of what they eat. As a result, it is unclear in studies using card sorts if participants were recalling food items that were familiar and typical of one dietary culture, or other factors such as ethnicity and race or the appearance of the food items may have influenced their responses. Given this, the confirmability of the results from these studies is questionable. Second, one study incorporated both a free list and card sort; however, no comparison was made between the items in the free list and the items in the card sort to assure the dependability and confirmability of the food items used in the card sort. Third, only one study included children's body mass index. Knowing children's body mass index is important since it is not currently known whether children who are obese and children who are of healthy weight think alike in relation to eating. Lastly, no researchers used free lists with children less than eight years old.

The purpose of this paper is to evaluate the feasibility of using free lists and card sorts with preschool-age children, and the dependability and confirmability of these methodologies and the data that they elicit.

Research Design and Methods

An exploratory mixed-methods study was conducted using free lists and card sorts embedded in an ethnographic interview. Data from the free lists and card sorts were quantitatively analyzed. Results from the ethnographic interview will be presented elsewhere. The study was approved by the University of Michigan Institutional Review Board.

Sample

Sixty four- to six-year-old Caucasian children were enrolled in the current study to explore their beliefs about eating. (See Chapter III for further description of the sample)

Instruments

Two free lists, an elicitation technique used to discover words and/or concepts that reflect items, elements, or members belonging to a cultural domain (Bernard, 2002; Weller & Romney, 1988), were used in this study. Free lists were elicited by asking the children to "Tell me about all the foods you can think of," and "Tell me about what you eat."

Two card sorts, another elicitation technique thought to reflect the organization of concepts, such as beliefs, values, and attitudes (Romney, Boyd, Moore, Batchelder, & Brazill, 1996), were used in this study. The initial card sort was unconstrained. In this card sort, children were asked to sort 73 cards into piles any way that they liked. Following the unconstrained card sort, children were asked to identify the food items in the card sort that they liked and the food items that they didn't like.

Cards bearing pictures of food items for this study were fashioned after the food items that were generated from children's books and free lists in Nguyen and Murphy's study (2003). These food items were shown to be typical of food items that children and parents were familiar with. Pictures of food items for this study were obtained from the Internet. A single food item appeared on a white plate, in a white bowl, or on a white background. Fruits appeared in their natural state, while meat and vegetables were prepared. Each image was centered, similar in size, and was laser printed onto 3 x 5 cards and laminated. (See Chapter III for further description of the development of the card sort)

Procedures

Data Collection

Children were told that the researcher was interested in understanding what children knew about eating and would ask them some questions about what they thought. Children were also told that they would be asked to place pictures of foods into piles and would be asked some questions about their piles. The first question in the interview was to "Tell me about all the foods you could think of." This prompt was followed by the interviewer reading the items back to the child and asking if there were any others. The second question was to "Tell me about what you eat." This question was followed by a prompt asking the children if they could tell me more about that. Following the free lists, children were asked to sort 73 pictures of foods into piles any way they liked. After sorting the cards, the children were then asked to identify the food items in the card sort that they liked and the food items they didn't like.

Data Analysis

Analysis of the raw data for the entire sample of preschool-age children followed the same methodology used to analyze the raw data for preschool-age children who were obese and preschool-age children who who were of healthy weight. (Please see Chapter III data analysis for further detail).

Food items from free lists that matched food items in the card sort were identified and tallied.

Feasibility of both free listed were assessed by the number of children completing the task, the average number of items that were listed by each child, the total number of items listed for the entire group, and the time it took children to complete the task. Dependability of both free lists was assessed by the frequency by which each of the food items were listed, the number of items that were listed by more than one child from each group (core items), the number of items that were listed between the two groups, the number of children reporting similar numbers of core items, and the identification of the same separate entities/items or outliers across multiple analyses. Confirmability of both free lists was assessed by comparing the findings from the current study to prior studies.

Feasibility of both card sorts was assessed by the number of children completing the task, the amount of time it took children to complete the task, comments made by children when approaching the task, the number of piles that were created in the unconstrained card sort, and the number of children who assigned labels to the piles. Dependability was assessed by the similarity in the labels assigned to piles by children from the two groups, the number of times a label was assigned, the frequency by which food items were identified as liked and disliked, and the identification of the same separate entities/items or outliers across multiple analyses. Confirmability of the card sort was assessed by agreement among the group members (consensus analysis), the number of food items from the free lists which appeared in the card sort, and comparison of the results from the current study to prior research.

Results

Free Lists

Feasibility

A total of 57 preschool-age children completed the initial free list of food items that they knew. They listed on average 8.0 food items (range 0-22, SD 4.7) that they knew. The entire group listed 156 food items that they knew. Of these, 18 were fruits and 15 were vegetables. It took children an average of 99.4 seconds (range 3-256 seconds, SD 45.8) to complete this list.

All preschool-age children completed the free list of the food items that they ate. They listed on average 5.8 food items (range 1-15, SD 3.1) that they ate. The entire group listed 134 food items that they ate. Of these, 10 were fruits and 11 were vegetables. It took children an average of 59.5 seconds (range 8-167 seconds, SD 38.6) to complete this list (see Table IV.1). (See Chapter III for further description of the results of the free lists for each group)

Table IV.1

Time Spent in Interview, Free Lists, and Card Sort

	Total Group M (SD)	Obese M (SD)	Healthy M (SD)
Interview (min, s)	25.47 (6.2)	24.97 (8.03)	25.96 (4.31)[a]
Free lists (s)	99.4 (45.8)	98.3 (51.4)	99.9 (40.4)[b]
Foods eaten (s)	59.5 (38.6)	60.6 (38.3)	58.4 (39.5)[c]
Card sort (min, s)	7.32 (3.9)	7.28 (3.23)	7.36 (4.22)

[a] t (45.5) = -.619, p = .539 (two-tailed), mean difference = -.9667, 95%CI: -4.09151 to 2.15818
[b] t (58) = -.809, p = .929 (two-tailed), mean difference = -.1.0667, 95%CI: -21.95874 to 22.82541
[c] t (58) = .219, p = .828 (two tailed), mean difference = 2.200, 05%CI: -17.92141 to 22.3241
[d] t (58) = -.819, p = .416 (two-tailed), mean difference = -.828, 95%CI: -2.85137 to 1.19537

Three children did not complete the initial free. These children either shrugged their shoulders, looked at the interviewer, or shook his/her head no. A limited number of children were also hesitant to participate in the interview when they sat down at the table even though they had been actively engaged in conversation while they had their height and weight measured. A few children wanted their mother to sit beside them or wanted to sit on their parent's lap.

Dependability/Confirmability

The reader is referred to Table C.1 to review the frequency by which food items had been listed as known by preschool-age children who were obese. Fifty-three of these food items (46.5%) were listed by two or more children who were obese. The reader is referred to Table C.2 to review the frequency by which food items had been listed as known by preschool-age children who were of healthy weight. Forty-five of these food items (45%) were listed by two or more children who were of healthy weight. Fifty-eight (37.2%) of the 156 food items that were listed as known were core items (Borgatti & Everett, 1999). The number of children reporting the same number of core food items that were listed as known is reported in Table IV.2.

Table IV.2

Summary of the number of children who listed the same number of core items that were known

Number of core items that were listed as known	Number of children who listed the same number of core items
2	7
3	10
4	10
5	4
6	6
7	5
8	4
9	3
10	2
11	2
12	1
13	1
16	1
22	1
23	1

The reader is referred to Table C.3 to review the frequency by which food items had been listed as eaten by preschool-age children who were obese. Thirty-nine of these food items

(38.2%) were listed by two or more children who were obese. The reader is referred to Table C.4 to review the frequency by which food items had been listed as eaten by preschool-age children who were of healthy weight. Thirty-eight of these food items (41.9%) were listed by two or more children who were of healthy weight. Fifty-one (38.1%) of the 134 food items that were listed as eaten were core food items. The number of children reporting the same number of core food items that were eaten is reported in Table IV.3.

Table IV.3

Summary of the number of children who listed the same number of core items that were eaten

Number of core items that were listed as eaten	Number of children who listed the same number of core items
2	12
3	15
4	5
5	1
6	6
7	1
8	4
9	4
10	1
11	1
17	1

Cluster analysis of the entire group of children relative to the food items that they listed as known revealed a final single cluster and a separate entity/item comprised of two children.

One of these children listed 22 items. This child was obese. The other child listed 14 items. This child was of healthy weight. Cluster analysis of the food items that the entire group of children listed as known revealed a final single cluster and a separate entity/item comprised of one food item. The item was pizza. (See Chapter III for further description of the results from cluster analysis for each group)

Multidimensional scaling of the entire group of children in relation to the food items that they listed as known did not meet the model criteria (Normalized Raw Stress .11319, Tucker's Coefficient of Congruence .94171, and Dispersion Accounted For .88681). Nonetheless, this model located two children as outliers. These children were those identified in cluster analysis as separate entities/items. Multidimensional scaling of the food items that the entire group of children listed as known met the model criteria (Normalized Raw Stress .08709, Tucker's Coefficient of Congruence .95546) and explained 91.3% of the variance. Multidimensional scaling of the food items located pizza, broccoli, apple, and carrots as outliers. (See Chapter III for further description of the results from multidimensional scaling for each group)

Cluster analysis of the entire group of children relative to the food items that they listed as eaten revealed a final single cluster and a separate entity/item comprised of one child. This child listed 15 food items. This child was obese. Cluster analysis of the food items that the entire group of children listed as eaten revealed a final single cluster and a separate entity/item comprised of one food item. This item was pizza. (See Chapter III for further description of the results from cluster analysis for each group)

Multidimensional scaling of entire group of children in relation to the food items that they listed as eaten did not meet the model criteria (Normalized Raw Stress .11319, Tucker's Coefficient of Congruence .94171, and Dispersion Accounted For .88681). Nonetheless, this model located two children as outliers. One of these children listed ten food items. This child was obese. The other child listed eight food items. This child was of healthy weight. Multidimensional scaling of the food items that the entire group of children listed as eaten met the model criteria (Normalized Raw Stress .09894, Tucker's Coefficient of Congruence .94924) and explained 90.1% of the variance. Multidimensional scaling of the food items located pizza as an outlier. (See Chapter III for further description of the results from multidimensional scaling for each group)

Card Sort

Feasibility

All preschool-age children completed both card sorts. It took children an average of 7 minutes 32 seconds (range 2.20 – 18.28, SD 3.90) to complete the unconstrained card sort (see Table IV.1). Children commented: "So, I put them all out and then put them in piles?" "You mean, I just make them in a pile?" "So, I pick a pile of the stuff you eat or like or …," "Should I put them in healthy and not healthy?" "So, should I find the things that I eat?" "Cool." Others said "Look!" and chuckled, while others went about sorting cards. Some children responded "ok." Others said nothing or shook their head yes and began to sort cards. Yet, others spoke or whispered to themselves as they sorted cards. On average, preschool-age children sorted 73 cards in the unconstrained sort into 8.2 piles (range 1-58). Thirty-three sorts contained three or fewer piles, four sorts contained four to six piles, and the remaining 23 sorts contained greater than eight piles. Thirty-four children (56.7%) assigned labels to the piles they had created. (See Chapter III for further description of the results of the unconstrained card sort for each group)

Twenty-six preschool-age children (43.4%) did not assign labels to the piles that they had created. A few children wanted to put the cards back into one pile after they had sorted the cards and needed encouragement to leave the cards in the piles. A few children divided the cards into equal piles and a few children sorted the cards into one pile.

Dependability/Confirmability

The reader is referred to Table III.10 to review the similarity in the labels and the number of times a labels was assigned to the piles by the children in the two groups.

Twelve children (20%) labeled their piles as like and dislike and/or eats and doesn't eat. Eleven children (18.3%) labeled their piles as healthy and unhealthy. Five children (8.3%) labeled the piles they had sorted using a combination of color, shape, physical property (liquid) of the food, the taxonomy of the food (e.g., fruit, snack, or dessert), script (a classification associated with familiar events such as breakfast, lunch, and dinner), and how food is served (e.g., in a bowl). Four children (6.7%) labeled the piles in the card sort using a combination of taxonomy, script, association with significant individuals, food preparation, and what the foods in the piles were made with, of, or from such as wheat or peanuts. One child labeled their piles according to the effort required to eat the food. One child labeled their piles for grown-up's, such as their mother or father. (See Chapter III for further description of the results of the unconstrained card sort for each group)

The reader is referred to Tables B.12 and B.13 for the frequencies of the food items identified as liked and disliked by each weight group. The average number of food items liked by preschool-age children was 53.7 (range 6 to 73). Food items identified as liked by preschool-age children from both groups include pancake, strawberries, watermelon, chips, cookie, pizza, and apple. The average number of food items disliked by children was 18.8 (range 0-67). Food items identified as disliked by preschool-age children from the two groups included salmon.

(See Chapter III for further description of the results from the card sort identifying the food items that were liked and the food items that were disliked)

Cluster analysis of the unconstrained card sort in Anthropac 4.0 for the entire group of children identified a central cluster. The first nine items of the card sort appeared as separate entities. (See Chapter III for further description of cluster analysis of the unconstrained card sort for each group)

Multidimensional scaling of the unconstrained card sort in Anthropac 4.0 did not meet the model criteria (stress .153) (see Figure C.1). (See Chapter III for further description of multidimensional scaling of the unconstrained card sort for each group)

Cluster analysis of the card sort identifying food items that were liked and disliked in Anthropac 4.0 for the entire group identified a central cluster. The first nine items of the card sort appeared as separate entities/items. (See Chapter III for further description of cluster analysis of the successive card sort for each group)

Multidimensional scaling of the card sort identifying food items that were liked and disliked in Anthropac 4.0 for the entire group did not meet the model criteria (stress .110). Three children were identified as outliers. Two of these children were of healthy weight and one child was obese (see Figure C.2). (See Chapter III for further description of multidimensional scaling of the successive card sort for each group)

The reader is referred to Chapter III for further description of consensus analysis of the members of each group with regard to their likes and dislikes.

Fifty-five core food items (75.3%) reported in the free list of food items that were known matched food items that appeared in the card sort (n = 73). Fifty-four core food items (74%)

reported in the free list as eaten matched food items that appeared in the card sort (n = 73). (See Chapter III for further detail of the development of the card sorts)

Discussion

The purpose of this manuscript was (1) to evaluate the feasibility of using free lists and card sorts with preschool-age children, and the dependability and the confirmability of these methodologies and the data that they elicit.

Free Lists: Feasibility, Dependability, and Confirmability

Evidence from this evaluation found that free lists can be used with preschool-age children and the methodology and the data elicited by this methodology are dependable and confirmable. Like school-age children and adolescents in prior studies, the vast majority of preschool-age children in this study completed the task of free listing the food items that they knew and those that they ate. Moreover, the content of their responses and the spontaneity in responding suggest that they understood the request. In addition, the time that it took children in the current study to list the food items that they knew was at most 256 seconds and to list the food items that they ate was 167 seconds. The amount of time to complete either of the free lists in this study is far less than the time (15 minutes) that was allotted for adolescents to write their free lists in Hough and Ferraris' study (2010). The minimal amount of time that it took children to complete the task also suggests that the task required little effort; and as a result, the task was easy to complete. Quinlan (2005) maintains that the short amount of time required to complete free lists is a strength of this methodology.

There were, however, three children (5%) in this study (n = 60) and ten school-age children (7%) in Morizet et al.'s, study (2011) (n = 145) who did not complete the free list. The free list that was not completed in the current study was the first question of the interview, i.e., “Tell me about all the foods you can think of.” Children who did not respond to the request either looked at the interviewer, shrugged their shoulders, or shook their head no. Reasons for why children may not have responded to the initial free list include that the interviewer was someone they did not know, that they needed more time to feel comfortable with the interviewer, that the word *all* caused them to feel overwhelmed, that they chose not to answer the question for any number of reasons, or, as suggested by Brewer (2002) and Brewer, Garrett, and Rinaldi (2002), they did not understand the question. No explanations were offered for why school-age children in Morizet et al.’s (2011) study did not complete the task. Given that the number of children not responding to the first free list in the current study is comparable to the number of older children not completing the task in Morizet et al.’s study is not enough evidence to suggest that free lists may not be useful for data collection with young children.

Evidence showing that the number of food items listed by children and the number of food items that were shared between the two groups of children in the current study is similar to that found in prior studies suggests that free lists elicit considerable amounts of dependable data. In Hough and Ferraris’ study (2010), 15- to 18-year-olds identified 26 fruits. Eleven of these fruits were listed by adolescents from both medium/high and low-income groups in Argentina (Hough & Ferraris, 2010). In Morizet et al.’s study (2011), children who were eight to 11 years old listed 54 vegetables. Children in the current study spontaneously listed 18 fruits and 15 vegetables that they knew and 10 fruits and 11 vegetables that they ate. Further analyses of this data, found that ten of the fruits and seven of the vegetables that were known were listed by both children who were obese and children who were of healthy weight. Six of the fruits and seven of the vegetables that were eaten were also listed by children in the two groups. The fact that a similar numbers of fruits and vegetables were reported by children in the current and prior studies, and that a number of food items were listed by children from two different groups helps to assure the dependability of the current study's findings. The fact that some of the same food items were reported by children from two disparate groups also helps to assure that the data were being retrieved from the same or similar dietary culture (Bell & Valentine, 1997) and strengthens the validity of the findings from this study.

Evidence indicating that the items generated in free lists by children in the current study is similar to those found in a prior study not only suggests that children younger than eight can perform free lists, but the task itself also reveals children's knowledge of food items and is dependable. According to anthropologist, list length reflects an individual's knowledge (Quinlan, 2005; Weller & Romney, 1988). In Morizet et al.'s study (2011), the average list length of vegetables listed by school-age children was five. In the current study, the average list length of food items known by four- to six-year-old children was 8.0. The average list length of food items eaten by the same four- to six-year-olds was 5.8. Showing that the number of items listed by children was similar in the current study and Morizet et al.'s study (2011) not only helps to assure that the findings are dependable, but also helps to establish that the data reported by preschool-age children is confirmable. This finding may also suggest that there may be little difference between preschool-age and school-age children's knowledge of food items.

Like the number of items that were listed and the number of items that were shared between two groups, the frequency by which food items were reported in the current study and prior studies is similar. This finding suggests that free lists identify the food items that are familiar to children. The frequency by which food items were reported and the food items that were most frequently reported is also interesting in a couple of respects. Hough and Ferraris (2010) reported that the food items most frequently listed by adolescents in their study included bananas, oranges, apples, grapes, peach, pear, melon, strawberry, kiwi, mandarin, and watermelon. Morizet et al., (2011) reported that the food items most frequently listed by school-age children included carrots, tomatoes, and lettuce. The food items most frequently listed by preschool-age children in the current study included pizza, carrots, apple, and broccoli. Further analysis of the data found that the food items most frequently listed by children who were obese included apples, carrots, pizza, bananas, and oranges, whereas the food item most frequently listed by children who were of healthy weight was pizza. The only food item listed most frequently as eaten by children whether they were obese or of healthy weight was pizza. It was surprising that similar food items (bananas, apples, oranges, and carrots) were reported by children from around the world.

It was also intriguing that these same items were those most frequently mentioned. According to some anthropologists, the frequency by which items are reported reflects the aggregate knowledge of a group (Borgatti & Everett, 1999). Others have suggested that the food items which are listed most frequently reflect food items that are representative of and/or salient to a group (culture) (Quinlan, 2005; Smith & Borgatti, 1998). Differences in the mean frequency of the food items reported in free lists in the current study also helped to reveal the total number of items that were familiar to each group and verified which food items were more familiar to each group (see Chapter III for differences in the mean frequencies). The frequency by which items were repeatedly listed and the identification of similar food items between these studies helps to assure the dependability and confirmability of the data in the current study.

Lastly, having similar findings across different statistical analyses in this study not only helps to build confidence in the findings, but also helps to affirm that the methodology accurately measures the phenomenon. For example, cluster analysis and multidimensional scaling of the food items listed in free lists in the current study identified the same food items that were different from the other food items within each group and in the entire sample. Their difference was confirmed by examining the frequency by which the food items were listed. Cluster analysis and multidimensional scaling of the children in relation to their free lists revealed children who were different from the other members within each group and in the entire sample. Their difference was confirmed by examining the number of items they had listed, i.e., list length. Comparing the food items that children had listed in each of the corresponding free lists and finding that a number of the food items were listed by children in each of the two groups not only helps to assure the reliability of each item, but also helps to assure that data was retrieved from a similar source. The frequency by which children identified the same number of core items also helps to show that these food items (data) are reliable. This approach is different from that used by Hough and Ferraris (2010) who also used cluster analysis and multidimensional scaling for analysis of their data. However, they did not compare the results from either of the analytic methods to substantiate their findings. In summary, the frequency by which items are reported not only reflects the reliability of the item, but also the familiarity of that item to individuals or groups of individuals (Borgatti & Everitt, 1999). In addition, finding similar results across multiple analyses also helps to assure that the data are reliable. In this case, the food items listed by preschool-age children reflect the food items that were representative of and/or salient to the entire group and to each group.

Card Sorts: Feasibility, Dependability, and Confirmability

Evidence from this evaluation also shows that cards sorts can be used with preschool-age children and the methodology and data elicited by this methodology is dependable and confirmable. All of the children in this study, like those who participated in prior studies, successfully completed both card sorts. Children in prior studies successfully completed the task of sorting food items based on their similarity (Michela & Contento, 1984), taxonomy, script, and evaluative categorization (Nemet et al., 2007; Nguyen, 2007; Nguyen & Murphy, 2003; Zarnowiecki et al., 2011). Two studies (Nguyen, 2005; Nguyen &Murphy, 2003) reported that 15 minutes were allotted to complete the task. In the current study, it took children at most 8 minutes and 21 seconds to sort cards. Children in the current study were also eager to examine the cards. Their comments reflected that they understood the instructions, and when performing the task, they were actively engaged and needed little or no encouragement to complete the task. Interestingly, no other studies have reported children's comments or their non-verbal behaviors to show that they understood what was being asked of them. Regardless, these findings suggest that children in these studies understood the request, that the task was able to be completed in a relatively short amount of time, and that children between the ages of three and 11 were able to complete the task. As such, these findings support the feasibility of using this task with preschool-age children.

Children in this and other studies sorted cards into a number of piles suggesting that this methodology captures the complexity of how children organize their thoughts in relation to food. In Michela and Contento's study (1984), five- to 11 ½-year-old children sorted cards into an average of 8.7 piles (range 2-20). In this study, the mean number of piles that children sorted cards into was 8.2. Two thirds of the children in Michela and Contento's study (1984) generated between five and nine piles and one third of the children generated between seven and eight piles. Fifty-five percent of the children ($n = 33$) in the current study formed three or fewer piles, 6.7% ($n = 4$) formed four, five or six piles, and 38.3% ($n = 23$) formed greater than eight piles. Similarity in the number of piles that children sorted cards helps to assure the dependability of the current study's findings. However, this conclusion also needs to be interpreted with caution since the purpose and the type of card sort used in the two studies differ, i.e., closed and unconstrained. Alternatively, the results may be interpreted as encouraging since two different methodologies produced similar results.

Given that the mean number of piles from this and Michela and Contento's (1984) study is similar, but the range and number of piles greater than eight differs suggests that there may be more occurring with regard to the how children organize their concepts and warrants further exploration. The variability in the number of piles may be explained by the fact that Michela and Contento (1984) instructed children in their study to form at least two piles, whereas children in the current study were told to sort the cards anyway they liked. The number of piles reported may also be due to the manner in which responses were coded. In Michela and Contento's study (1984, p. 61) children's responses were coded according to "a priori conceptual distinctions." Data in the current study were reported verbatim, i.e., as the children had stated. The variability in the range of the number of piles formed may also be explained by a phenomenon referred to as lumpers and splitters, i.e., where participants divide their cards into a few piles, while others place their cards into multiples piles (Borgatti, 1996; Ross, 2004; Weller & Romney, 1988). Given that card sorts are thought to reflect the structure by which individuals organize their concepts and the number of piles in this study varied greatly, i.e., 1-58, may indicate that the cognitive organization of individual group members differ, yet they share a collective cultural conceptual structure. Another possible reason for dividing cards into a few or many piles is, as Markman, Cox, and Machida (1981) have suggested, that children had to have constructed some framework to sort cards even if it were to form only one pile representing food, to have divided the cards mechanistically into equal piles, or to sort them by some other criteria, e.g., taxonomy, script, nutritional value. Goldman and Levine (1963) have also suggested that children may not have understood the directions as their cognitive development and understanding varies at different stages. Still others propose that children may organize concepts differently depending on the context of the situation (Mandler, Fivush, & Reznick, 1987; Smiley & Brown, 1979). Nevertheless, lumping and splitting revealed the labels that children assigned to their piles in the current study, which were consistent with the criteria used by Michela and Contento (1984) to code the responses of children in their study. Similarity between the labels from the current study and Michela and Contento's (1984) study helps to support the dependability and confirmability of the findings from the current study. This finding also needs to be interpreted with caution since the goal of Michela and Contento's (1984) study and the current study differ.

Reasons for why children did or did not assign labels to their piles also require investigation. More than half of the children in the current study assigned labels to the piles in the unconstrained card sort reflecting the relationship among the food items in each pile. This is not to say that children who did not label their piles had not made some inferences about the relationships between the food items as the position of their respective points were located next to others who had assigned labels to their piles. But more likely, as Ross (2004) has suggested that like adults, children sometimes have difficulty expressing their thoughts. These findings differ from Michela and Contento's study (1984) who reported that all the children labeled their piles. This may be due to the fact that Michela and Contento (1984) asked the children to place food items into at least two piles that were similar. Limiting the card sort to similarity, i.e., a closed card sort automatically restricts the criteria that can be used conceptually to create piles; but at the same time, facilitates the ability of children to articulate the criteria that they used in creating their piles. Both approaches, i.e., open/unconstrained and closed card sorts have their own inherent strengths and limitations. The use of one method over another is dependent upon the research question.

Of equal or greater interest is the meaning of the labels that were used by children in the current and the criteria used by Michela and Contento's (1984) to code children's card sorts. The meaning given to their labels and the criteria used by Michela and Contento (1984) may suggest that there may be universal construals when talking about food. This, in itself, supports the confirmability of the data and methodology. To further explain, labels used in Michela and Contento's (1984) study were developed from their prior work and were coded as taxonomy (sematic category), script (function), nutritional quality, taste/texture, food unknown or never tasted, preference, and miscellaneous. Labels in this study were generated by the children themselves. Labels included healthy/unhealthy, like/dislike, taxonomy, script, color, shape, physical property, plating, association with a significant individual, for grown-ups, soft/hard to chew, presentation, and made with, of, or from. These labels are similar to the labels that were coded by Michela and Contento (1984) in determining the criteria which children used to sort cards. Given that the labels that were used in the current study and prior work (Michela & Contento, 1984) are similar, helps to assure confidence in the findings of the current study. This finding may suggest that there may be commonality between the views of insider's and outsider's; which in turn, supports the socially agreed upon meaning given to food and its classification. Lastly, revealing that the findings from the current study differed from the previous study also helps to extend the previous work.

Generation, selection, and presentation of items and their implementation in card sorts are critical in assuring the confirmability of the measure. Prior studies have described some of the sources from which they generated items, such as their previous work (Michela & Contento, 19984; Nemet et al., 2011; Nguyen, 2007; Nguyen & Murphy, 2003), guides to healthy eating (Zarnowiecki et al., 2011), or National Food Consumption Survey and Health and Nutrition Examination Survey (Michela & Contento, 1984); how food items were presented, i.e., in pictures/photographs (Michela & Contento, 1984; Nguyen, 2007; Nguyen & Murphy, 2003) or on computer laptop screens (Nemet et al, 2011; Zarnowiecki et al., 2011); and the type of card sort that was used, e.g. closed (Michela & Contento, 1984), triad sort (Nguyen & Murphy, 2003), or paired sort (Nemet et al., 2011; Nguyen, 2007; Zarnowiecki et al., 2011). However, there was little discussion in these studies regarding the criteria that was used to determine why specific food items were selected or the criteria that was used to present food items in a standardized manner. For instance, in Zarnowiecki et al.'s 2011 study, they selected 16 food items from five core groups (fruits, vegetables, meat and alternatives, cereals, dairy) and 14 food items from non-core groups (junk) with varying degree of nutritional value from the Australia Guide to Healthy Eating. However, they did not present the criteria that were used to determine the nutritional value of the food items or the number of items selected from each of the five core groups.

Investigators also presented the manner (size and mounting; picture, photograph, computer screen) in which food items were displayed. However, there was little or no discussion in most of these studies as to how factors that may influence food selection such perceptual cue (color, shape, size, preparation and presentation of food), food classification (taxonomy, script, or evaluative category), and familiarity and typicality were controlled for. Nguyen and Murphy (2003) and Nguyen (2007) did, however, assure familiarity and typicality (Aldridge, Dovey, & Halford, 2009; Bjorklund & Thompson, 1983) of the food items in their studies by generating items from free lists and having parents verify that the items were familiar and typical. Michela and Contento (1984) also assured familiarity by analyzing the number of times a food item was not recognized. They found that in presenting 71 food items to 115 participants (8165 presentations) there were only 18 cases where the food item was not recognized.

Dependability and confirmability of the card sort in this study were assured by using the 73 food items that were published from Nguyen and Murphy's (2003) study and by comparing the food items that were reported in both free lists and the food items that appeared in the card sort. Fifty-five core food items (75.3%) that were listed as known and 54 core food items (74%) that were listed as eaten appeared in the card sort. As such, the percentage of agreement between the food items in the free lists and food items in the card sort helps to support the reliability of the card sort (Waltz, Strickland, & Lenz, 2010). These findings also help to strengthen the validity of the food items used in the card sort in this study. This is unlike Morizet et al.'s study (2011) in which they asked children to free list vegetables that they knew and sort pictures of vegetables into piles. Interestingly, they made no comparison between the items in the free list and the card sort to help support the dependability of their methodology and confirmability of their findings in the card sort.

A limitation of the card sort used in the current study is that familiarity and typicality of the food items were not established with this sample of children prior to conducting the study. Despite this limitation, the majority of preschool-age children in this study recognized the 73 food items. Children did, however, have difficulty recognizing spinach, salmon, gravy, and stuffing. The lack of recognition may be due in part to a lack of experience with the food or the manner in which the food item was presented. Cards used in this study were developed from free lists elicited from children and parents residing in the Midwest United States. Even so, their knowledge of food items is likely to be different from other individuals living in the same region. As Bell and Valentine (1997) have highlighted, "We are where we eat."

Another limitation of the card sort used in the current study is the similarity in the appearance of some of the items. Nguyen and Murphy (2003) assured that food items in their study were not similar in appearance by asking parents to evaluate the pictures prior to their study. In this study, children had some difficulty distinguishing between hot dogs and carrots, and cream cheese and butter due to the similarity in their appearance.

Seeing that the procedures used to analyze data from cards sorts in the current and prior studies differ suggest that there is a number of ways to analyze the data. All of the investigators who used card sorts analyzed the data for the number of correct food classifications (Nemet et al., (2007), Nguyen, 2007; Nguyen & Murphy, 2003; and Zarnowiecki et al., (2011) with the exception of Michela and Contento (1984). They used the frequency by which food items were grouped, the number of children using each coded criteria, cluster analysis of the food groupings, and multidimensional scaling of food groupings to analyze their data (Michela & Contento, 1984). However, Michela and Contento (1984) did not examine the similarity and dissimilarity among the children in the study. Similarity between participants is important as it helps to establish dependability and confirmability (Bratchell, 1989; Clatworthy et al., 2005; Giguere, 2006; Johnson & Wickern, 1982). One reason for not examining similarity and dissimilarity between participants in their study was, as they reported, that their software could not accommodate the number of subjects. Analyses of the card sorts in the current study were conducted in Anthropac 4.0 (Borgatti, 1996) and included consensus and cluster analysis, and multidimensional scaling of the food items and the participants. For example, cluster analysis and multidimensional scaling of children who were obese with respect to the food items they liked and those they disliked revealed the same children as separate entities or outliers in two-dimensional space for this group. Cluster analysis and multidimensional scaling of children who were of healthy weight with respect to the food items they liked and those they disliked revealed the same children as separate entities or outliers in two-dimensional space for this group. Similar findings between cluster analysis and multidimensional scaling within each group in concert with similar results from other statistical analyses help to assure the dependability of the data. In addition, showing that members were in agreement with each other with regard to their likes and dislikes helps to assure confirmability. Because the results from cluster analysis and multidimensional scaling of the two groups were dependable and were supported by other analyses, the conceptual organization of concepts related to food revealed for each group can be trusted.

A second card sort was conducted in this study that identified the food items that children liked and disliked. However, no studies have been located that present results from a closed card sort exploring the food items that children like and dislike for comparison.

Lastly, dependability and confirmability of the data from free lists and cards sorts were also assured through systematic and rigorous processes of data collection and data analysis, audit trails, and theoretical, methodological, and analytic triangulation. The audit trail consisted of three journals: a personal, a theoretical, and an analytic journal to record the thought processes, decisions, and feelings throughout the research process allowing the researcher to reflect on their work to minimize personal bias (Curtin, 2001; Cutcliffe & McKenna, 2004; Koch, 1994; Krefting, 1991; Lincoln & Guba; 1985; Rodgers & Cowles, 1993).

Transferability of the findings from this study is limited as the goal of qualitative studies is to describe a phenomenon to the extent that the characteristics and context of the phenomenon are clearly portrayed. Transferability, however, may be achieved after several replications of the study (Denzin & Lincoln, 1994; Maxwell, 1992; Patton, 2002). With the exception of Nguyen

(2007) and Nguyen and Murphy's (2003) studies, the lack of replication of studies using free lists and card sorts to explore children's concepts related to food and the organization of these concepts is a major limitation.

Implications

There are several implications from the evaluation of these two methodologies for future research, clinical practice, and education. The pictures of food items used in the current card sort need to be assessed by preschool-age children to assure the familiarity and typicality of food items with this age group and revised accordingly. The number of cards needs to be reduced to present core food items that are common to children who are obese and children who are of healthy weight. The study needs to be replicated with another sample of children who are obese and children who are of healthy weight from a population with similar descriptive characteristics. Future studies also need to include parents to compare the similarities and differences in their free lists and card sorts to those of their children. Inclusion of a food frequency questionnaire may be beneficial in assessing the reliability of children's and adults' free lists. Additional statistical analyses need to be completed to further explore the free lists (minimal residual factor analysis) and to evaluate the extent to which free lists may be able to predict body mass index. Free lists may be translated for use in clinical practice by the including pertinent questions in the dietary history such as "Tell me about all the foods you can think of." or "Tell me about what you eat." An alternative approach would be to develop technology that will allow preschool-age children and their parents to independently complete free lists and card sorts. Lastly, elicitation techniques need to be presented and discussed in academic courses.

Conclusion

This study has shown that free lists and card sorts are simple, yet powerful, trustworthy, and complimentary tools that can be used with preschool-age children to reveal concepts related to food and the structure used by children to organize their concepts related to food. Free lists and card sorts, as such, can be completed in a relatively short period of time by preschool-age children to elicit large amounts of dependable and confirmable tacit rich data for meaningful analysis. As such, free lists reveal concepts related to food and card sorts reveal the cognitive organization of these concepts. Moreover, labels assigned to the piles in the card sort reflect the attributes used in organizing culturally relevant concepts related to food. Multiple statistical analyses of the data from free lists and card sorts helped to assure dependability and confirmability of the results. This evidence builds confidence in the trustworthiness of the study's findings.

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Chapter V

Conclusion

Summary

In this three manuscript dissertation, I synthesized the literature regarding children knowledge about eating and nutrition, elicited preschool-age children's responses to describe the similarities, differences and patterns in their concepts related to food and the organization of these concepts, and evaluated the feasibility of free listed used with card sorts, and the dependability and confirmability of these methodologies and the data that they elicited.

The review of the literature found that a limited number of researchers have investigated preschool-age children's knowledge about eating. This research showed that preschool-age children were experientially knowledgeable about food, nutrition, the body, and its relationship to health (Nguyen, 2007; Slaughter & Ting, 2010; Wellman & Johnson, 1992), as well as processes related to digestion (Teixeira, 2000; Toyama, 2000). Unlike these studies, other researchers found that school-age children and adolescents had learned enough factual information about food, nutrition, and health that they responded correctly to questions about nutrition (Michela & Contento, 1984; Nemet, Perez, Reges, & Eliakim, 2007; Zarnowiecki, Dollman, & Sinn, 2011) and they understood the relationship between nutrition, physical activity, and health (Edwards & Hartwell, 2002; Giskes, Patterson, Turrell, & Newman, 2005; Gracey, Stanley, Burke, Corti, & Beilin, 1996). Two studies conducted with school-age children and adolescents relative to the concept of childhood obesity found that they based their health on physical appearance and the ability to perform (Power, Bindler, Goetz, & Daratha, 2010; Williams, Taylor, Wolf, Lawson, & Crespo, 2008).

Studies in this review have contributed to the body of knowledge about children's beliefs/tacit knowledge and declarative knowledge related to eating; however, there are several gaps. These gaps include: (a) that children under the age of six have not been enrolled as primary informants in studies focusing on childhood obesity, (b) that the number of children who were obese and the number of children who were of healthy weight has not been provided or included in the analysis of data, and (c) that children from minority or low-socioeconomic status have not been included in the majority of studies.

Therefore, an exploratory mixed-methods study using free lists and cards sorts that were embedded in an ethnographic interview was conducted with 30 children who were obese and 30 children who were of healthy weight to elicit their concepts of food and the organization of these concepts. Results from this study found that there were no significant differences in what preschool-age children from the two groups typically knew about food. However, there was a modest difference in the food items that were representative of each group. This study also found that children who are obese and children who are of healthy weight organize their concepts related to food differently.

An evaluation of the feasibility, dependability, and confirmability of free lists and card sorts used with preschool-age children found that free lists and card sorts were easily completed by preschool-age children and that both methodologies elicited a large amount of dependable and confirmable data. Moreover, free lists revealed the food items that were representative of and salient to preschool-age children with a similar dietary culture. Cards sorts were also easily completed, and more importantly, revealed the conceptual framework used by preschool-age children to organize their concepts related to food.

There were limitations to the free lists and card sorts used in this study. (1) Although a large amount of data was obtained from free lists, the data were likely not exhaustive. (2) There was not agreement among the members of each group in relationship to the unconstrained card sort. This may be due to the small sample size or that each preschool-age child had organized their concepts related to food in reference to their individual experiences, yet their overall conceptual framework is shared within a larger cultural conceptualization of food. (3) Although over 70% of the food items in the free list appeared in the card sort and children recognized many of the food items, the familiarity and typicality of the food items presented in the card sort can be improved.

There are several strengths to this study. To the best of my knowledge, this is the first study to have used free lists and card sorts to elicit preschool-age children's responses to reveal concepts related to food and the organization of these concepts with those who are obese and those who are of healthy weight. In addition, no studies have used free lists with children less than eight-years-old. The cards used in this study were also standardized relative to the color of the plate and background on which foods were presented, food size, card size, and the location of the food item on the card, adding strength and confidence in the trustworthiness of the results. This study was also conducted with a homogenous sample, which strengthens the confirmability of the results. Lastly, this study extends our knowledge regarding the concepts of preschool-age children who are obese and those who are of healthy weight related to food and the organization of these concepts. This knowledge will lead to the development of effective interventions to prevent childhood obesity.

Implications

Findings from this study have implications for practice, education, and research. Prompts asking preschool-age children to tell their care provider about all the foods that they can think of and/or asking them to tell the provider about the foods that they eat can be incorporated in the dietary history during an office visit. Parents can then verify the accuracy of the data. In addition, approaching the delivery of care to children and their parents from the theoretical standpoint that beliefs/tacit knowledge are inferred in relation to personal experiences and conveyed through language (Boster, 1986; Hatano & Inagaki, 2005; Ross, 2004; Ross, Medin, Coley, & Atran, 2003) supports the inclusion of preschool-age children in discussions regarding eating and their participation in shopping for groceries and preparation of meals.

Results from this study also need to be included in nursing education. Free lists and cards sorts need to be presented in coursework discussing methodological approaches used for data collection with young children. Moreover, theoretical and empirical evidence needs to be presented in the education of nursing students demonstrating that the cognitive abilities of preschool-age children exceed what Piaget and others, such as Carey, have proposed. This knowledge will support the development of novel methodologies to reveal young children's understanding of the world around them, particularly, in relation to their health and well-being.

Future Directions

Results from this study also have implications for research. First, the methodology for selecting food items for the card sort and standardization of the cards need to be refined. Second, the study needs to be replicated with children and a caregiver who is primarily responsible for meal preparation. Third, a study needs to be designed to further explore the visual cues that influence preschool-age children's preferences for food items. Fourth, another study needs to be designed to examine how individuals in the child's immediate environment talk about food and eating. Fifth, further analysis needs to be completed to determine if results from the free lists and/or card sorts are predictive of body mass index. Sixth, results from this study need to be disseminated. Lastly, results from these studies need to be incorporated into interventions to assist preschool-age children to eat more healthily and assist parents with their child's eating behavior.

In the presence of an obesogenic environment, what children believe/tacitly know about food is critical. This study not only revealed preschool-age children's concepts related to food, the food items and food associations that were familiar to preschool-age children, and the food items that were representative of each group, but this study also revealed that preschool-age children from the two groups organized their concepts related to food differently. It now becomes even more important to further understand what preschool-age children's experiences have been in relation to food and what and how parents talk about food to capture the evolution and development of their concepts related to food and the organization of these concepts.

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Appendix A

Figures pertaining to Chapter I

Figure A.1

Beliefs-desire Schema for Reasoning

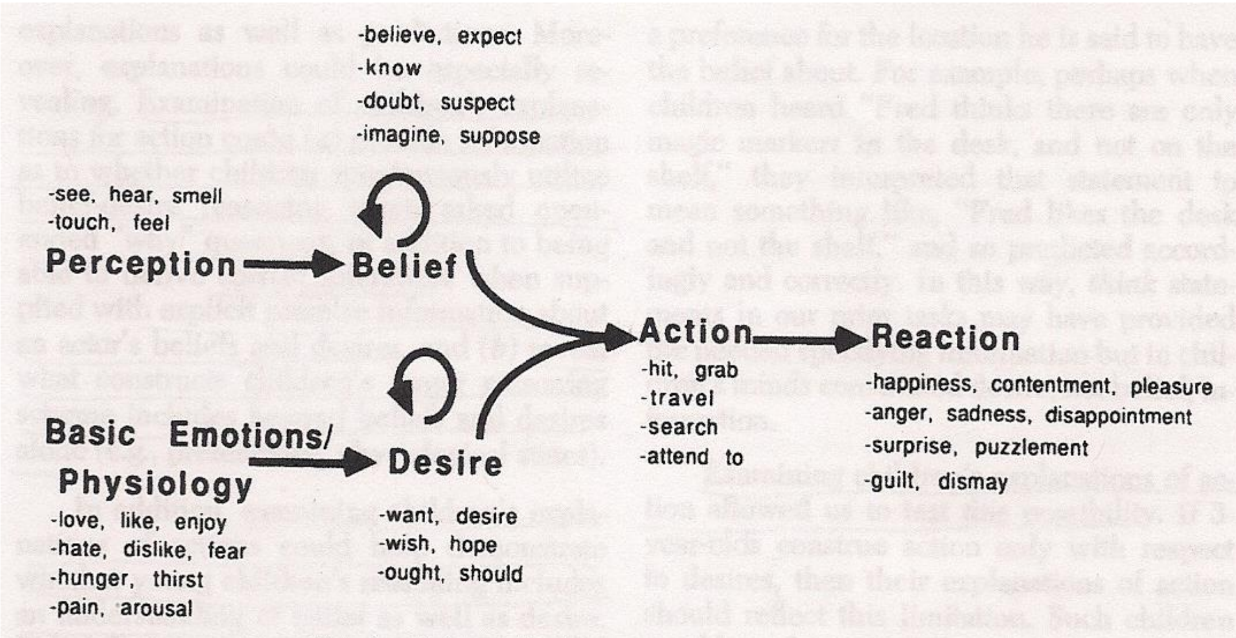


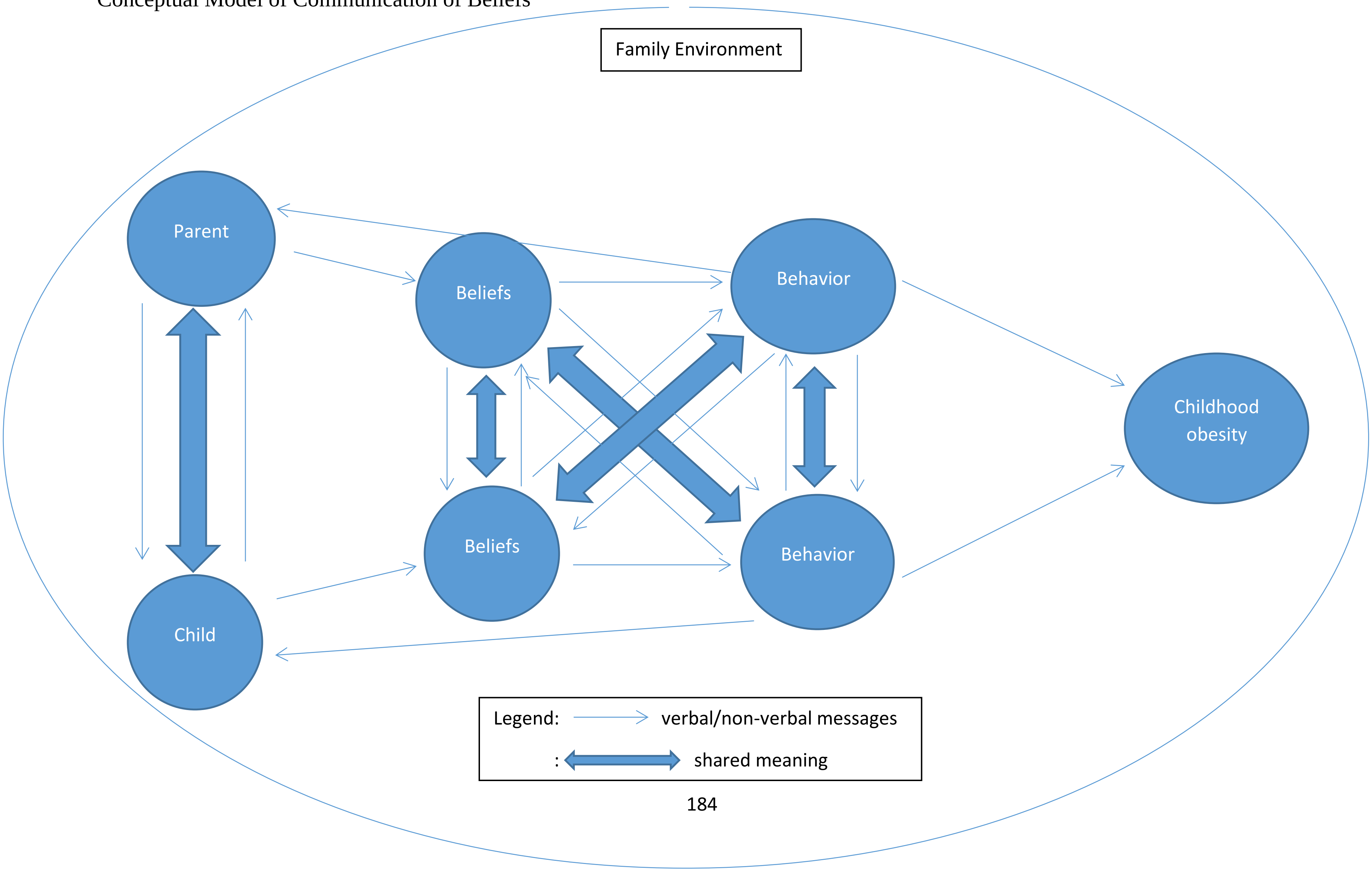
FIG. 1.—Scheme for depicting belief-desire reasoning

Beliefs-desire schema adapted from "Young Children's Attribution of action to beliefs and desire" by K. Bartsch and H. M. Wellman, 1989, Child Development, 60(4), p. 947. Reprinted with permission.

Appendix A

Figure A.2

Conceptual Model of Communication of Beliefs



Appendix B

Tables, Figures, Instruments, Images, Coding Guide, Forms, and Results pertaining to Chapter III

Ethnographic Interview

Hello, my name is Celeste. I am working on a research project to understand what children know about eating. I would like to ask you some questions about eating, and what you think about that. I will also ask you to place pictures of food into piles and ask you some questions about the piles. Your parent(s) said it would be okay. There are no right or wrong answers. It is okay for you not to answer some of the questions or to say that you don't want to answer any more questions. You may take a break to eat a snack, use the bathroom, or play for a short while. Can you tell me what we are going to do? Are you ok with talking to me? Let's begin.

Topic	Prompts	Probes	Field Notes
Explores one construal of subjective and cultural semantic domain of eating, i.e., food	*Tell me about all the foods you can think of?*	*Let me read them back to you. Are there any others?*	
Establishes rapport with child, identifies the vocabulary used by the child about eating, establishes the meaning of words, identifies the child's level of comprehension, and orients the child to the context of the interview.	*Tell me about what you eat.* *Tell me everything you know about eating.*	Can you tell me more about that?	
Reveals the child's beliefs about, knowledge (procedural) related to, and explanations given for biological	Why do we need to eat?	Tell me more about that. (*clarifying statements: What do you think your body does with food? What do*	

phenomena.	How do you know when to eat? If you are hungry and it is not meal time, what do you do?	*you think food does for your body?)* How does that work? *(Clarifying statement: Tell me about the foods that you eat for a snack)*	
Discovers the organization of the child's representations related to eating and its subcomponents including food, nutrition, the body, health, bodily outcomes and biological processes related to eating.	*(Revised: This stack of cards contains pictures of foods. Go through the cards and then place them in piles anyway you like. When you are finished, leave the cards in the piles.)*		
Reveals the similarities and differences used by children in comparing foods	(*Revised: Tell me about each of these piles of food*).	(*Revised: How are these piles alike*? *How are the items in this pile alike*?) *(Revised: Is that important? Why is that important?)* *(Revised: How*	

	(Revised: Is there anything else you would like to tell me about these piles of food?)	*are these piles different? How are the items in this pile different?)* *(Revised: Is that important? Why is this important?)* Can you explain that to me?	
Discovers child's understanding and prediction of outcomes to biological processes.	What would happen to your body if you ate this pile of foods every day?	How does that work?	
Reveals sensory-motor experiences with eating, serving as the base for interpretation in constructing perceptions.	(*Revised: Tell me about the piles of food you like or word used to describe pile).* *(Revised: Tell me about the piles of food you don't like or word used to describe pile?)*	Tell me more about that. *(Revised: Tell me why you like them or word used to describe them or Tell me what you like about them or word used to describe them).* *(Revised: Is that important? Why is that important?)* *(Revised: Tell me why you don't like them or word used to describe them or Tell me what you don't*	

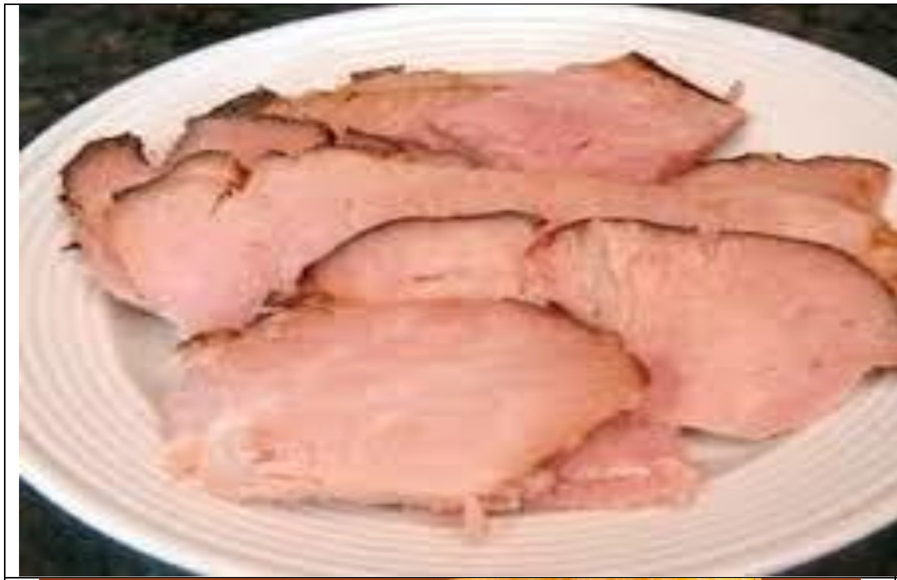
	(Revised: Is there anything else you would like to tell me about these piles of food?)	*like about them or word used to describe them).* *(Revised: Is that important? Why is that important?)* Can you describe that to me?	
Identifies potential sources of knowledge, as well as insight into the context of eating within the family environment.	*(Revised: Let's pretend that you are your mother. What would she tell you about this pile of food?)*	What do you think about that? What might someone else say about this pile of food?	
Identifies child's beliefs about how foods are restricted	(*Revised: Tell me about any of these piles of food that your parents won't let you eat*.)	*(Added: Can you tell me more about that*?) What do you think about that?	
Identifies child's beliefs about using food as reward	*(Revised: Tell me about any of these piles of food that are given to you as a reward).*	What do you think about that?	
Allows child to share additional knowledge that is important to them, provides a voice for the child, and brings	What do you think is important for me to know about eating?		

interview to close.	*(Revised: Do you think there is anything else I should know about eating? Can you tell me about that?)*		

Appendix B

Cards for Sorting Task

Standardized mages of food items appear on the following pages

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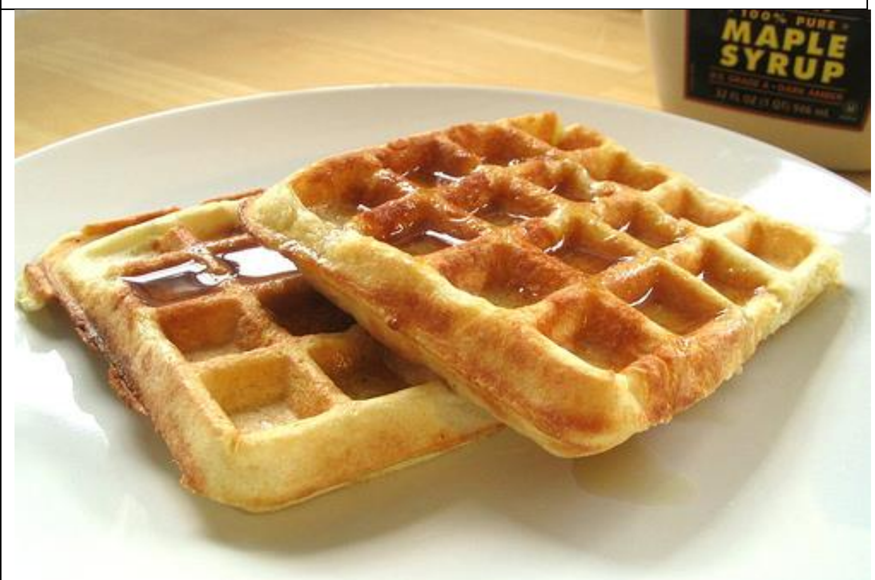
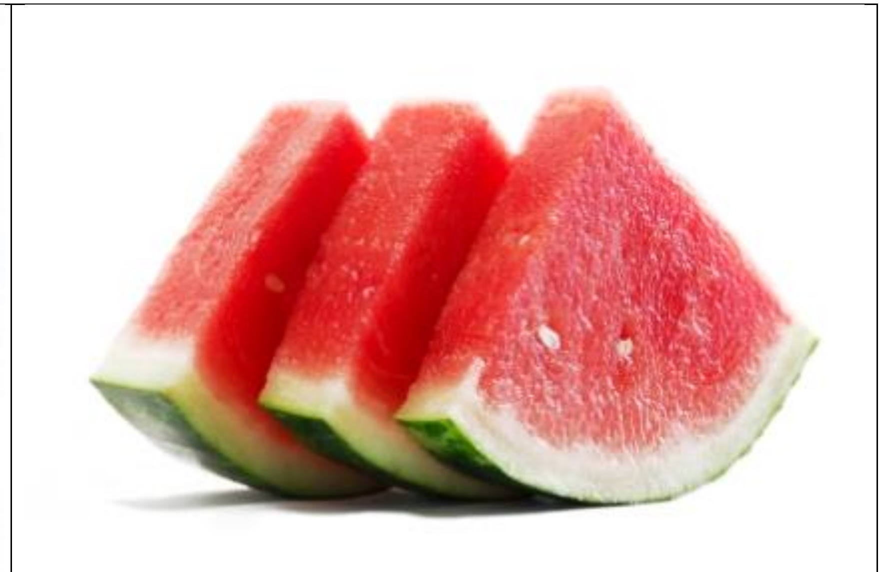

MAPLE
SYRUP









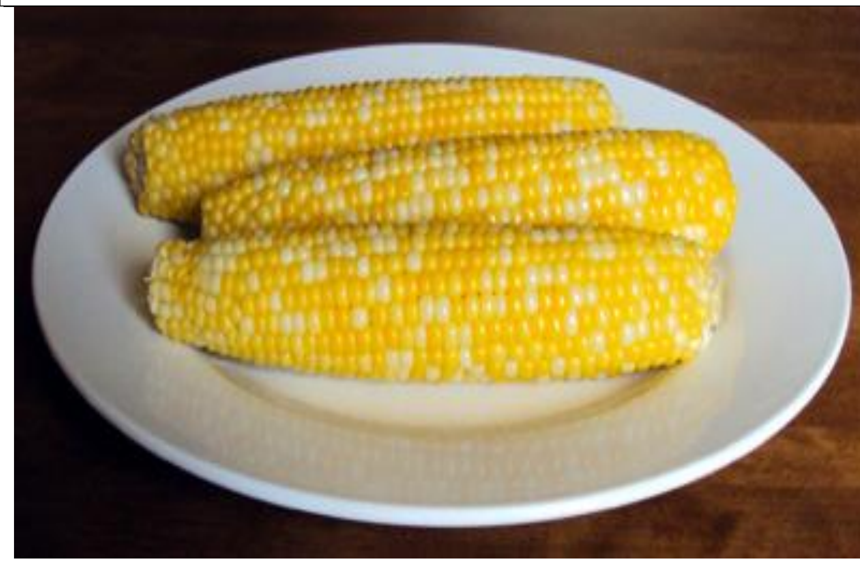




FreeFoto.com

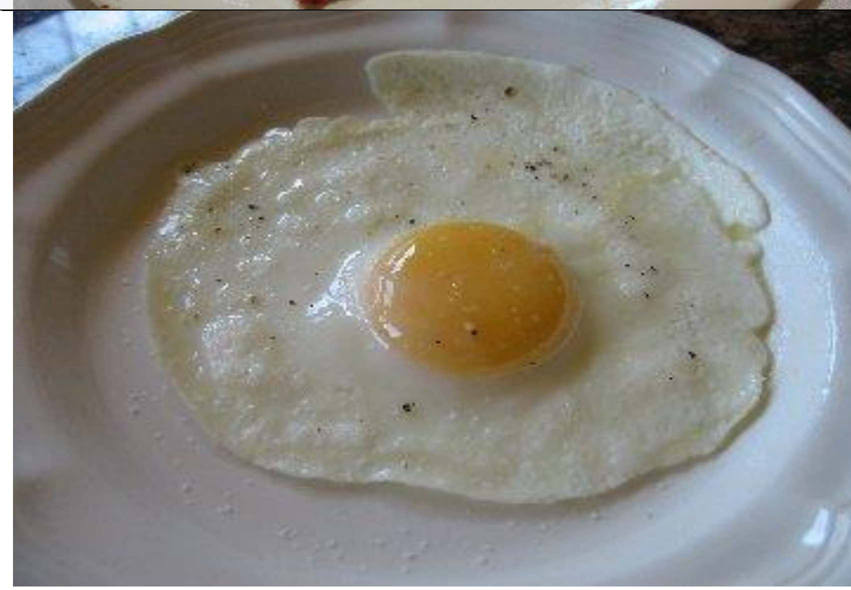

Coca-Cola
classic


Sprite

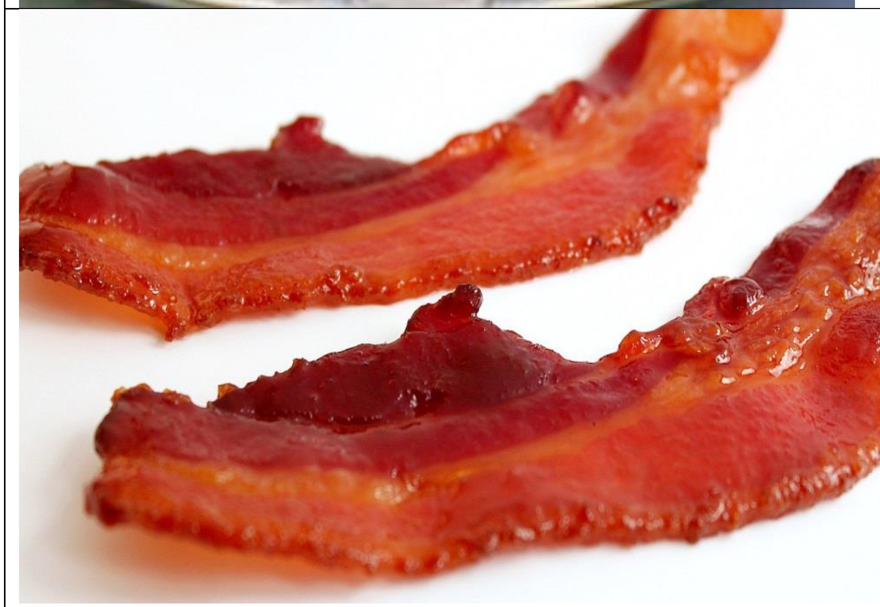


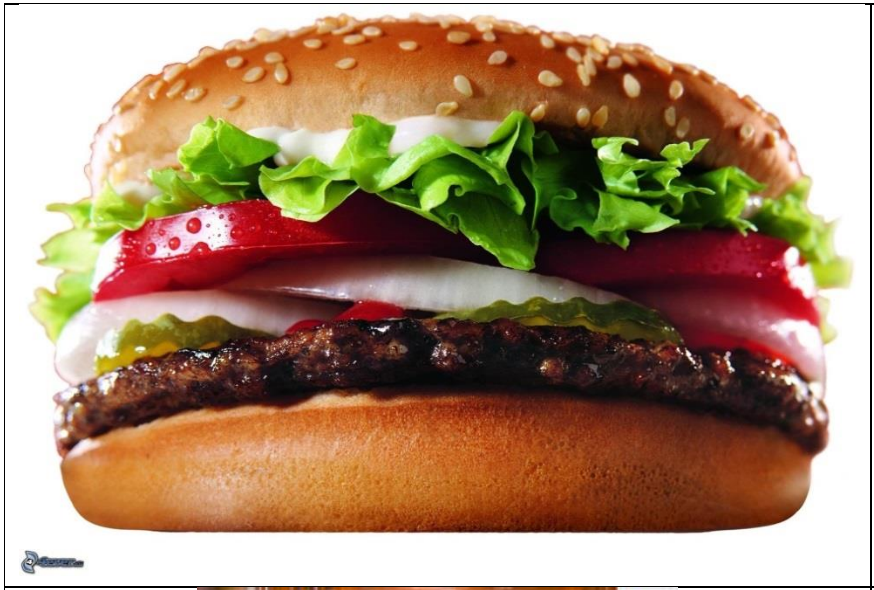
	
	



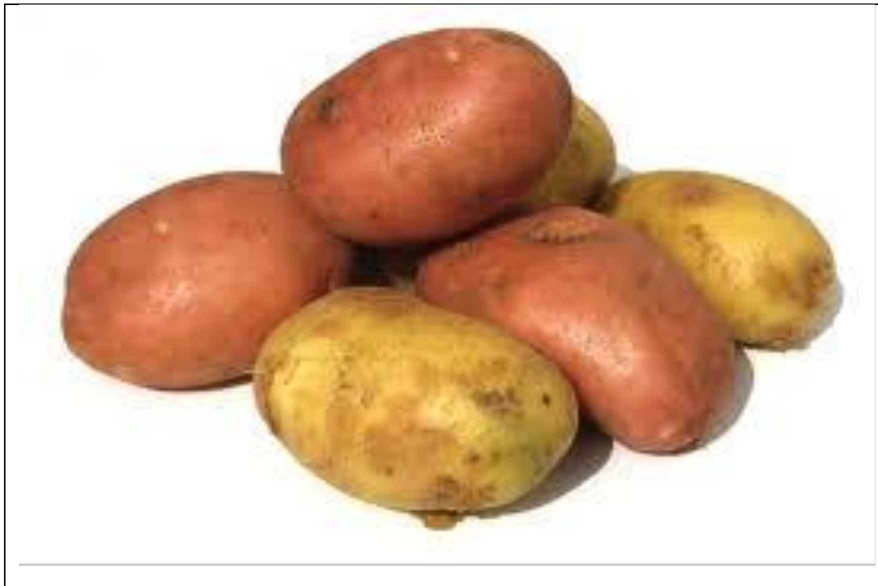







foodieling.blogspot.com

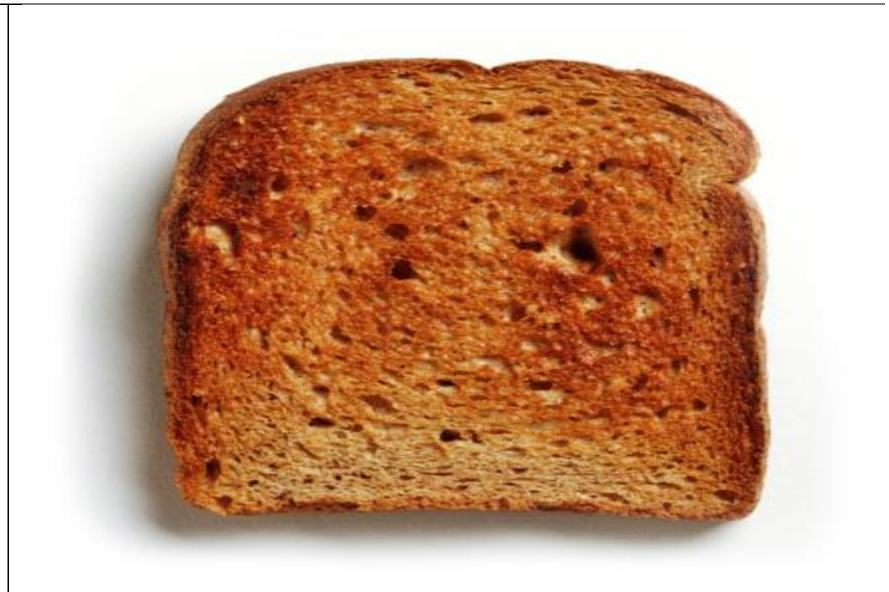



†Natural flavors







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Appendix B

Form

Parental Permission

Dear Parent:

Celeste Schultz, RN-BC MS CPNP, doctoral student, at The University of Michigan, School of Nursing, invites your child to participate in a research study to understand what children between the ages of four and six know about eating. The study is entitled, "Giving Children a Voice: Exploring Young Children's Beliefs about Eating.

We will ask your child about food, why they need to eat, what happens to the body in relation to eating, and how they learn about eating. We have pictures of foods that we will ask your child to sort into piles and describe those piles. We will also measure your child's height, weight, blood pressure, and waist. We will record your child's age and birthdate. In addition, we will ask you as the parent or caregiver to answer a question about your child's ethnicity and race and verify your child's school attendance and residence.

If you allow your child to be part of this study, we will arrange to meet you and your child at your convenience. We are happy to meet you at a public library or the pediatric office. The interview will take approximately one hour to talk to your child about eating. The interview may be divided into two sessions to meet your child's needs. Breaks will also be offered during the interview for your child to play, eat a snack, and use the restroom. You, as the parent, may be present to provide support to your child. We ask, though, that you not give your child answers to the questions, and to remain seated behind your child. We plan to tape record what your child tells us. If you choose not to have the interview tape recorded, your child may still participate in the study. In this case, we will take notes during the interview. Your child will receive $15.00 at the completion of the interview in compensation for your time. If the interview is not completed, compensation will not be dispensed.

Although your child may not directly benefit from being in this study; information from this study may benefit other children and parents. You, as the parent, may learn more about what your child knows about eating. We hope that this study will help us better understand what children know about eating so we can develop programs to help parents with their child's eating behavior.

Potential risks are that your child may become bored, tired, or frustrated during the interview. To help reduce these risks and help your child successfully complete the interview, breaks are offered during the interview for your child to play, eat a snack, or use the restroom. Your child may choose not to participate or may choose to stop participating at any time and will not be penalized.

There is no cost to you to participate in the study. All costs for the study are incurred by the researcher. This study is self-funded.

The information you provide will be kept strictly confidential. This information may be used in presentations or articles, but will not include any information that would identify you, your child or other family members. To keep this information safe, the interviews will be placed in a locked file cabinet. A copy of the tape recorded interview will be written word-for-word. Once this process is complete, the original information will be destroyed. The researchers will enter study data on a computer that is password-protected. To protect confidentiality, your child's real name and the names of any family members will not be used in the written copy of the discussion. The researchers plan to keep the transcribed data indefinitely for future research regarding what children know about eating.

There are some reasons why people other than the researchers may need to see information you and/or your child provided as part of the study. This includes organizations responsible for making sure that the research is done safely and properly, including the University of Michigan or government offices. Also, if your child tells us something in the interview that makes us believe that your child or others have been or may be physically harmed; we may report that information to the appropriate agencies.

We hope that you will be willing to allow your child to share in this experience with us.
If you have questions about research or this study, you can contact me or my faculty advisor at:
Celeste Schultz, RN-BC, MS, CPNP,
University of Michigan, School of Nursing
400 North Ingalls, Ann Arbor, MI 48109-5482
(419)-345-1239
celestms@umich.edu.

Faculty Advisor: Donna Marvicsin, PhD, PNP-BC, CDE
University of Michigan, School of Nursing
400 North Ingalls, Ann Arbor, MI 48109-5482
1-734-647-0344
djmarvic@umich.edu

If you have questions about your rights as a research participant, or wish to obtain information, ask questions or discuss any concerns about this study with someone other than the researcher(s), please contact: The University of Michigan Health Sciences and Behavioral Sciences Institutional Review Board, 540 E Liberty St., Ste 202, Ann Arbor, MI 48104-2210, (734) 936-0933 **[or toll free, (866) 936-0933]**, irbhsbs@umich.edu.

Sincerely,
Celeste Schultz, RN-BC, MS, CPNP
Doctoral student
University of Michigan
School of Nursing
400 North Ingalls
Ann Arbor. MI 48109-5482

Parental Permission
By signing this document, you are agreeing to allow your child, _______________, to be part of the study entitled Giving Children a Voice: Exploring Young Children's Beliefs about Eating. Your child's participation in this study is completely voluntary. If you allow your child to be part of the study, you may change your mind and withdraw your approval at any time.

Your child may choose not to be part of the study, even if you agree, and may refuse to answer an interview question or stop participating at any time.
You will be given a copy of this document for your records and one copy will be kept with the study records. Be sure that the questions you have asked about the study have been answered and that you understand what your child will be asked to do. You may contact the researcher if you think of a question later.

I give my permission for my child to participate in this study and be tape recorded.

____________________________________ ____________________
Signature Date

*I give my permission for my child to participate in this study and **not** be tape recorded.*

____________________________________ ____________________
Signature Date

Appendix B

Script

Child Assent

Hello, my name is Celeste. I am working on a research project to understand what children know about eating. I would like to ask you some questions about eating, and what you think about that. I will also ask you to place pictures of food into piles and ask you some questions about the piles. Your parent(s) said it would be okay. There are no right or wrong answers. It is okay for you not to answer some of the questions or to say that you don't want to answer any more questions. You may take a break to eat a snack, use the bathroom, or play for a short while. Can you tell me what we are going to do? Are you ok with talking to me? Let's begin.

Appendix B

Food Classification System for Data Reduction

Food Classification	Children's Reports
Breads and rolls	corn bread, muffin, monkey bread, zucchini bread, buns/rolls, toast, bagel, wheat, bread and/with butter, bread
Cereals/Breakfast food	pancake, waffles, cheerio's, oatmeal, fruit loops, crepe, breakfast bar, eggs, scrambled egg, toaster strudel, pop tart, cereal
Flour	eliminate
Pasta	noodles, macaroni
Bakery products	cake, cookies, cupcakes, brownies, donut, pie, cheese cake
Sweets/Goodies	sucker, lollipop, chocolate, candy, marshmallow, candy corn, treats, candy cane, gummy bears, chocolate bar, jaw breaker, ice cream, cookie, chocolate chips, Twinkie, treat, ice cream cone
Rice	rice (only 1 response)
Sugar	eliminate
Sugar excluding chocolate	eliminate
Chocolate	combined under sweets/goodies
Vegetable oils	eliminate
Margarine	eliminate
Butter	butter (1)
Nuts	peanut butter, peanuts
Pulses (legumes)	eliminate

Vegetables	cucumber, mushroom, carrots, tomato, broccoli, green beans, corn, asparagus, spinach, celery, radishes, lettuce, potato, peppers, zucchini, peppers, cauliflower, peas, greens, mashed potatoes, vegetable
Roots/potatoes	combined with vegetable
Fruits	oranges, bananas, apples, pear, watermelon, strawberries, lemon, peaches, grapefruit, plum, cherry, blueberries, pineapple, kiwi, lime, green apple, melon, green grapes, purple grapes, avocado, grapes, fruit
Water	water, coconut water
Fruit juices (non-milk based drinks)	apple juice, orange juice, juice
Sugar sweetened beverages	smoothies, hot chocolate, slushes, pop popsicles, chocolate milk, milkshake, lemonade, flashes
Coffee, tea, cocoa powder	coffee
Beer	eliminate
Wine	eliminate
Alcoholic beverages	eliminate
meat	steak, bacon, meatballs, pepperoni, ham, sausage, bologna, meat loaf, meat
Poultry	chicken, turkey
Offals (organ meats)	eliminate
Fish/Seafood	fish, salmon
Eggs	combine with breakfast food
Dairy/Milk	cheese, milk, cottage cheese, yogurt, cream cheese, cheese sticks, string cheese, peek-a-boo cheese
Cheese	combined with milk

Other milk	eliminate
Miscellaneous (spices, condiments)	salt, pepper, cinnamon, jelly, pickle, honey, alfredo, stuffing, gravy
Special foods	eliminate
Non-foods	worms, pooh, rods & sticks, party hats, phones, washing soap, paper, mommy, burning leaves, surges, phones
Ethnic foods	tacos, nachos, grape leaves, Chinese food, guacamole, bronie, shrova, nachos and chips
Combined foods	sandwich, macaroni and cheese, spaghetti, peanut butter and jelly, pasta with meatballs, pasta with vegetables, chili, maple sandwich, grilled cheese, egg sandwich, left over sandwich, salad, sandwich bagel, pizza, peanut butter sandwich, chicken noodle soup, bologna sandwich, soup, tomato soup, turkey sandwich, spaghetti and meatball
Fast/convenience foods	fries, chicken nuggets, hot dog, hamburger, Subway, chickey bites, chicken fries, cheese burger, happy meal, lunchable, cheesey bread, croissant dog
Snacks	pretzels, chips, Cheetos, popcorn, cheese its, Chex mix, pudding, Jell-O, pizza roll, fruit snack, gold fish, bread sticks, granola bar, granola, fiber one, applesauce, crackers, chocolate pudding, raisins, pudding
Drink	drink
Healthy	healthy
Unhealthy	unhealthy
Food	food

Appendix B

Figure B.1

Multidimensional Scaling of Children who were obese relative to Food Items that were Listed

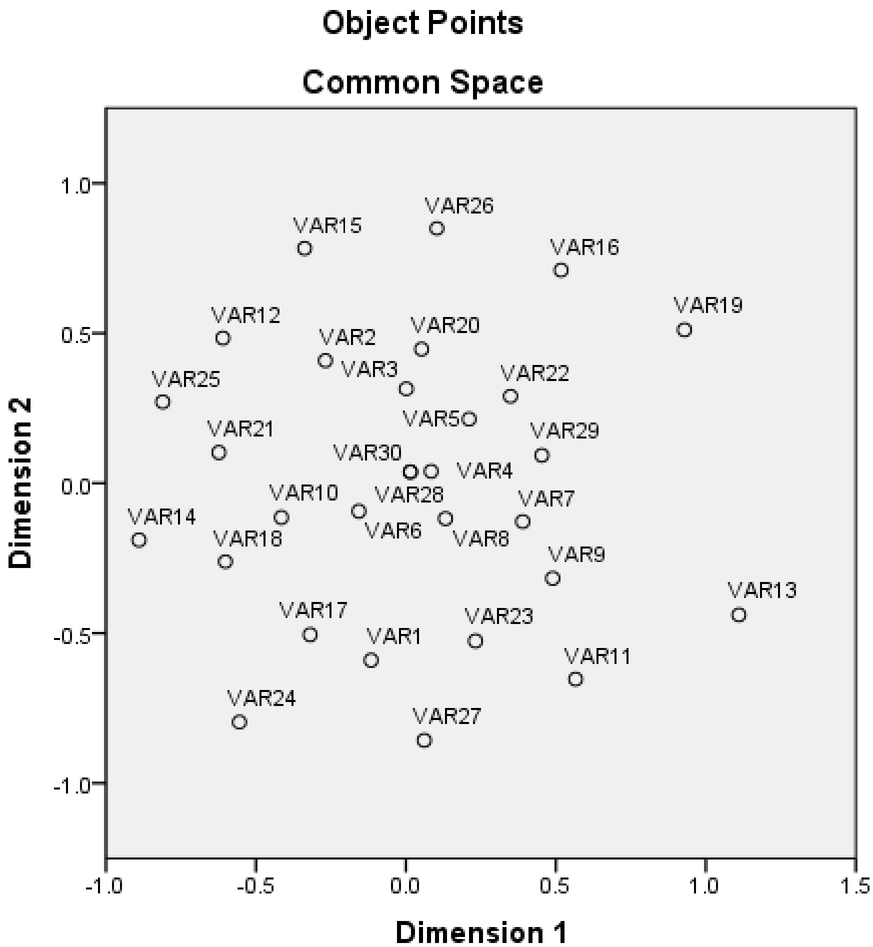


Figure B.2

Multidimensional Scaling of Children who were of healthy weight relative to Food Items that were Listed

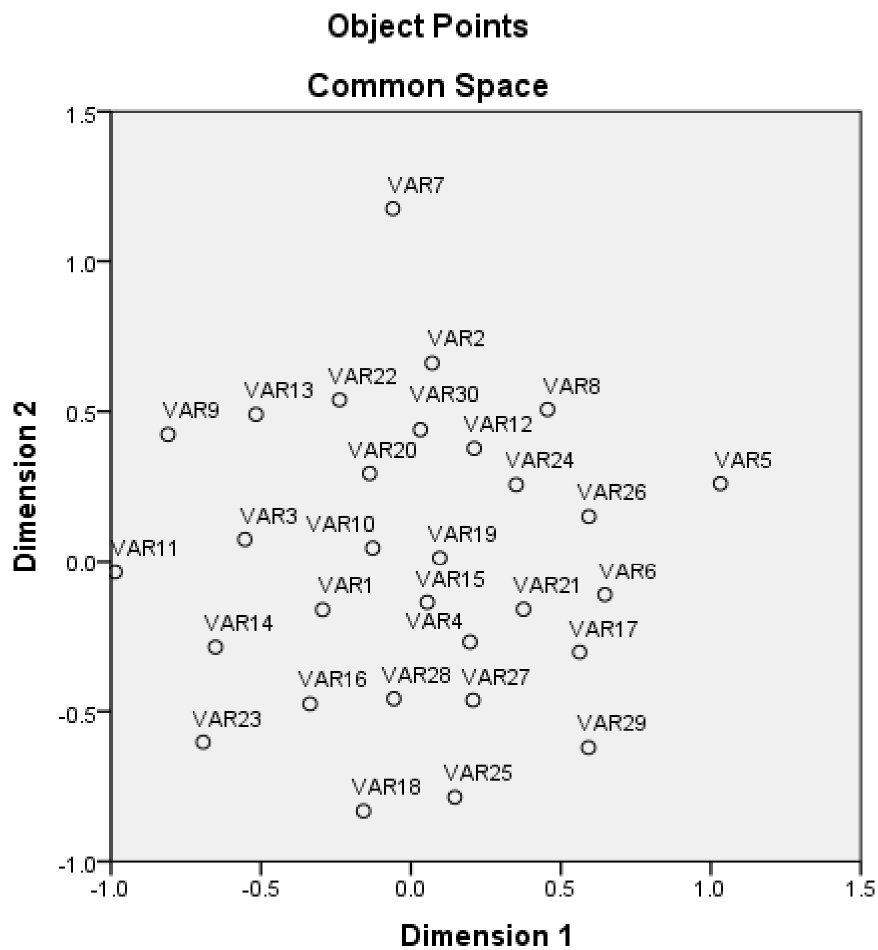
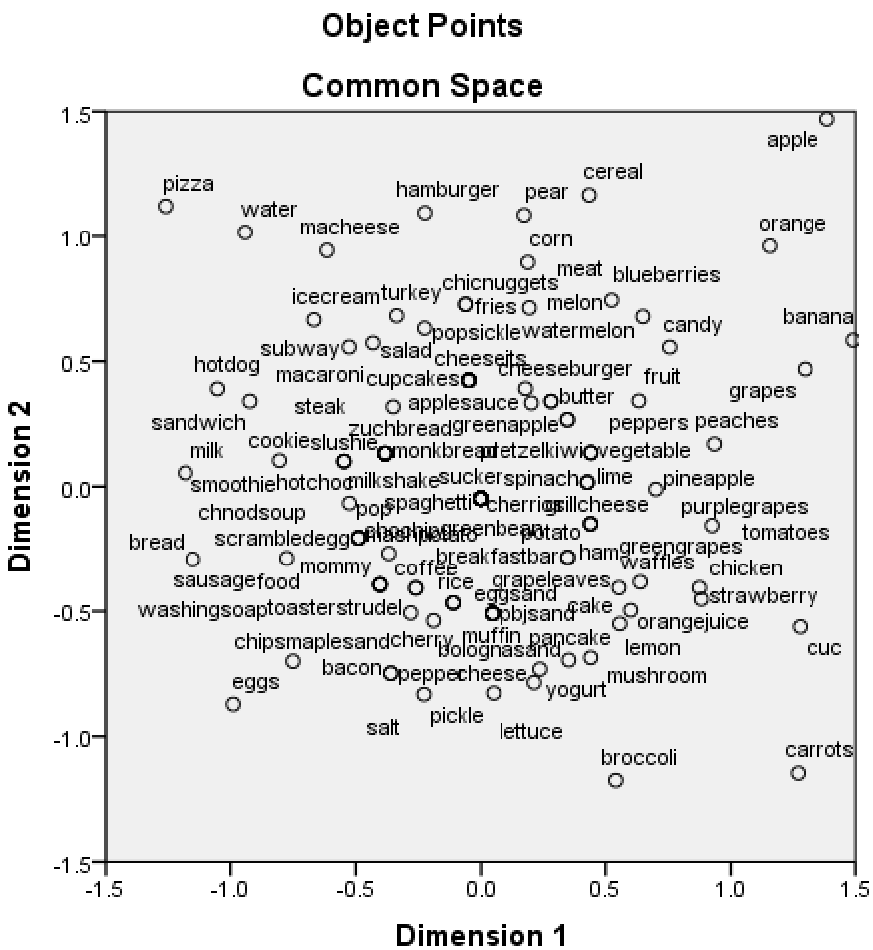


Figure B.3

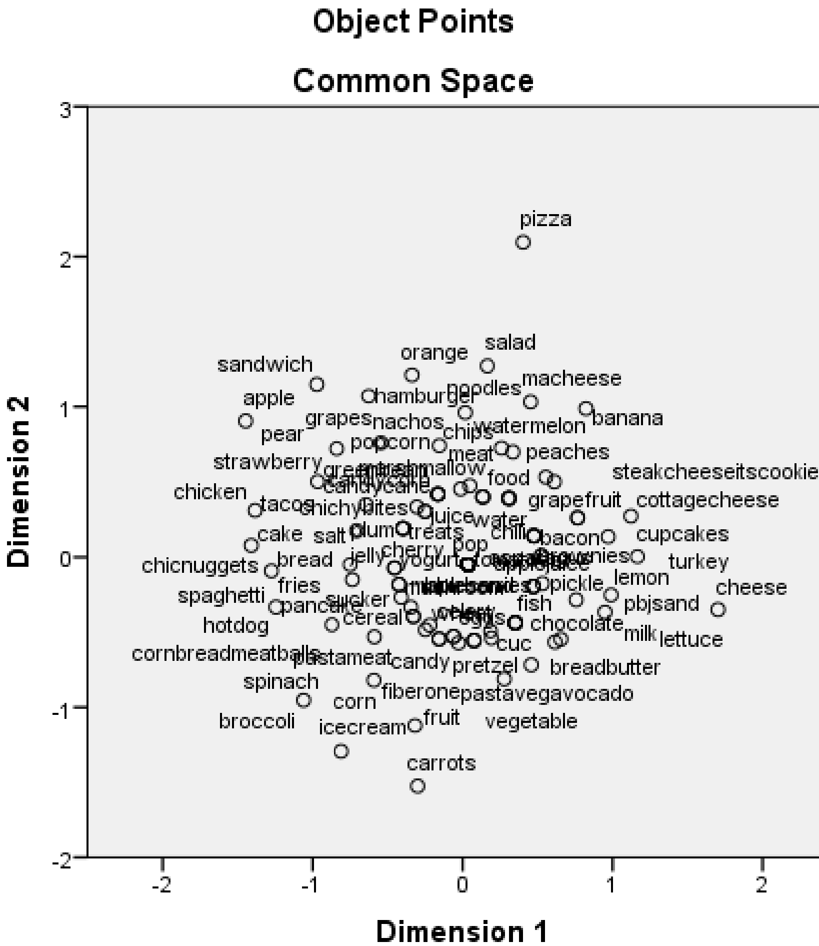
Multidimensional Scaling of Foods Items Listed by Children who were obese



Appendix B

Figure B.4

Multidimensional Scaling of Food Items Listed by Children who were of healthy weight



Appendix B

Table B.1

Differences in Mean Frequencies of Listed Food Items from Raw, Normalized, and Salience Data

Item	Raw μ_o-μ_h	Normalized item/length of list	Salience S_o-S_h
apple	.133	.0142	.129571
carrots	.067	.002947	.008359
pizza	-.167	-.0023	-.14167
bananas	.1	.0195 (.0050)	.073662
oranges	.066	.010202 (.1947)	.07
water	.167	.012331	.081907
grapes	.1	.019727	.066897
cucumber	.133	.0136	.048643
cereal	.134	.0082	.053813
broccoli	-.033	-.010777	-.057865
egg	.134	.022199	.057236
mac/cheese	.000	.0026	-.019495
pear	.000	-.0042	.012938
hot dog	.033	-.0057	.032778
bread	.066	.013636	.011868
hamburger	-.034	-.001142	-.04
sandwich	-.133	-.017755	-.0869
chicken	-.1	.0189	-.04798
ice cream	-.133	-.018996	-.06045
candy	.067	.008862	.04
corn	.0	-.00793	-.030303
strawberry	-.033	-.009357	-.079304
peaches	.033	.0058	.012458
tomatoes	.067	.006557	.036397
chips	.033	.0061	-.000882
meat	.067	.003887	.041615
blueberries	.1 (not listed by healthy)	.009881	.063214
choc milk	.03 (not listed by healthy)	.002564	.061026
chick nug	-.133	-.020044	-.061657
fries	-.1	-.0188	-.05
mushroom	.067 (not listed by healthy)	.008333	.044444
pickle	.034	.003824	.005051
cake	.0	-.002626	.004343
pancake	.034	.000277	.03
cheese	-.23	-.0145	-.086624
watermelon	.0	.000648	.018333

turkey	-.066	-.000589	-.038401
lemon	.000	.005495	.000686
salad	-.1	-.017159	-.023526
subway	.034	.00438	.012714
salt	.0	-.003172	.00811
lettuce	.0	.000025	.008999
yogurt	.034	.001287	.027015
sausage	.034	.008031	.013182
orange juice	.067 (not listed by healthy)	.010833	.043333
waffles	.067 (not listed by healthy)	.006944	.0625
smoothies	.067 (not listed by healthy)	.005556	.022222
pineapple	.067 (not listed by healthy)	.008182	.04
macaroni	.067 (not listed by healthy)	.004293	.057828
pepper	.067 (not listed by healthy)	.005294	.02451
milk	-.033	.012982	.007999
fruit	-.066	-.015186	-.046851
choc bar	.03 (not listed by healthy)	.002564	.021795
pb&j sand	-.067	-.008483	-.046603
vegetable	-.034	-.005397	-.021429
cookie	-.1	-.008285	-.022421
popsicle	-.034	-.0074	-.029394
cupcake	-.067	-.004787	-.024739
cheese its	-.034	-.004041	-.02697
spinach	.0	-.003637	.002424
maple sand	.033	.033333	.033333
steak	-.03	.0061	-.058334
bacon	-.034	.0144	-.005556
food	.0	-.002223	-.001111
cherry	.0	.001603	.015705
potato	.0	-.000926	-.00463
grilled cheese	.0	-.003637	.000364
applesauce	.0	-.005152	-.015151
ham	.0	-.000555	-.002778
pop	.033 (not listed by healthy)	.016667	.033333
cheeseburg	.033 (not listed by healthy)	.004167	.008333
cheerios	.033 (not listed by healthy)	.00303	.00303
granola bar	.033 (not listed by healthy)	.015152	.02272
gold fish	.033 (not listed by healthy)	.015152	.021212
donuts	.033 (not listed by healthy)	.015152	.016667
pb sand	.033 (not listed by healthy)	.015152	.015152
kiwi	.033 (not listed by healthy)	.002381	.014286
lime	.033 (not listed by healthy)	.002381	.011905
hot choc	.033 (not listed by healthy)	.002778	.011111
milkshake	.033 (not listed by healthy)	.002778	.005556

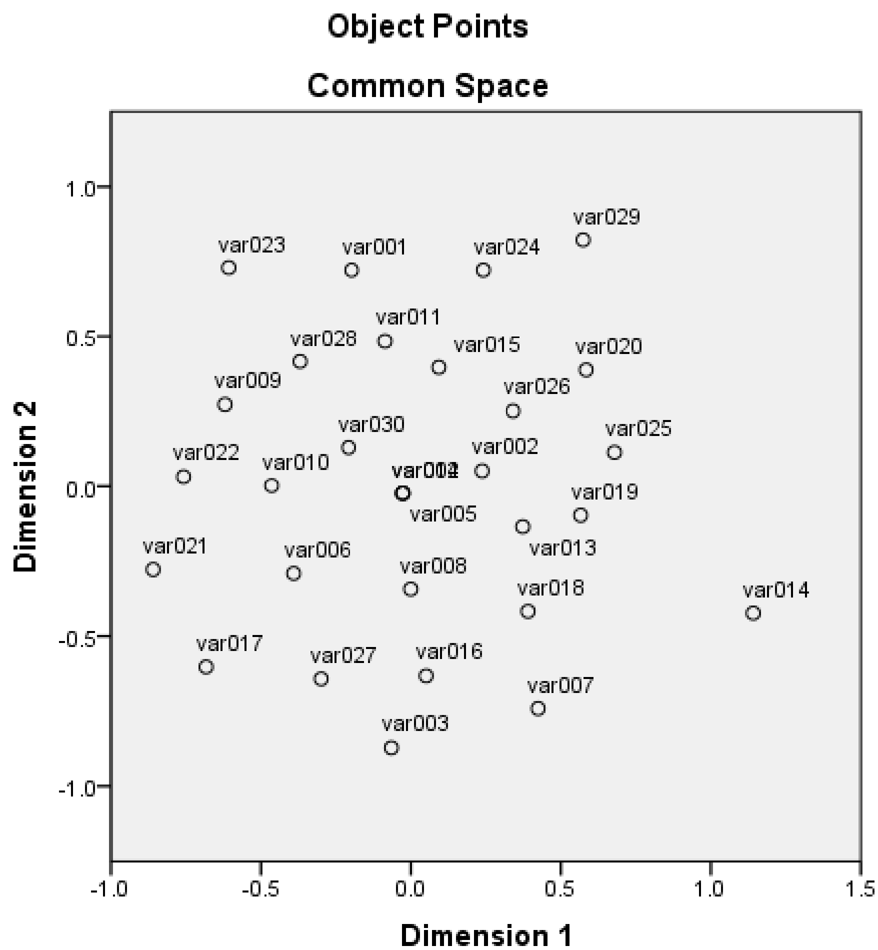
rice	.033 (not listed by healthy)	.004167	.029167
grapeleaves	.033 (not listed by healthy)	.004167	.025
peppers	.033 (not listed by healthy)	.003704	.033333
gummy bear	.033 (not listed by healthy)	.003704	.011111
muffin	.033 (not listed by healthy)	.001961	.021569
bologna sand	.033 (not listed by healthy)	.001961	.033333
egg sand	.033 (not listed by healthy)	.001961	.029412
cheesy brd	.033 (not listed by healthy)	.005294	.011765
Chinese fd	.033 (not listed by healthy)	.005294	.005882
Worms	.033 (not listed by healthy	.005294	.001961
Butter	.033 (not listed by healthy)	.003333	.003333
Gr apple	.033 (not listed by healthy)	.003333	.01
Melon	.033 (not listed by healthy)	.003704	.011111
Slushie	.033 (no listed by healthy)	.002564	.00256
Zuch brd	.033 (not listed by healthy)	.002564	.015385
Monk brd	.033 (not listed by healthy)	.002564	.012821
Pooh	.033 (not listed by healthy)	.002564	.025641
Rodsticks	.033 (not listed by healthy)	.002564	.0250513
Leftorsand	.033 (not listed by healthy)	.002564	.017949
Grgrapes	.033 (not listed by healthy)	.002778	.025
Purgrapes	.033(not listed by healthy)	.002778	.008333
Cauliflower	.033 (not listed by healthy)	.002778	.027778
Mommy	.033 (not listed by healthy)	.003333	.023333
Coffee	.033 (not listed by healthy)	.003333	.013333
Washsoap	.033 (not listed by healthy)	.003333	.003333
Paper	.033 (not listed by healthy)	.003333	.006667
Mashpot	.033 (not listed by healthy)	.00303	.033333
Scramegg	.033 (not listed by healthy)	.00303	.021212
Chnodsoup	.033 (not listed by healthy)	.00303	.01
Breadstick	.033 (not listed by healthy)	.00303	.012121
Meatloaf	.033 (not listed by healthy)	.00303	.00303
Brkstbar	.033 (not listed by healthy)	.008333	.016667
Toaststrud	.033 (not listed by healthy)	.008333	.008333
Flashes	.033 (not listed by healthy)	.002564	.023077
Spaghetti	-.17 (not listed by obese)	-.030623	-.125505
Noodles	-.1 (not listed by obese)	-.0011	-.028745
Tacos	-.067(not listed by obese)	-.01	-.04
Nachos	-.067(not listed by obese)	-.008095	-.038571
Meatballs	-.067(not listed by obese)	-.009259	-.035185
Sucker	-.033(not listed by obese)	-.006667	-.006667
Pretzel	-.033(not listed by obese)	-.004167	-.008333
Green bean	-.033(not listed by obese)	-.004167	-.0125
Pastameat	-.033(not listed by obese)	-.0083333	-.025
Pastaveg	-.033(not listed by obese)	-.0083333	-.008333

Breadbut	-.033 (not listed by obese)	-.0083333	-.016667
Avocado	-.033 (not listed by obese)	-.002222	-.031111
Fish	-.033 (not listed by obese)	-.002222	-.017778
Chocolate	-.033 (not listed by obese)	-.002222	-.006667
Cinnamon	-.033 (not listed by obese)	-.0022222	-.004444
Choc chips	-.0033 (not listed by obese)	-.006111	-.002222
Wheat	-.033 (not listed by obese)	-.005556	-.005556
Asparagus	-.033 (not listed by obese)	-.001515	-.027273
Brownie	-.033 (not listed by obese)	-.045455	-.021212
Applejuice	-.033 (not listed by obese)	-.001515	-.007576
Marshmal	-.033 (not listed by obese)	-.017159	-.028205
Candycorn	-.033 (not listed by obese)	-.002564	-.020513
Popcorn	-.033 (not listed by obese)	-.002564	-.017949
Grapefruit	-.033 (not listed by obese)	-.002222	-.013333
Cottageches	-.033 (not listed by obese)	-.002222	-.008889
Chili	-.033 (not listed by obese)	-.0022222	-.004444
Celery	-.033 (not listed by obese)	-.003704	-.014815
Chickbites	-.033 (not listed by obese)	-.0033333	-.026667
Juice	-.033 (not listed by obese)	-.0055556	-.005556
Treat	-.033 (not listed by obese)	-.00303	-.033333
Candycane	-.033 (not listed by obese)	-.00303	-.030303
Fiberone	-.033 (not listed by obese)	-.005555	-.011111
Cornbread	-.033 (not listed by obese)	-.0083333	-.016667
Radishes	-.033 (not listed by obese)	-.004762	-.009524
Plum	-.033 (not listed by obese)	-.002564	-.007692
Jelly	-.033 (not listed by obese)	-.002564	-.002564
Pizzaroll	-.033 (not listed by obese)	-.004762	-.028571
Pepperoni	-.033 (not listed by obese)	-.004762	-.019048
Fruitsnack	-.033 (not listed by obese)	-.004762	-.014286
Chickfries	-.033 (not listed by obese)	-.006667	-.013333
Happymeal	-.033 (not listed by obese)	-.002564	-.023077
Stringchees	-.033 (not listed by obese)	-.002222	-.028889

Appendix B

Figure B.5

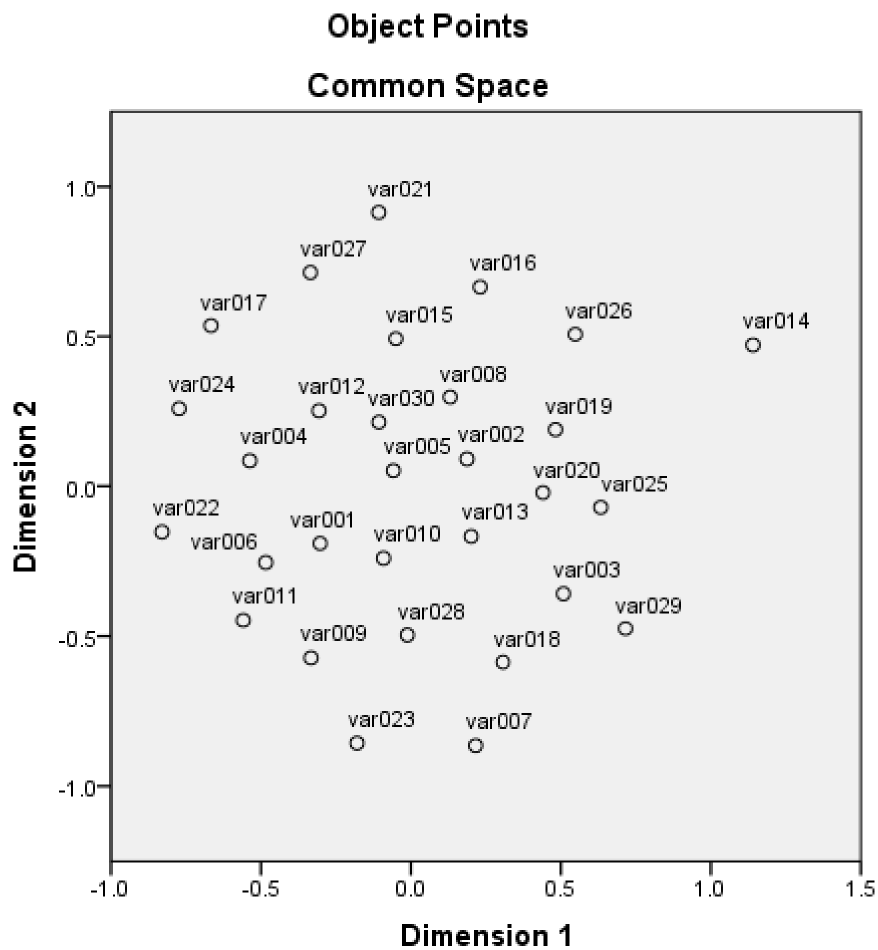
Multidimensional Scaling of Children who were obese relative to Food Items Listed as Eaten



Appendix B

Figure B.6

Multidimensional Scaling of Children who were of healthy weight relative to Food Items Listed as Eaten



Appendix B

Figure B.7

Multidimensional Scaling of Food Items Listed as Eaten by Children who were obese

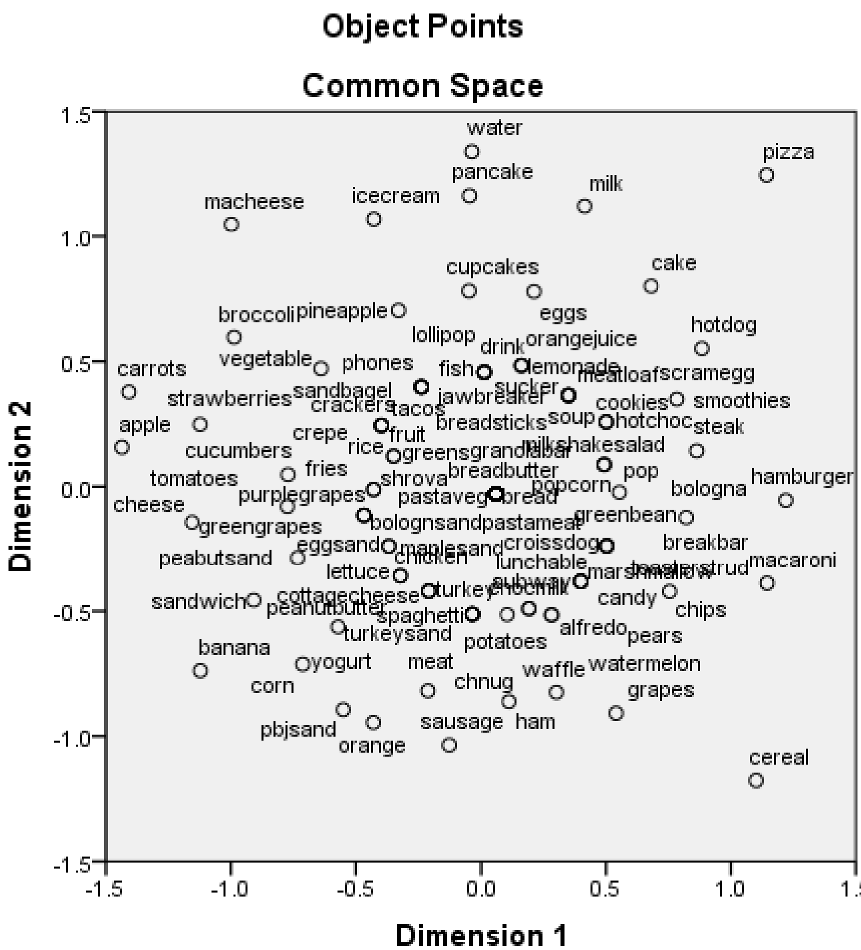
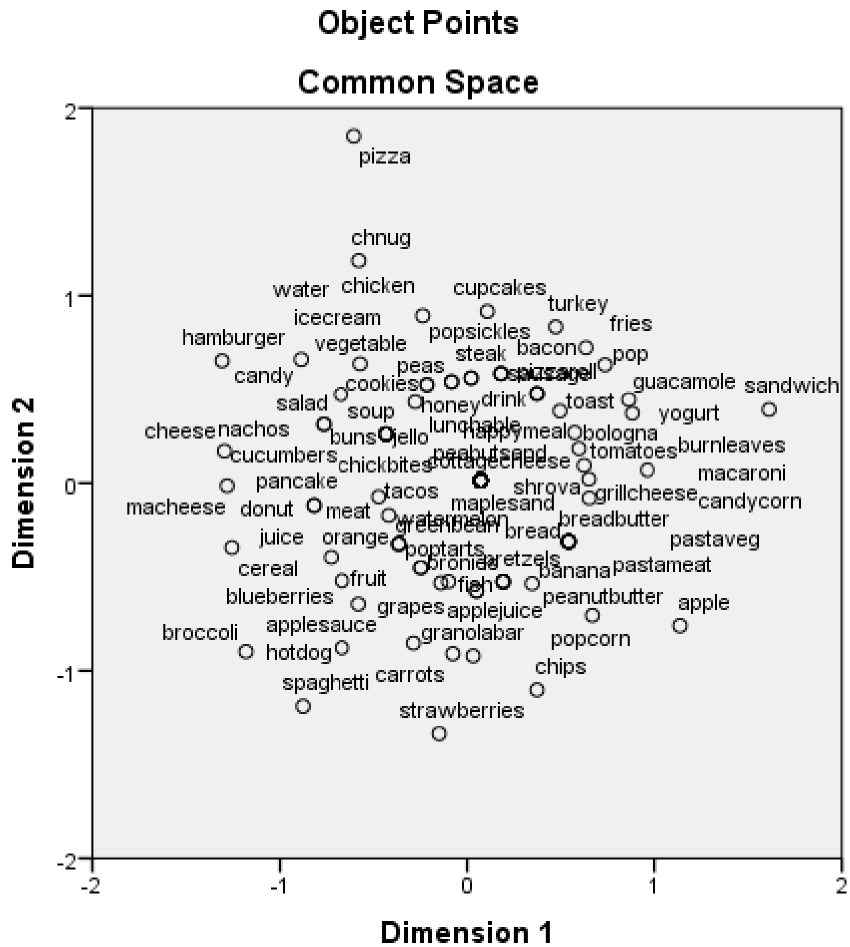


Figure B.8

Multidimensional Scaling of Food Items Listed as Eaten by Children who were of healthy weight



Appendix B

Table B.2

Difference of Mean Frequencies of Foods Listed as Eaten from Raw, Normalized, and Salience Data

Item	Raw μ_o-μ_h	Normalized item/length of list	Salience S_o-S_h
pizza	-.033	-.001161	-.077782
cereal	.1	.01	.04
apple	.067	-.006995	.031414
carrots	.133	.013283	.062677
banana	.1	.007474	.064748
water	.067	.009394	.06351
macchees	.07	-.008914	-.029192
broccoli	-.034	-.011454	-.03
hamburger	-.034	-.015859	-.04
strawberries	.0	-.010025	-.078359
ice cream	.066	.007475	.044647
cheese	.0	-.005303	.002742
macaroni	.066	.001602	.036494
pancakes	.066	.006894	.061136
milk	.1	.00828	.010328
sandwich	-.1	-.025556	-.066389
orange	.067	.003333	.03337
hot dogs	.0	-.00541	.024286
grapes	.067	.010833	.048334
sausage	.067	.007792	.020508
cake	.1 (not listed by healthy)	.02833	.053333
pb&j sand	.1 (not listed by healthy)	.04	.05
corn	.1	.01053	.072424

chicnug	-.066	-.011666	-.000833
steak	.034	.011111	.029167
bologna	.034	-.001969	-.01
yogurt	.0	.001984	.021032
tomatoes	.034	-.002525	.001515
cupcakes	.0	-.006969	.006566
chips	-.033	-.010278	-.003333
cuc	.034	.004042	.011212
peabutsand	.067 (not listed by healthy)	.02222	.022222
vegetable	.034	.012222	.022223
eggs	.067 (not listed by healthy)	.006061	.039394
ham	.067 (not listed by healthy)	.011111	.061111
waffle	.034	.002222	.027778
smoothie	.067 (not listed by healthy)	.007197	.022727
pineapple	.067 (not listed by healthy)	.0075	.010833
potato	.03 (not listed by healthy)	.008095	.04
fries	-.034	.01	.01
shrova	.033 (not listed by healthy)	.003333	.006667
turkey	-.034	-.009167	-.005
greenbean	.0	-.0025	.015834
watermelon	.0	.026666	.026666
fruit	-.034	-.003055	-.04
popcorn	-.034	-.008889	.021111
spaghetti	-.134	-.028889	-.106111
salad	-.034	.005556	-.02
chnodsoup	-.03	.00254	.007937
tomatosoup	-.03	.008888	.013333
candy	-.034	-.001111	-.016667
cottagech	.033 (not listed by healthy)	.004762	.033333

maplesand	.033 (not listed by healthy)	.004762	.028571
peabutter	.0	-.000794	-.006349
turkeysand	.033 (not listed by healthy)	.016667	.033333
chicken	-.034	-.006944	-.022222
meat	.0	-.003334	.003333
drink	.0	-.002526	.010606
fish	.0	-.002526	-.016161
granolabar	-.034	-.011667	-.031667
sucker	.033 (not listed by healthy)	.00303	.033333
lollipp	.033 (not listed by healthy)	.00303	.030303
jawbreaker	.033 (not listed by healthy)	.00303	.027273
bacon	.0	-.001137	.017045
cookie	.0	-.001137	.012879
pop	-.034	-.0125	-.008334
lettuce	.03	.001388	-.011107
lunchable	.0	.001111	.014444
tacos	.0	-.0025	-.018334
subway	.033 (not listed by healthy)	.006667	.033333
marshmal	.033 (not listed by healthy)	.006667	.006667
greens	.033 (not listed by healthy)	.006667	.013333
pears	.033 (not listed by healthy)	.005556	.033333
alfredo	.033 (not listed by healthy)	.005556	.005556
hochoc	.033 (not listed by healthy)	.00303	.009091
milkshake	.033 (not listed by healthy)	.00303	.00303
crepe	.033 (not listed by healthy)	.003333	.033333
rice	.033 (not listed by healthy)	.003333	.026667
grapeleav	.033 (not listed by healthy)	.003333	.023333
cherries	.033 (not listed by healthy)	.003333	.016667
pepper	.033 (not listed by healthy)	.003333	.026667

bologsand	.033 (not listed by healthy)	.005556	.033333
eggsand	.033 (not listed by healthy)	.005556	.027778
lemonade	.033 (not listed by healthy)	.00303	.018182
orangjui	.033 (not listed by healthy)	.00303	.015152
chocmilk	.033 (not listed by healthy)	.036364	.057576
greengrap	.033 (not listed by healthy)	.00303	.024242
purplegrap	.033 (not listed by healthy)	.00303	.006061
cauliflow	.033 (not listed by healthy)	.00303	.027273
crackers	.033 (not listed by healthy)	.004167	.025
sandbagel	.033 (not listed by healthy)	.004167	.0125
phone	.033 (not listed by healthy)	.004167	.029167
partyhats	.033 (not listed by healthy)	.004167	.016667
breadsticks	.033 (not listed by healthy)	.004762	.004762
scramegg	.033 (not listed by healthy)	.004762	.014286
meatloaf	.033 (not listed by healthy)	.004762	.02381
pickles	.033 (not listed by healthy)	.004762	.028571
toastrudel	.033 (not listed by healthy)	.004167	.020833
crosdog	.033 (not listed by healthy)	.004167	.0125
breakbar	.033 (not listed by healthy)	.004167	.008333
worms	.033 (not listed by healthy)	.005556	.01111
blueberries	-.067 (not listed by obese)	-.008333	-.05
guacamole	-.067 (not listed by obese)	-.013889	-.019444
nachos	-.067 (not listed by obese)	-.008889	-.042222
juice	-.067 (not listed by obese)	-.011111	-.027778
donut	-.067 (not listed by obese)	-.010833	-.0375
applesauce	-.067 (not listed by obese)	-.013333	-.04
bread	-.033 (not listed by obese)	-.008333	-.033333
pastameat	-.033 (not listed by obese)	-.0083333	-.025
breadbutter	-.033 (not listed by obese)	-.0083333	-.016667

pastaveg	-.033 (not listed by obese)	-.0083333	-.008333
healthy	-.033 (not listed by obese)	-.016667	-.033333
unhealthy	-.033 (not listed by obese)	-.016662	-.016667
soup	-.00 (not listed by obese)	-.004163	-.016667
candycorn	-.033 (not listed by obese)	-.006667	-.006667
burnleaves	-.033 (not listed by obese)	-.005556	-.005556
surges	-.033 (not listed by obese)	-.011111	-.033333
chexmix	-.033 (not listed by obese)	-.011111	-.022222
pudding	-.033 (not listed by obese)	-.011111	-.011111
grillcheese	-.033 (not listed by obese)	-.0083333	-.025
jello	-.033 (not listed by obese)	-.002222	-.026667
chckbites	-.033 (not listed by obese)	-.002222	-.022222
buns	-.033 (not listed by obese)	-.002222	-.017778
bronie	-.033 (not listed by obese)	-.005556	-.033333
pretzel	-.033 (not listed by obese)	-.005556	-.005556
applejuic	-.033 (not listed by obese)	-.008333	-.008333
peas	-.033 (not listed by obese)	-.004167	-.029167
coconutwat	-.033 (not listed by obese)	-.005556	-.005556
happymeal	-.033 (not listed by obese)	-.004167	-.020833
popsicle	-.033 (not listed by obese)	-.004762	-.028571
honey	-.033 (not listed by obese)	-.004762	-.009524
toast	-.033 (not listed by obese)	-.0055556	-.033333
pizzaroll	-.033 (not listed by obese)	-.005556	-.016667
poptart	-.033 (not listed by obese)	-.000667	-.026667

Appendix B

Table B.3

Summary of Findings from Cluster Analysis of Raw Shared, Salience, Salience Shared, Reduced Normalized, and Reduced Normalized Shared Data for Foods Listed Within and Between the two Groups

File	Children who are obese	Children who were of healthy weight
Raw shared: Number of clusters of children	1 final single cluster of 29 children 1 separate entity/item – 1 child who had listed 22 food items	1 final single cluster of 29 children 1 separate entity/item – 1 child who had listed 14 food items
Raw shared: Food Items	1 final single cluster of 53 items 1 separate entity/item - Carrots 1 separate entity/item - Pizza 1 separate entity/item – Banana, apple, and orange	1 final single cluster of 57 items 1 separate entity/item - Pizza
Salience: Number of clusters of children	1 final single cluster of 29 children 1 separate entity/item – 1 child who had listed 22 food items	1 final single cluster of 29 children 1 separate entity/item - 1 child who had listed 22 food items
Salience: Food Items	1 final single cluster of 155 items 1 separate entity/item - Apple	1 final single clusters of 155 items 1 separate entity/item -Pizza
Salience shared: Number of clusters of children	1 final single cluster of 29 children 1 separate entity/item - 1child who had listed 22 food items	1 final single cluster of 29 children 1 separate entity/item – 1 child who had listed 14 food items
Salience shared: Food Items	1 final single cluster of 57 items 1 separate entity/item – Apple	1 final single cluster of 57 items 1 separate entity/item - Pizza
Reduced normalized: Number of clusters of children	1 final single cluster of 29 children 1 separate entity/item – 1 child listed 22 items that were classified into 8 categories (fruit, combined foods, bakery/products, snacks, cereal/breakfast, sweets/goodies,	1 final single cluster of 28 children 1 separate entity/item contained a pair of children: 1 child listed 22 items that were classified into 8 categories (combined foods, bakery product, vegetable, fruit, poultry, dairy, fruit

	fast/convenience, vegetable)	juice, and sweets/goodies), 1 child listed 4 categories (snack, dairy, fruit, and combined) , the other child listed 15 items that were classified into 4 categories (snack, dairy, fruit, and combined)
Reduced normalized: Food Items	1 final single cluster of 22 categories 1 separate entity/item - Fast/convenience foods	1 final single cluster of 22 categories 1 separate entity/item - Fast/convenience foods
Reduced normalized shared: Number of clusters of children	1 final single cluster of 27 children 1 separate entity/item – a pair of children and a single child: 1 child (pair) listed 10 items that were classified into 4 categories (fruit, fast/convenience, combined foods, and ethnic), 1 child (pair) listed 7 items that were classified into 3 categories (vegetable, cereal/breakfast, and fast/convenience), 1 single child listed 5 items classified into 4 categories (meat, combined food, dairy, and pasta)	1 final single cluster of 28 children 1 separate entity/item contained a pair of children: 1 child listed 8 categories (combined foods, bakery product, vegetable, fruit, poultry, dairy, fruit juice, and sweets/goodies), 1 child listed 4 categories (snack, dairy, fruit, and combined)
Reduced normalized (raw shared) food items	1 final single cluster of 18 categories 1 separate entity/item - Fast/convenience food	1 final single cluster of 18 categories 1 separate entity/item - Fast/convenience food

Appendix B

Table B.4

Summary of Findings from Multidimensional Scaling of Raw Shared, Salience, Salience Shared, Reduced Normalized, and Reduced Normalized Shared Data for Foods Listed Within and Between the two Groups

File	Children who are obese	Children who were of healthy weight
Raw shared: Number of children as outliers	2 outliers: 1 child had listed 17 items 1 child had listed 22 items	Children were evenly distributed across two-dimensional space 1 child – had listed 22 items
Raw shared: Food Items as outliers	4 outliers: Apple, pizza, milk, and carrots	Pizza
Salience: Number of children as outliers	4 outliers: 2 children had listed 12 items, 1 child had listed 17 items, 1 child had listed 22 food items	Did not meet the criteria for multidimensional scaling
Salience: Food items as outliers	5 outliers: Oranges, bananas, apple, carrots, and pizza	Pizza
Salience shared: Number of children as outliers	1 outlier – 1 child had listed 22 items	Did not meet the criteria for multidimensional scaling
Salience shared: Food Items as outliers	4 outliers: Oranges, bananas, apples, and carrots	3 outliers: Pizza, apple, and broccoli
Reduced normalized: Number of children as outliers	3 outliers: 1 child had listed 17 food items classified into 10 categories (combined, snacks, cereal/breakfast, bread/rolls, dairy, vegetable, fast/convenience, miscellaneous, ethnic, and non-foods), 1 child listed 22 items classified into 9 categories (fruit, combined, pasta, bakery products, snacks, cereal/breakfast, sweet/goodies, fast/convenience, and	3 outliers: 1 child listed 22 items classified into 8 categories (combined foods, bakery product, vegetable, fruit, poultry, dairy, fruit juice and sweets/goodies), 1 child listed 6 items classified into 6 categories (fruits, vegetables, water, combined foods, food, and fruit juice), 1 child had listed 8 items classified into 6 categories (vegetables, poultry, combined foods,

	vegetable), 1 child listed 10 items classified into 4 categories (vegetable, fast/convenience, combined foods, and poultry)	fast/convenience, snacks, and dairy)
Reduced normalized: Food Items as outliers	1 outlier - Fast/convenience food	1 outlier - Fast/convenience food
Reduced normalized shared: Number of children as outliers	3 outliers: 1 child had listed 17 food items classified into 10 categories (combined, snacks, cereal/breakfast, bread/rolls, dairy, vegetable, fast/convenience, miscellaneous, ethnic, and non-foods), 1 child listed 22 items classified into 9 categories (fruit, combined, pasta, bakery products, snacks, cereal/breakfast, sweet/goodies, fast/convenience, and vegetable), 1 child listed 10 items classified into 4 categories (vegetable, fast/convenience, combined foods, and poultry)	3 outliers: 1 child had listed 7 items classified into 3 categories (vegetable, cereal/breakfast, and fast/convenience), 1 child had listed 3 foods classified into 1 category (fruit), 1 child had listed 1 item classified into 1 category (bread/rolls)
Reduced normalized shared: Food Items as outliers	1 outlier - Fast/convenience food	1 outlier - Fast/convenience food

Appendix B

Table B.5

Summary of Findings from Cluster Analysis of Raw Shared, Salience, Salience Shared, Reduced Normalized, and Reduced Normalized Shared Data for Foods Listed as Eaten Within and Between the two Groups

File	Children who were obese	Children who were of healthy weight
Raw shared: Number of clusters of children	1 final single cluster of 27 children 3 separate entities/items – 3 children formed 3 separate entities/items 1 child had listed 9 food items as eaten, 2 children had listed 10 food items as eaten	1 final single cluster of 29 children 1 entity/item – 1 child had listed 15 items as eaten
Raw shared: Food Items	1 final single cluster of 49 items 1 separate entity/item - Pizza 1 separate entity/item - cereal	1 final single cluster of 50 items 1 separate entity/item - Pizza
Salience: Number of clusters of children	1 final single cluster of 29 children 1 separate entity/item – 1 child had listed 11 items as eaten	1 final single cluster of 28 children 1 separate entity/item – 1 child had listed 6 items 1 separate entity/item - 1 child had listed 8 items
Salience: Food Items	1 final single cluster of 132 items 1 separate entity/item - Apples and carrots	1 final single cluster of 133 items 1 separate entity/item – Pizza
Salience shared: Number of clusters of children	1 final single cluster of 27 children 3 separate entity/item - 3 children 1 child had listed 9 food items as eaten, 2 children had listed 10 food items as eaten	1 final single cluster of 28 children 1 separate entity/item - 1 child had listed 6 items 1 separate entity/item - 1 child had listed 8 items
Salience shared: Food Items	1 final single cluster of 49 items 1 separate entity/item - Apples and carrots	1 final single cluster of 50 items 1 separate entity/item - Pizza
Reduced Normalized:	1 final single cluster of 29	1 final single cluster of 28

Number of clusters of children	children 1 separate entity/item – 1 child had listed 12 food items as eaten of which 8 were idiosyncratic, these were classified into 5 categories (vegetable, non-food, bread rolls, sugar-sweetened beverage, and meat)	children 1 separate entity/item - 2 children 1 child had listed 8 items classified into 5 categories (fruit, combined, vegetable, fast/convenience, and sweets/goodies) 1 child had listed 6 items classified into 6 categories (dairy, fruit, combined, snack, ethnic, and non-foods)
Reduced Normalized: Food Items	1 final single cluster of 27 categories 1 separate entity/item - Combined food	1 final single cluster of 27 categories 1 separate entity/item – Fruit
Reduced Normalized shared: Number of clusters of children	1 final single clusters of 29 children 1 separate entity/item - 1child had listed 1 items classified into 1 category (sugar-sweetened beverage)	1 final single cluster of 28 children 1 separate entity/item - 2 children 1 child had listed 8 items classified into 5 categories (fruit, combined, vegetable, fast/convenience, and sweets/goodies) 1 child had listed 6 items classified into 6 categories (dairy, fruit, combined, snack, ethnic, and non-foods)
Reduced Normalized shared: Food Items	1 final single cluster of 20 categories 1 separate entity/item - Combined food formed 1 cluster	1 final single cluster of 20 categories 1 separate entity/item – Fruit

Appendix B

Table B.6

Summary of Findings from Multidimensional Scaling of Raw Shared, Salience, Salience Shared, Reduced Normalized and Reduced Normalized Shared Data for Foods Listed as Eaten Within and Between the two Groups

File	Children who were obese	Children who were of healthy weight
Raw shared: Number of children as outliers	1 outlier - 1child had listed 10 items as eaten	Did not meet model criteria 1 outlier – 1 child had listed 15 items
Raw shared: Food items as outliers	3 outliers: Cereal, pizza, and macaroni and cheese	5 outliers: Sandwich, pizza, spaghetti, broccoli, and chicken nuggets
Salience: Number of children as outliers	1 outlier - 1 child had listed 9 items	Did not meet model criteria: Children dispersed across 2 dimensional space
Salience: Food items as outliers	2 outliers: Carrots and apples	2 outliers: Pizza and apples
Salience shared: Number of children as outliers	Did not meet the model criteria	Did not meet the model criteria
Salience shared: Food items as outliers	2 outliers: Steak and broccoli	5 outliers: Pizza, sandwich, apple, cereal, and strawberries
Reduced Normalized: Number of children as outliers	2 outliers: 1 child had listed 9 items classified into 5 categories (fast/convenience, combined, fruit, water, and ethnic) 1 child had listed 3 items classified into 3 categories (vegetable, meat, and combined)	Did not meet the model criteria
Reduced Normalized: Food Items as outliers	4 outliers: Fruits, vegetables, combined foods, and sugar sweetened beverages	2 outliers: Combined foods and fruit
Reduced Normalized shared: Number of children as outliers	4 outliers: 1 child had listed 1 items classified into 1 category (sugar-sweetened beverage) 1 child listed 1 item classified into 1 category (fruit) 1 child had listed 2 items	Did not meet the model criteria

	classified into 2 categories (cereal/breakfast, bakery product) 1 child had listed 6 items classified into 3 categories (fast/convenience, combined, and sweets/goodies)	
Reduced Normalized shared: Food Items as outliers	4 outliers: Fruits, vegetables, combined foods, and sugar sweetened beverages	5 outliers: Vegetables, fast/convenience foods, fruits, combined foods, and cereal/breakfast foods

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Table B.7

Summary of Reduced Normalized Categories of Food Listed by Children who were obese and Children who were of healthy weight

	Children who were obese	Children with healthy weight
Number of categories items classified into	23	20
Number of core categories	19	17
Number of idiosyncratic categories	4 Rice, butter, coffee/tea, food	3 Water, fish, food
Most frequently listed categories	Fruit (n = 62), vegetables (n = 36), combine foods/meal (n = 26)	Fruits (n = 44), combined foods/meal (n = 43), vegetables (n = 29)
Categories not listed	5 Nuts, fish, drinks, healthy, and unhealthy	8 Rice, butter, nuts, coffee/tea, non-foods, healthy, and unhealthy

Appendix B

Table B.8

Frequency and Differences in Means of Categories of Food Items Listed and Eaten

	Listed			Foods Listed as Eaten		
	Obese	Healthy	Mean Difference	Obese	Healthy	Mean Difference
Bread	7	5	.06	0	4	-.13
Cereal	18	3	.5	19	8	.37
Bakery	5	10	.17	6	5	.03
Sweets	9	15	.20	9	5	.13
Rice	1	0	.03	1	0	.03
Butter	1	0	.03	0	0	.00
Nuts	0	0	.00	1	1	.00
Vegetable	36	29	.23	25	13	.40
Fruit	62	44	.60	29	17	.40
Water	6	1	.17	5	4	.03
Juice	2	2	.00	1	3	-.13
SSB	11	2	.30	8	3	.17
Coffee	1	0	.03	0	0	.00
Meat	9	8	.03	12	5	.23
Poultry	5	10	-.17	2	4	-.07
Fish	0	1	-.03	1	1	.00
Dairy	6	15	-.30	11	7	.13
Misc	6	5	.03	2	1	.03
Non-food	6	0	.20	3	2	.03
Ethnic	2	4	-.07	3	6	-.01
Combined	26	43	-.57	30	32	-.07
Fast	16	22	-.02	13	17	-.13
Snack	8	10	-.07	6	14	-.27
Pasta	2	3	-.03	4	2	.07
Food	1	1	.00	0	0	.00
Drink	0	0	.00	1	1	.00
Healthy	0	0	.00	0	1	-.03
Unhealthy	0	0	.00	0	1	-.03

Differences were calculated by subtracting the means of healthy weight from the means of obese. Numbers with a negative sign represent greater frequency/familiarity with the category of food items for those with healthy weight.

Appendix B

Table B.9

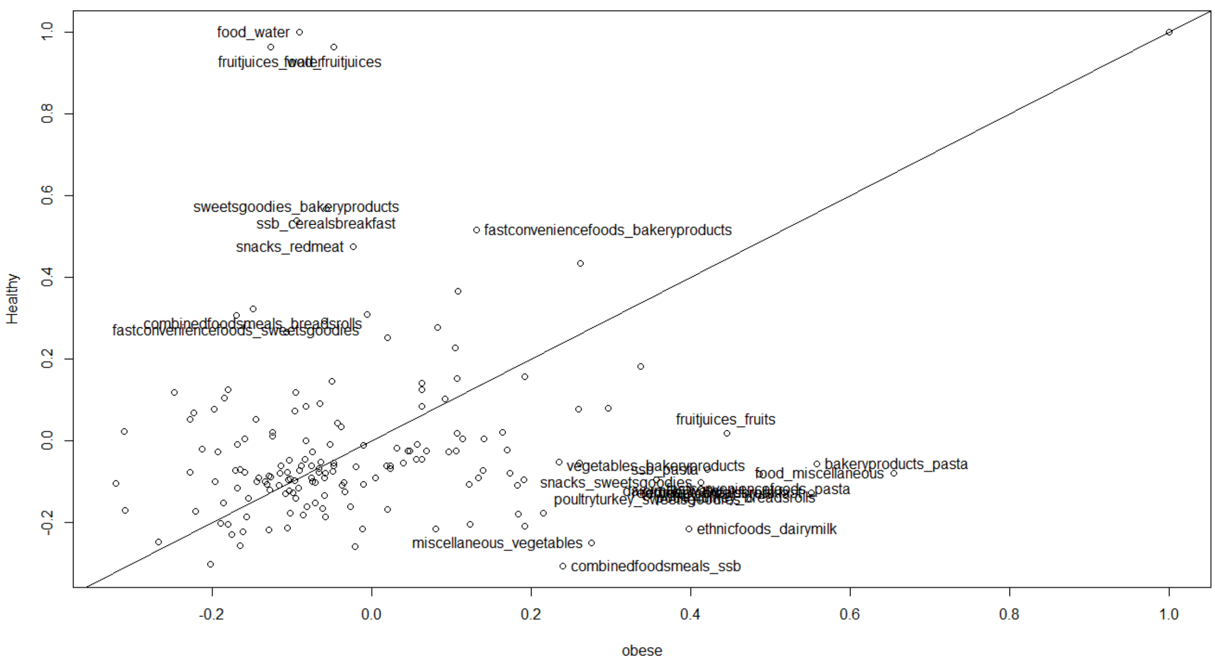
Significant Associations between Categories of Listed Food Items

Categories of associations	Children who were obese	Children who were of healthy weight
Bakery products/ pasta	2.52	
Sweets-goodies/ bakery products		-2.57
SSB/cereal-breakfast		-2.59
Red meat/bread-rolls	2.57	
Red meat/cereal- breakfast	2.75	
Fast-convenience/ pasta	2.25	
Poultry/sweets-goodies	2.42	
Snack/sweets-goodies	1.99	
Ethnic/rice	5.06	
Miscellaneous/ vegetable	1.97	
Fruit juice/water		-7.82
Dairy/water	2.24	
Food/fruit juice		-7.53
Combined foods/SSB	2.0	
Miscellaneous/coffee	2.88	
Non-foods/coffee	4.96	
Snack/red meat		-1.99
Fast-convenience/fish		-2.80
Ethnic/dairy	2.35	
Non-food/ miscellaneous	2.65	
Food/miscellaneous	3.17	
Food/non-food	4.96	

Numerical values were obtained by subtracting the z scores from correlation coefficients of preschool-age children with healthy weight from the z scores from correlation coefficients of preschool-age children who were obese. Numerical values with a negative sign denote that preschool-age children with healthy weight had a greater number of significant food associations.

Figure B.9

Scatter Plot of Correlation Coefficients from Category-to-Category Matrices of Reduced Normalized Foods that were Listed



Appendix B

Table B.10

Summary of Reduced Normalized Categories of Foods Listed as Eaten by Children who were obese and Children who were of healthy weight

	Children who are obese	Children who were of healthy weight
Number of categories items classified into	22	24
Number of core categories	17	18
Number of idiosyncratic categories	5 Rice, juice, fish, nuts, drink	6 Nuts, fish, miscellaneous, drink, healthy, and unhealthy
Most frequently listed categories	Combined food/meals (n = 30), fruits (n = 29), vegetables (n = 25)	Combined foods/meals (n = 32), fast/convenience (n = 17), fruits (n = 17)
Categories not listed	6 Bread, butter, coffee/tea, healthy, unhealthy, and food	4 Rice, butter, coffee/tea, and food

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Table B.11

Significant Associations between Categories of Foods Items Listed as Eaten

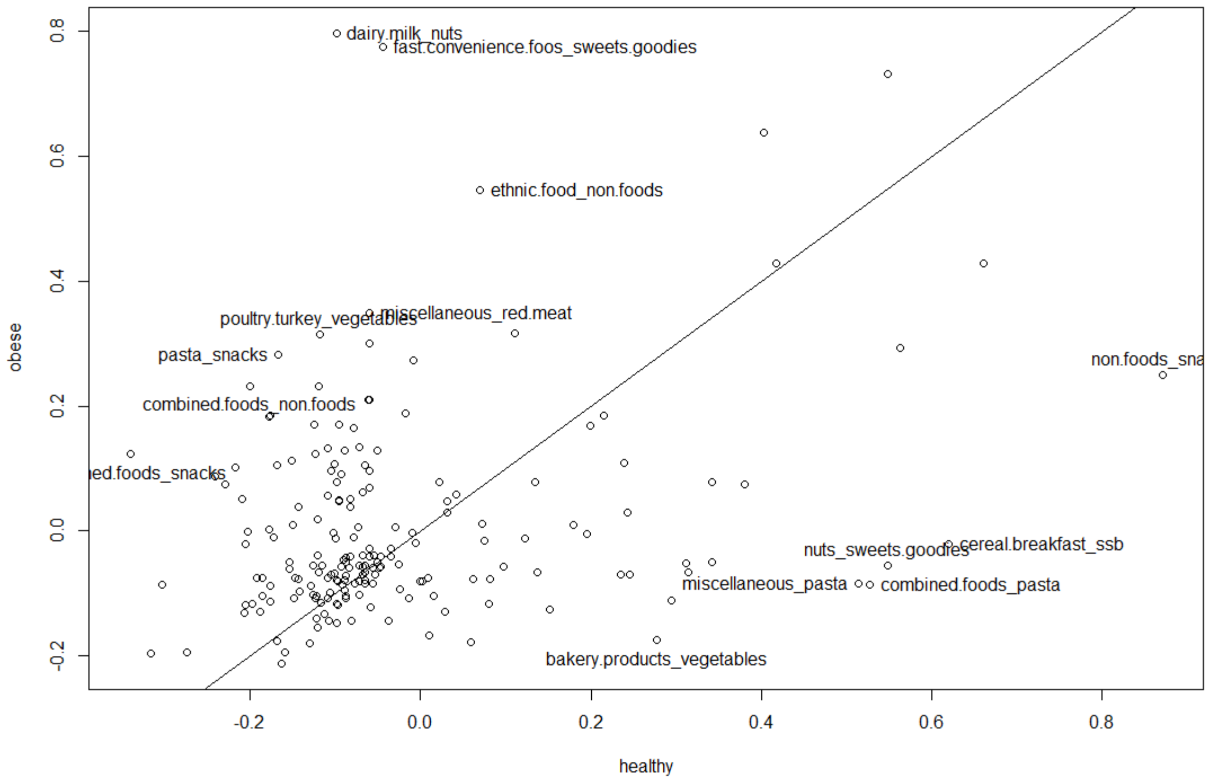
Associations between foods listed as eaten	Children who were obese	Children who were of healthy weight
Sweets-goodies/cereal-breakfast	7.40	
Dairy/cereal-breakfast	4.20	
Bread-rolls/combined		-4.11
Water/pasta	67.49	
Dairy/pasta	67.49	
Fast-convenience/pasta	67.49	
Sweets-goodies/bakery products		-68.76
Vegetable/bakery products		-4.8
SSB/bakery products		-68.76
Combined/bakery products	6.4	
Red meat/sweets-goodies	68.76	
Combined/sweets-goodies	2.24	
Snacks/sweets-goodies		-2.01
Water/vegetable	64.61	
Red meat/vegetable	2.3	
Poultry/vegetable	67.49	
Combined/vegetable	2.12	
Ethnic/fruits		-48.91
Snack/fruit		-7.17
Combined/red meat	7.63	
Fast-convenience/red meat		-2.91
Ethnic/dairy	67.49	
Combined/ethnic	8.4	
Fast-convenience/ethnic		-2.7
Snack/combined	6.69	
Snack/fast-convenience		-2.24

Numerical values were obtained by subtracting the z scores from correlation coefficients of preschool-age children with healthy weight from the z scores from correlation coefficients of preschool-age children who were obese. Numerical values with a negative sign denote that preschool-age children with healthy weight had a greater number of significant food associations.

Appendix B

Figure B.10

Scatter Plot of Correlation Coefficients from Category-to-Category Matrices of Reduced Normalized Foods that were Listed as Eaten



Appendix B

Table B.12

Frequency of Food Items Identified as Liked and Disliked by Preschool-age Children who were obese

	Liked	Disliked
Cream cheese	19	11
Pancake	30	0
Oranges	27	2
Peanut butter	26	4
Candy	28	2
Egg	25	5
Brownie	29	0
Spinach	12	17
Bagel	27	2
Peanuts	23	5
Sausage	22	7
Bologna	23	5
Pretzels	27	1
Honey	18	11
Ice cream	27	2
Stuffing	9	19
Sandwich	24	5
Yogurt	26	3
Broccoli	18	10
Twinkie	17	10
Meatball	22	7
Fruit loops	27	3
Pie	19	11

Muffin	28	2
Corn	29	0
Pineapple	24	4
Gravy	15	12
Waffles	27	1
Cheese cake	18	12
Oatmeal	20	10
Bacon	23	7
Chicken nuggets	26	4
Pop	15	13
Chicken	20	8
Crackers	29	1
Strawberries	29	1
Watermelon	28	2
Hot dogs	26	2
Turkey	23	7
Chocolate pudding	20	9
Hamburger	19	10
Cookie	29	1
Banana	30	0
Pizza	29	1
Milk	26	4
Raisins	21	8
Ham	21	7
Butter	20	9
Potato	18	11
Spaghetti	27	3
Green beans	17	12

Apple	30	0
Noodles	26	3
Water	28	1
Carrots	24	5
Grapes	29	1
Milkshake	23	6
Rolls	26	4
Cupcakes	26	3
Steak	20	9
Salmon	10	19
Chips	28	1
Cheetos	30	0
Cheese	24	5
Jell-O	24	6
Bread	27	2
Celery	15	13
Salad	19	11
Cake	24	5
Chocolate	27	3
Soup	22	8
Orange juice	28	2
Toast	29	0

Appendix B

Table B.13

Frequency of Food Items Identified as Liked and Dislike by Preschool-age Children who were of healthy weight

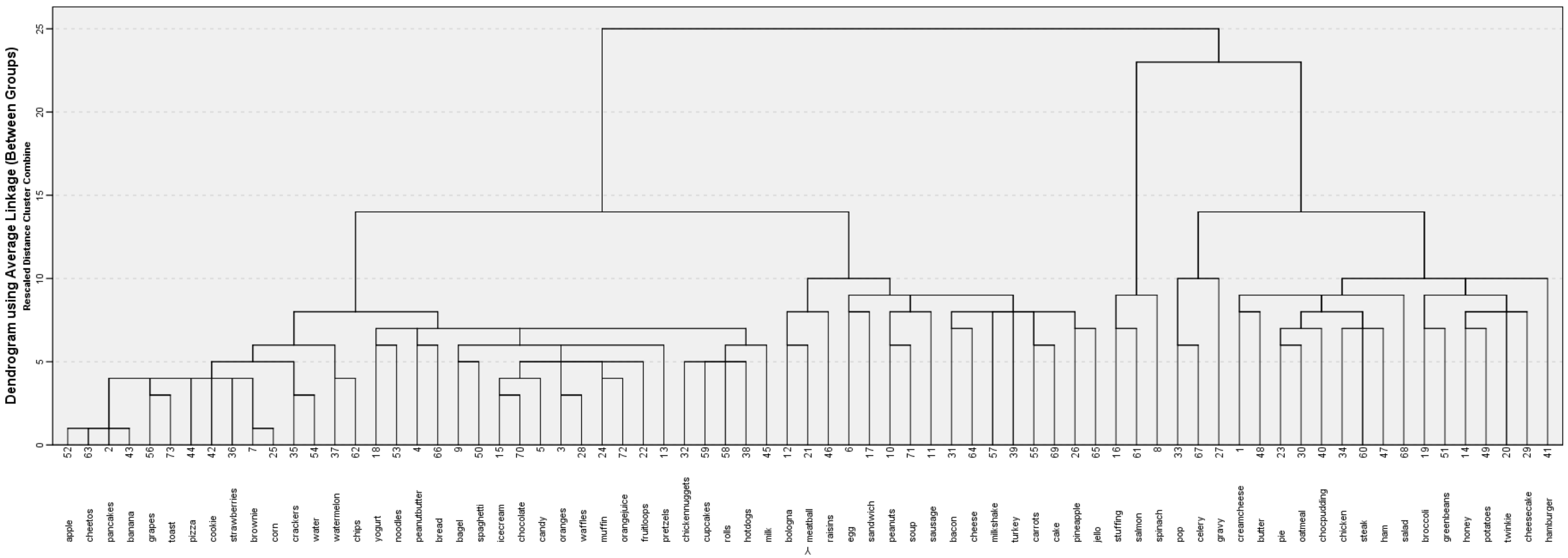
	Liked	disliked
Cream cheese	15	15
Pancake	26	4
Oranges	21	9
Peanut butter	17	13
Candy	24	6
Egg	18	12
Brownie	22	8
Spinach	14	16
Bagel	20	10
Peanuts	18	12
Sausage	23	7
Bologna	16	14
Pretzels	25	5
Honey	15	15
Ice cream	25	5
Stuffing	11	19
Sandwich	18	12
Yogurt	17	13
Broccoli	19	11
Twinkie	14	16
Meatball	18	12
Fruit loops	27	3
Pie	13	17
Muffin	19	11

Corn	21	9
Pineapple	18	12
Gravy	14	16
Waffles	24	6
Cheese cake	13	17
Oatmeal	17	13
Bacon	23	7
Chicken nuggets	25	5
Pop	22	8
Chicken	19	11
Crackers	25	5
Strawberries	26	4
Watermelon	26	4
Hot dogs	23	7
Turkey	19	11
Chocolate pudding	15	15
Hamburger	18	12
Cookie	25	5
Banana	19	11
Pizza	25	5
Milk	22	8
Raisins	20	10
Ham	19	11
Butter	20	10
Potato	12	18
Spaghetti	23	7
Green beans	13	17
Apple	25	5

Noodles	16	14
Water	23	7
Carrots	21	9
Grapes	24	6
Milkshake	19	11
Rolls	17	13
Cupcakes	23	7
Steak	18	12
Salmon	13	17
Chips	26	4
Cheetos	21	9
Cheese	22	8
Jell-O	20	10
Bread	23	7
Celery	14	16
Salad	14	16
Cake	23	7
Chocolate	26	4
Soup	17	13
Orange juice	22	9
Toast	20	10

Figure B.11

Dendrogram of Food Items Liked and Disliked by Preschool-age Children who were obese



Appendix B

Figure B.12

Dendrogram of Food Items Liked and Disliked by Preschool-age Children who were of healthy weight

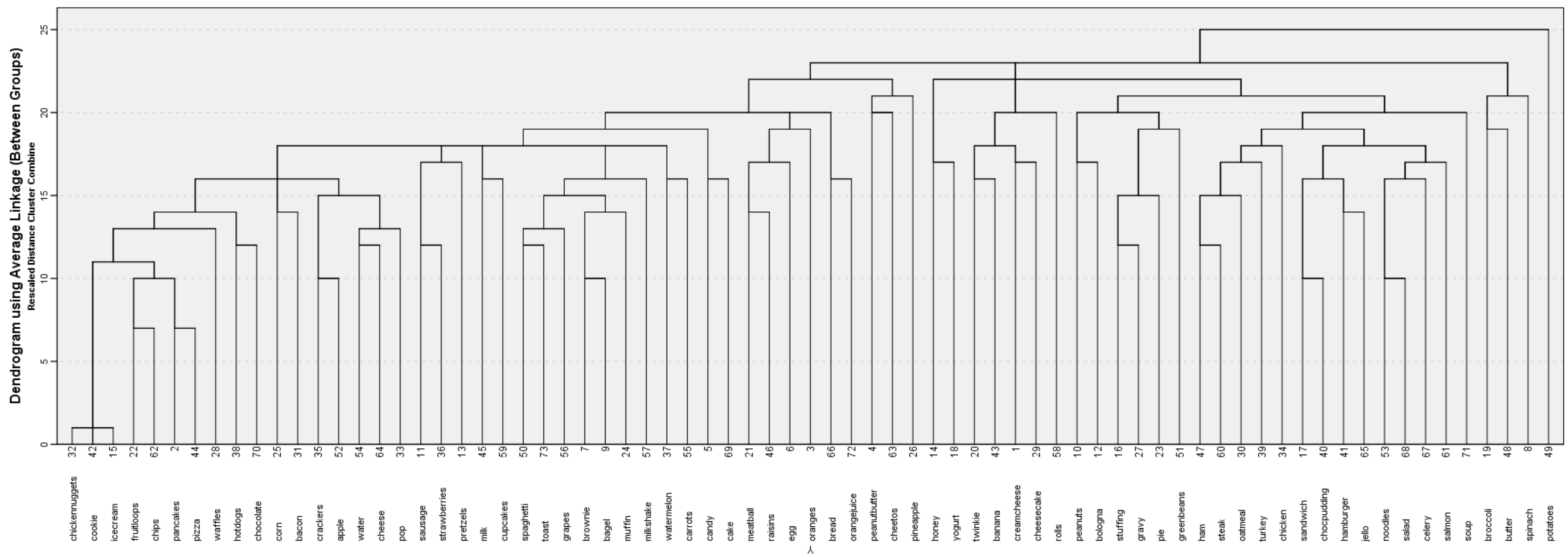
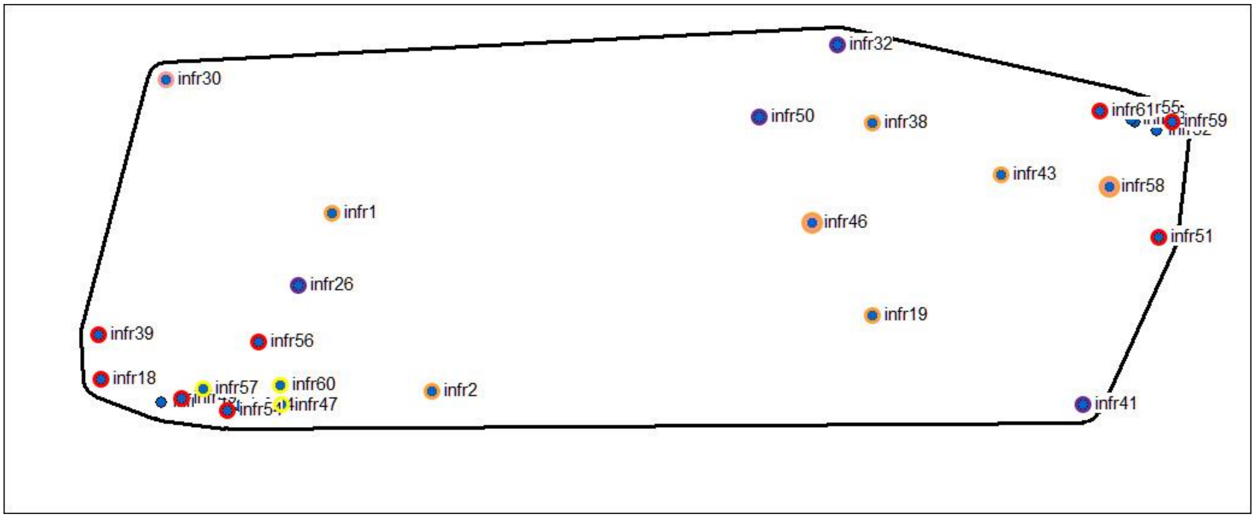


Figure B.13

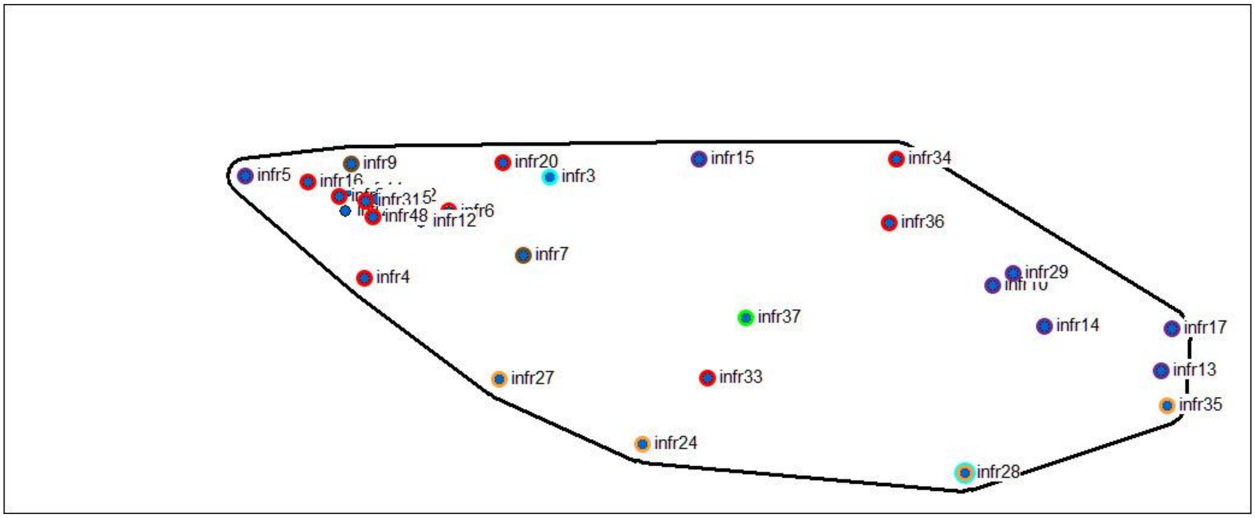
Multidimensional scaling of Preschool-age children who were obese relative to the Food Items Identified as Liked and Disliked



Red no label
Yellow combination color, shape, script, plating, and taxonomy
Orange doesn't like
Purple healthy/unhealthy
Pink likes to eat/doesn't like to eat

Figure B.14

Multidimensional scaling of Preschool-age Children who were of healthy weight relative to the Food Items Identified as Liked and Disliked



Red no label
Purple healthy/unhealthy
Orange doesn’t like
Green soft/hard to chew
Bright blue dad’s pile, mom’s pile
Brown foods made with of, with or from
Bright green for grown-ups

Appendix B

Table B.14

Differences in Mean Frequencies of Liked and Disliked Food Items from Card Sort

	Like	dislike		like	dislike		like	dislike
Cream cheese	1	-0.067	waffles	.99	-.03	carrots	1.0	-.07
Pancake	.96	0	cheese cake	1.02	-.10	grapes	.99	-.03
Oranges	1.01	-.08	oatmeal	1.0	-.07	milkshake	1.0	-.06
Peanut butter	.97	-.03	bacon	.95	.00	rolls	1.0	-.1
Candy	1.0	-.07	chicken nuggets	.98	-.03	cupcakes	.98	-.03
Egg	1.0	-.07	pop	1.02	-.06	steak	1.0	-.07
Brownie	.98	-.03	chicken	1.00	-.07	salmon	1.0	-.1
Spinach	.98	-.03	crackers	.95	-.00	chip	.99	.03
Bagel	.97	-.14	strawberries	.99	-.03	Cheetos	.98	-.03
Peanuts	.97	-.03	watermelon	.96	.00	cheese	.98	-.03
Sausage	1.0	-.07	hot dog	.98	-.03	Jell-O	.98	-.03
Bologna	1.0	-.07	turkey	.97	-.03	bread	1.0	-.06
Pretzels	1.0	-.07	chocolate pudding	1.0	-.1	celery	1.1	-.13
Honey	.97	.03	hamburger	.97	.04	salad	1.0	-.11
Ice cream	.99	-.03	cookie	.99	-.03	cake	1.1	-.1
Stuffing	.99	-.07	banana	1.04	-.10	chocolate	.99	-.03
Sandwich	1.0	-.07	pizza	.99	-.23	soup	1.0	-.07
Yogurt	.97	-.03	milk	.98	-.03	orange juice	1.0	-.07
Broccoli	.94	-.03	raisins	1.04	-.09	toast	1.0	-.07
Twinkie	1.0	-.10	ham	1.0	-.07	corn	.97	-.03
Meatball	1.0	-.07	butter	1.0	-.03	pineapple	.97	-.03
Fruit loops	.95	.0	potato	.96	-.03	apple	.95	-.20
Pie	.99	-.07	spaghetti	.98	-.03	noodle	.97	-.03
Muffin	1.0	-.07	green beans	.99	-.07			

Appendix C

Tables and Figures pertaining to Chapter IV

Table C.1 Frequency and Rank of Foods Listed by Children who were obese (n = 114)

Food item	frequency of listing	proportion of participants	# of items	salience of item for the group	classification
Apple	13	(.433)	(1)	0.343153	fruit
Carrots	9	(.3)	(2)	0.162191	vegetable
Pizza	9	(.3)		0.150392	combined
Bananas	8	(.267)	(1)	0.1854125	fruit
Oranges	7	(.233)	(1)	0.18782	fruit
Water	6	(.2)	(3)	0.104129	water
Grapes	6	(.2)		0.085985	fruit
Cucumber	6	(.2)		0.097128	vegetable
Cereal	5	(.167)	(3)	0.067146	cereal/breakfast
Broccoli	5	(.167)		0.112698	vegetable
Egg	5	(.167)		0.081046	cereal/breakfast
Mac & cheese	4	(.133)	(5)	0.068712	combined
Pear	4	(.133)		0.08234	fruit
Hot dog	4	(.133)		0.1	fast/convenience

Bread	4	(.133)		0.069444	bread
Hamburger	4	(.133)		0.056187	fast/convenience
Sandwiches	3	(.1)	(12)	0.059444444	combined
Chicken	3	(.1)		0.050505	poultry
Ice cream	3	(.1)		0.037121	sweet/goodie
Candy	3	(.1)		0.074339	sweet/goodie
Corn	3	(.1)		0.047475	vegetable
Strawberries	3	(.1)		0.030556	fruit
Peaches	3	(.1)		0.051347	fruit
Tomatoes	3	(.1)		0.050033	vegetable
Chips	3	(.1)		0.063562	snack
Meat	3	(.1)		0.065425	meat
Blueberries	3	(.1)		0.063214	fruit
Chocolate milk	3	(.1)		0.061026	SSB
Chicken nuggets	2	(.067)	(25)	0.039393939	fast/convenience
Fries	2	(.067)		0.02	fast/convenience
Mushroom	2	(.067)		0.044444	vegetable
Pickle	2	(.067)		0.038384	miscellaneous
Cake	2	(.067)		0.029798	bakery products
Pancake	2	(.067)		0.047222	cereal/breakfast
Cheese	2	(.067)		0.027778	dairy/milk
Watermelon	2	(.067)		0.053333	fruit
Turkey	2	(.067)		0.032407	poultry
Lemon	2	(.067)		0.034524	fruit
Salad	2	(.067)		0.025045	combined
Subway	2	(.067)		0.015278	fast/convenience
Salt	2	(.067)		0.029804	miscellaneous
Lettuce	2	(.067)		0.033761	vegetable
Yogurt	2	(.067)		0.052941	dairy/milk

Sausage	2	(.067)		0.043182	meat
Orange juice	2	(.067)		0.043333	fruit juice
Waffles	2	(.067)		0.0625	cereal/breakfast
Smoothies	2	(.067)		0.022222	SSB
Pineapple	2	(.067)		0.04	fruit
Macaroni	2	(.067)		0.057828	pasta
Pepper	2	(.067)		0.02451	miscellaneous
Milk	2	(.067)		0.046296	dairy/milk
Fruit	2	(.067)		0.042593	fruit
Chocolate bar	2	(.067)		0.021795	sweet/goodie
PB & J sandwich	1	(.033)	(61)	0.031373	combined
Vegetable	1	(.033)		0.028571	vegetable
Cookie	1	(.033)		0.022222	bakery product
Popsicle	1	(.033)		0.010606	SSB
Cupcake	1	(.033)		0.025758	bakery product
Cheese its	1	(.033)		0.019697	snack
Spinach	1	(.033)		0.009091	vegetable
Maple sandwich	1	(.033)		0.033333	combined
Steak	1	(.033)		0.008333	meat
Bacon	1	(.033)		0.011111	meat
Food	1	(.033)		0.01	food
Cherry	1	(.033)		0.020833	fruit
Potato	1	(.033)		0.025	vegetable
Grilled cheese	1	(.033)		0.018182	combined
Applesauce	1	(.033)		0.018182	applesauce
Ham	1	(.033)		0.013889	meat
Pop	1	(.033)		0.033333	SSB
Cheese burger	1	(.033)		0.008333	fast/convenience
Cheerios	1	(.033)		0.00303	cereal/breakfast
Granola bar	1	(.033)		0.022727	snack

Gold fish	1	(.033)	0.021212	snack
Donuts	1	(.033)	0.016667	bakery product
Peanutbutter sand	1	(.033)	0.015152	combined
Kiwi	1	(.033)	0.014286	fruit
Lime	1	(.033)	0.011905	fruit
Hot chocolate	1	(.033)	0.011111	SSB
Milkshake	1	(.033)	0.005556	SSB
Rice	1	(.033)	0.029167	rice
Grape leaves	1	(.033)	0.025	ethnic
Peppers	1	(.033)	0.033333	vegetable
Gummy bears	1	(.033)	0.011111	sweet/goodies
Muffin	1	(.033)	0.021569	bread
Bologna sand	1	(.033)	0.033333	combined
Egg sandwich	1	(.033)	0.029412	combined
Cheesy bread	1	(.033)	0.011765	fast/convenience
Chinese food	1	(.033)	0.005882	ethnic
Worms	1	(.033)	0.001961	non-food
Butter	1	(.033)	0.003333	butter
Green apple	1	(.033)	0.01	fruit
Melon	1	(.033)	0.011111	fruit
Slushie	1	(.033)	0.002564	SSB
Zucchini bread	1	(.033)	0.015385	bread
Monkey bread	1	(.033)	0.012821	bread
Pooh	1	(.033)	0.025641	non-food
Rod & sticks	1	(.033)	0.0250513	non-food
Left over sand	1	(.033)	0.017949	combined
Green grapes	1	(.033)	0.025	fruit
Purple grapes	1	(.033)	0.008333	fruit
Cauliflower	1	(.033)	0.027778	vegetable
Mommy	1	(.033)	0.023333	non-food
Coffee	1	(.033)	0.013333	coffee

Washing soap	1	(.033)	0.003333	non-food
Paper	1	(.033)	0.006667	non-food
Mashed potatoes	1	(.033)	0.033333	vegetable
Scrambled egg	1	(.033)	0.021212	cereal/breakfast
Chicken noodle	1	(.033)	0.272727	combined
Bread stick	1	(.033)	0.012121	snack
Meatloaf	1	(.033)	0.00303	meat
Breakfast bar	1	(.033)	0.016667	cereal/breakfast bar
Toaster strudel	1	(.033)	0.008333	cereal/breakfast bar
Flashes	1	(.033)	0.023077	SSB

Appendix C

Table C.2 Frequency and Rank of Foods Listed by Children who were of healthy weight (n = 100)

Item	frequency listed	proportion	number for that frequency	salience of item for the group	classification
Pizza	14	(.467)	(1)	0.292062	combined
Cheese	10	(.333)	(1)	0.114402	dairy/milk
Apple	9	(.3)	(1)	0.213582	fruit
Sandwich	7	(.233)	(3)	0.146344211	combined
Carrots	7	(.233)		0.153832	vegetable
Ice cream	7	(.233)		0.097571	sweet/goodie
Chicken nuggets	6	(.2)	(4)	0.101051171	fast/convenience
Broccoli	6	(.2)		0.170563	vegetable
Spaghetti	6	(.2)		0.125505	combined
Chicken	6	(.2)		0.098485	poultry
Orange	5	(.167)	(5)	0.11447	fruit
Banana	5	(.167)		0.1117508	fruit
Fries	5	(.167)		0.08	fast/convenience
Hamburger	5	(.167)		0.099259	fast/convenience
Salad	5	(.167)		0.048571	combined
Mac & cheese	4	(.133)	(6)	0.088207	combined
Pear	4	(.133)		0.069402	fruit
Turkey	4	(.133)		0.070808	poultry
Fruit	4	(.133)		0.089444	fruit

Cookie	4	(.133)		0.044643	bakery product
Strawberry	4	(.133)		0.10986	fruit
PB & J sandwich	3	(.1)	(7)	0.077976	combined
Hot dog	3	(.1)		0.067222	fast/convenience
Milk	3	(.1)		0.038297	dairy/milk
Cupcakes	3	(.1)		0.050497	bakery products
Corn	3	(.1)		0.077778	vegetable
Grapes	3	(.1)		0.019088	fruits
Noodles	3	(.1)		0.028745	pasta
Cucumber	2	(.067)	(17)	0.048485	vegetable
Cake	2	(.067)		0.025455	bakery product
Watermelon	2	(.067)		0.035	fruit
Bread	2	(.067)		0.057576	bread
Vegetable	2	(.067)		0.05	vegetable
Popsicle	2	(.067)		0.04	SSB
Lemon	2	(.067)		0.033838	fruit
Cheese its	2	(.067)		0.046667	snack
Chips	2	(.067)		0.064444	snack
Tacos	2	(.067)		0.04	ethnic
Nachos	2	(.067)		0.038571	ethnic
Steak	2	(.067)		0.066667	meat
Bacon	2	(.067)		0.016667	meat
Salt	2	(.067)		0.021694	miscellaneous
Meat balls	2	(.067)		0.035185	meat
Lettuce	2	(.067)		0.03	vegetable
Peaches	2	(.067)		0.038889	fruit
Water	1	(.033)	(55)	0.022222	water
Cereal	1	(.033)		0.013333	cereal/breakfast
Pickles	1	(.033)		0.033333	miscellaneous

Pancakes	1	(.033)	0.013333	cereal/breakfast
Sucker	1	(.033)	0.006667	sweet/goodie
Pretzel	1	(.033)	0.008333	snack
Green beans	1	(.033)	0.0125	vegetable
Pasta & meatballs	1	(.033)	0.025	combined
Pasta & vegetable	1	(.033)	0.008333	combined
Bread/butter	1	(.033)	0.016667	bread
Avocado	1	(.033)	0.031111	fruit
Fish	1	(.033)	0.017778	fish
Chocolate	1	(.033)	0.006667	sweet/goodies
Cinnamon	1	(.033)	0.004444	miscellaneous
Chocolate chips	1	(.033)	0.002222	sweets/goodies
Candy	1	(.033)	0.033333	sweets/goodies
Wheat	1	(.033)	0.005556	bread
Asparagus	1	(.033)	0.027273	vegetable
Brownie	1	(.033)	0.021212	bakery product
Tomatoes	1	(.033)	0.013636	vegetable
Apple juice	1	(.033)	0.007576	fruit juice
Marshmallow	1	(.033)	0.028205	sweets/goodies
Candy corn	1	(.033)	0.020513	sweets/goodies
Popcorn	1	(.033)	0.017949	snack
Subway	1	(.033)	0.002564	fast/convenience
Grapefruit	1	(.033)	0.013333	fruit
Cottage cheese	1	(.033)	0.008889	dairy/milk
Chili	1	(.033)	0.004444	combined
Spinach	1	(.033)	0.006667	vegetable
Celery	1	(.033)	0.014815	vegetable
Chickey bites	1	(.033)	0.026667	fast/convenience
Meat	1	(.033)	0.02381	meat
Food	1	(.033)	0.011111	food
Juice	1	(.033)	0.005556	fruit juice

Treat	1	(.033)	0.33333	sweet/goodie
Candy cane	1	(.033)	0.030303	sweet/goodie
Fiber one	1	(.033)	0.011111	snack
Eggs	1	(.033)	0.02381	cereal/breakfast
Corn bread	1	(.033)	0.016667	bread
Radishes	1	(.033)	0.009524	vegetable
Plum	1	(.033)	0.007692	fruit
Cherry	1	(.033)	0.005128	fruit
Jelly	1	(.033)	0.002564	miscellaneous
Yogurt	1	(.033)	0.025926	dairy/milk
Potato	1	(.033)	0.02963	vegetable
Pizza roll	1	(.033)	0.028571	snack
Pepperoni	1	(.033)	0.019048	meat
Fruit snack	1	(.033)	0.014286	snack
Grilled cheese	1	(.033)	0.02	combined
Chicken fries	1	(.033)	0.013333	fast/convenience
Applesauce	1	(.033)	0.033333	snack
Ham	1	(.033)	0.016667	meat
Sausage	1	(.033)	0.03	meat
Happy meal	1	(.033)	0.023077	fast convenience
String cheese	1	(.033)	0.028889	dairy/milk

Appendix C

Table C.3 Frequency and Rank of Foods Eaten by Children who were obese (n = 101)

Item	frequency	proportion	number of items	salience of item for the group	classification
Pizza	8	(.267)	1	0.11571	combined
Cereal	7	(.233)	1	0.0975	cereal/breakfast
Apple	6	(.2)	2	0.142525	fruit
Carrots	6	(.2)		0.12101	vegetable
Banana	5	(.167)	3	0.1147475	fruit
Water	5	(.167)		0.103788	water
Mac & cheese	5	(.167)		0.069697	combined
Broccoli	4	(.133)	8	0.10070	vegetable
Hamburger	4	(.133)		0.083864	fast/convenience
Strawberries	4	(.133)		0.035808	fruit
Ice cream	4	(.133)		0.053258	sweet/goodies
Cheese	4	(1.33)		0.071194	dairy/milk
Macaroni	4	(.133)		0.07697	pasta
Pancakes	4	(.133)		0.088636	cereal/breakfast
Milk	4	(.133)		0.038106	dairy/milk

Sandwich	3	(.1)	8	0.070277778	combined
Orange	3	(.1)		0.06667	fruit
Hot dogs	3	(.1)		0.072619	fast/convenience
Grapes	3	(.1)		0.056667	fruit
Sausage	3	(.1)		0.049675	meat
Cake	3	(.1)		0.053333	bakery product
PB&J sandwich	3	(.1)		0.05	combined
Corn	3	(.1)		0.072424	vegetable
Chicken nug	2	(.067)	16	0.058333333	fast/convenience
Steak	2	(.067)		0.0625	meat
Bologna	2	(.067)		0.015455	meat
Yogurt	2	(.067)		0.057143	dairy/milk
Tomatoes	2	(.067)		0.034848	vegetable
Cupcakes	2	(.067)		0.035455	bakery product
Chips	2	(.067)		0.036667	snacks
Cucumber	2	(.067)		0.024545	vegetable
Peanutbutter sand	2	(.067)		0.022222	combined
Vegetable	2	(.067)		0.055556	vegetable
Eggs	2	(.067)		0.039394	cereal/breakfast
Ham	2	(.067)		0.061111	meat
Waffle	2	(.067)		0.041111	cereal/breakfast
Smoothies	2	(.067)		0.022727	ssb
Pineapple	2	(.067)		0.010833	fruit
Potatoes	2	(.067)		0.04	vegetable
Fries	1	(.033)	63	0.02	fast/convenience
Shrova	1	(.033)		0.006667	ethnic

Turkey	1	(.033)	0.02	poultry
Green beans	1	(.033)	0.029167	vegetable
Watermelon	1	(.033)	0.033333	fruit
Fruit	1	(.033)	0.026667	fruit
Popcorn	1	(.033)	0.003333	snack
Spaghetti	1	(.033)	0.01	combined
Salad	1	(.033)	0.026667	combined
Chicken noodle	1	(.033)	0.019048	combined
Tomato soup	1	(.033)	0.022222	combined
Candy	1	(.033)	0.013333	sweets/goodies
Cottage cheese	1	(.033)	0.033333	dairy/milk
Maple sandwich	1	(.033)	0.028571	combined
Peanut butter	1	(.033)	0.004762	nuts
Turkey sandwich	1	(.033)	0.033333	combined
Chicken	1	(.033)	0.027778	poultry
Meat	1	(.033)	0.023333	meat
Drink	1	(.033)	0.027273	drink
Fish	1	(.033)	0.006061	fish
Granola bar	1	(.033)	0.013333	snack
Sucker	1	(.033)	0.033333	sweets/goodie
Lollipop	1	(.033)	0.030303	sweets/goodie
Jaw breaker	1	(.033)	0.027273	sweets/goodie
Bacon	1	(.033)	0.021212	meat
Cookie	1	(.033)	0.021212	bakery
Pop	1	(.033)	0.033333	ssb
Lettuce	1	(.033)	0.00556	vegetable
Lunchable	1	(.033)	0.02	fast/convenience
Tacos	1	(.033)	0.008333	ethnic
Subway	1	(.033)	0.033333	fast/convenience
Marshmallow	1	(.033)	0.006667	sweets/goodies
Greens	1	(.033)	0.013333	vegetable

Pears	1	(.033)	0.033333	fruit
Alfredo	1	(.033)	0.005556	miscellaneous
Hot chocolate	1	(.033)	0.009091	ssb
Milkshake	1	(.033)	0.00303	ssb
Crepe	1	(.033)	0.033333	cereal/breakfast
Rice	1	(.033)	0.026667	rice
Grape leaves	1	(.033)	0.023333	ethnic
Cherries	1	(.033)	0.016667	fruit
Pepper	1	(.033)	0.026667	miscellaneous
Bologna sandwich	1	(.033)	0.033333	combined
Egg sandwich	1	(.033)	0.027778	combined
Lemonade	1	(.033)	0.018182	ssb
Orange juice	1	(.033)	0.015152	fruit juice
Chocolate milk	1	(.033)	0.057576	ssb
Green grapes	1	(.033)	0.024242	fruit
Purple grapes	1	(.033)	0.006061	fruit
Cauliflower	1	(.033)	0.027273	vegetable
Crackers	1	(.033)	0.025	snacks
Sandwich bagel	1	(.033)	0.0125	combined
Phones	1	(.033)	0.029167	non-food
Party hats	1	(.033)	0.016667	non-foods
Bread sticks	1	(.033)	0.004762	snacks
Scrambled egg	1	(.033)	0.014286	cereal/breakfast
Meatloaf	1	(.033)	0.02381	meat
Pickles	1	(.033)	0.028571	miscellaneous
Toaster strudel	1	(.033)	0.020833	cereal/breakfast
Croissant dog	1	(.033)	0.0125	fast/convenience
Breakfast bar	1	(.033)	0.008333	cereal/breakfast
Worms	1	(.033)	0.01111	non-food

Appendix C

Table C.4 Frequency and Rank of Foods Eaten by Children who were of healthy weight (n = 86)

Item	frequency listed	proportion	number of items	salience of item in the group	classification
Pizza	9	(.30)	1	0.193492	combined
Sandwich	6	(.20)	1	0.136666667	combined
Broccoli	5	(.167)	3	0.124167	vegetable
Hamburger	5	(.167)		0.116389	meat
Spaghetti	5	(.167)		0.116111	combined
Chicken nug	4	(.133)	6	0.059166667	fast/convenience
Mac & cheese	4	(.133)		0.098889	combined
Apple	4	(.133)		0.111111	fruit
Strawberries	4	(.133)		0.114167	fruit
Cheese	4	(.133)		0.068452	dairy/milk
Cereal	4	(.133)		0.088095	cereal breakfast
Water	3	(.10)	3	0.040278	water
Hot dog	3	(.10)		0.048333	fast/convenience
Chips	3	(.10)		0.04	snack
Banana	2	(.067)	22	0.05	fruit
Fries	2	(.067)		0.01	fast/convenience
Turkey	2	(.067)		0.025	poultry
Yogurt	2	(.067)		0.036111	dairy/milk

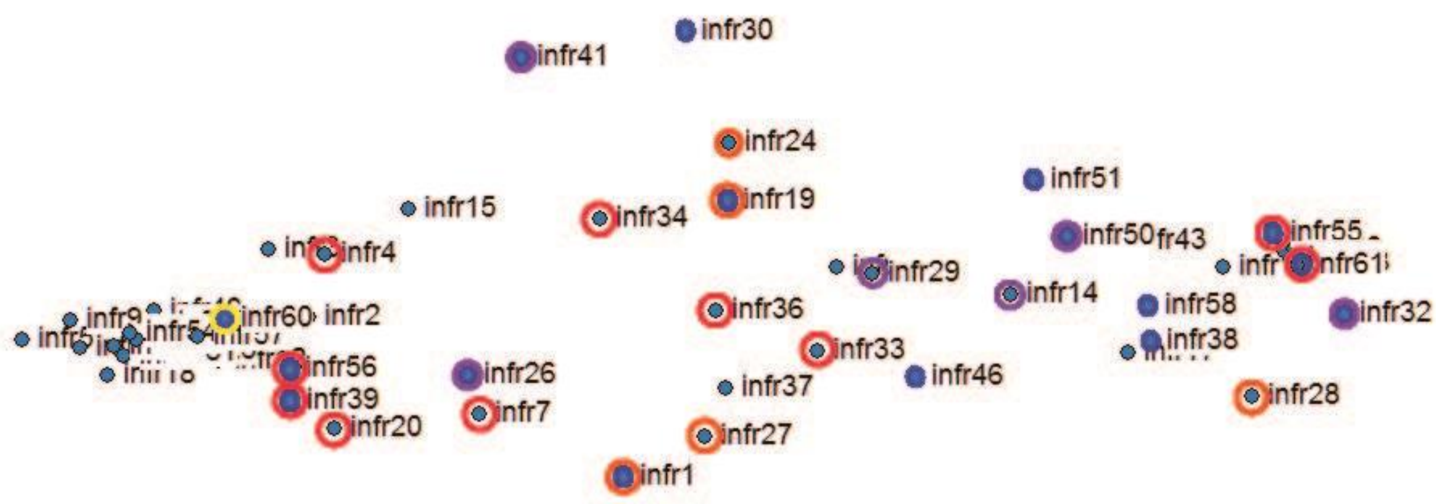
Fruit	2	(.067)		0.061111	fruit
Blueberries	2	(.067)		0.05	fruit
Ice cream	2	(.067)		0.008611	sweet/goodie
Cupcakes	2	(.067)		0.028889	bakery products
Popcorn	2	(.067)		0.024444	snack
Guacamole	2	(.067)		0.019444	ethnic
Macaroni	2	(.067)		0.040476	pasta
Nachos	2	(.067)		0.042222	ethnic
Salad	2	(.067)		0.046667	combined
Candy	2	(.067)		0.03	sweet/goodie
Chicken	2	(.067)		0.05	poultry
Juice	2	(.067)		0.027778	ssb
Granola bar	2	(.067)		0.045	snack
Carrots	2	(.067)		0.058333	vegetable
Pancakes	2	(.067)		0.0275	cereal/breakfast
Donut	2	(.067)		0.0375	bakery product
Pop	2	(.067)		0.041667	ssb
Applesauce	2	(.067)		0.04	snack
Orange	1	(.033)	50	0.0333	fruit
Steak	1	(.033)		0.033333	meat
Bologna	1	(.033)		0.025	meat
Green beans	1	(.033)		0.013333	vegetable
Watermelon	1	(.033)		0.006667	fruit
Bread	1	(.033)		0.033333	bread
Pasta/meatball	1	(.033)		0.025	combined
Bread/butter	1	(.033)		0.016667	bread
Pasta/vegetables	1	(.033)		0.008333	combined
Healthy	1	(.033)		0.033333	healthy
Unhealthy	1	(.033)		0.016667	unhealthy
Grapes	1	(.033)		0.008333	fruit
Soup	1	(.033)		0.016667	combined

Tomato	1	(.033)	0.033333	vegetable
Candy corn	1	(.033)	0.006667	sweet/goodie
Burning leaves	1	(.033)	0.005556	non-food
Surges	1	(.033)	0.033333	non-food
Chex mix	1	(.033)	0.022222	snack
Pudding	1	(.033)	0.011111	snack
Grilled cheese	1	(.033)	0.025	combined
Jell-O	1	(.033)	0.026667	snack
Chickey bites	1	(.033)	0.022222	fast
Buns	1	(.033)	0.017778	bread
Cucumber	1	(.033)	0.013333	vegetable
Chicken noodle	1	(.033)	0.011111	combined
Tomato soup	1	(.033)	0.008889	combined
Sausage	1	(.033)	0.029167	meat
Peanut butter	1	(.033)	0.011111	nuts
Meat	1	(.033)	0.02	meat
Vegetable	1	(.033)	0.033333	vegetable
Drink	1	(.033)	0.016667	drink
Bronie	1	(.033)	0.033333	ethnic
Fish	1	(.033)	0.022222	fish
Pretzel	1	(.033)	0.005556	snack
Apple juice	1	(.033)	0.008333	fruit juice
Bacon	1	(.033)	0.004167	meat
Peas	1	(.033)	0.029167	vegetable
Cookie	1	(.033)	0.008333	bakery product
Milk	1	(.033)	0.27778	dairy/milk
Coconut water	1	(.033)	0.005556	water
Happy meal	1	(.033)	0.020833	fast/convenience
Popsicle	1	(.033)	0.028571	ssb
Honey	1	(.033)	0.009524	miscellaneous
Lettuce	1	(.033)	0.016667	vegetable

Toast	1	(.033)	0.033333	bread
Pizza roll	1	(.033)	0.016667	snack
Lunchable	1	(.033)	0.005556	fast/convenience
Pop tart	1	(.033)	0.026667	cereal/breakfast
Waffle	1	(.033)	0.013333	cereal/breakfast
Taco	1	(.033)	0.026667	ethnic

Appendix C

Figure C.1 Multidimensional scaling of entire group unconstrained card sort



Appendix C

Figure C.2   Multidimensional scaling of likes and dislikes for entire group