12-2017

Design and Validation of a Scale for Preschoolers: Measuring Nutrition Knowledge, Beliefs, and Behaviors

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A dissertation

presented to

the faculty of the Department of Early Childhood Education

East Tennessee State University

In partial fulfillment

of the requirements for the degree

Doctor of Philosophy in Early Childhood Education

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by

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December 2017

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Keywords: Scale, Preschool, Nutrition, Knowledge, Attitudes, Beliefs, Behaviors

ABSTRACT

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The literature indicates a lack of validated scales to measure nutrition knowledge, attitudes and behaviors in preschool-aged children. Reliable and valid assessment tools are critical in the development of nutritional interventions for young children; careful design, including psychometric evaluation of reliability and validity, is the best approach to scale development. Best practice points to an efficient, yet comprehensive look at the constructs of knowledge, attitudes, and behaviors. This multi-phase study included 298 preschool children ages 2-6 years (151 girls, 147 boys; mean age 3.936). A 45-item scale was created, with 4 subscales to measure the nutrition knowledge, attitudes, and behaviors of preschool children, and piloted among 54 of these children (30 girls, 24 boys; mean age 4.3). Cronbach's alpha (α) for the total scale with predicted behavior excluded was .775, and also determined for each subscale, including food identification (0.642), food group categorization (0.644), and classification of foods as healthy and unhealthy (0.576). Behavior was predicted, as children created a virtual plate of preferred food and beverage selections for breakfast, lunch, and snack. Internal consistency was not calculated for this stage of scale development. ANOVA and post-hoc testing identified age-related differences between 3 and 5-year olds, in overall performance on the scale, $F(3, 43) = 6.183$, $p = .001$, partial $\eta^2 = .301$ but not among other age groups (3, 4, 5, and 6 included).

Through multiple iterations of the scale, it became clear that the healthy versus unhealthy subscale was problematic. An adaptation of the Traffic-light diet, a variation of this subscale, was created and piloted with 74 items, and then narrowed to 25 items (Cronbach's α .924). This resulted in a revised final version of the scale, with 52 items including 8 food identification tasks, 15 food group categorization tasks, 25 Go, Slow, Whoa tasks, and 4 virtual plate food and beverage preference tasks, for delivery on interactive technology (iPad). Future research will include pre-post testing with a nutrition intervention to determine further validity and test-retest reliability. It is predicted that Cronbach's α will be similar if not improved by further testing.

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CHAPTER 1

INTRODUCTION

Obesity among adults and children has become a concern as the long-term risks are alarming. The causes are established: excess energy intake; decreased physical activity; an abundance of low-quality, inexpensive foods; a busy lifestyle causing decreased focus on health; and poor adherence to known healthy behaviors (Briley & McAllaster, 2011). A clear understanding of the influences on a child's nutrition knowledge, beliefs, and behaviors is important, as the population continues to decline in health (Birch, & Fisher, 1998; Briley & McAllaster, 2011). Experts understand the need for early intervention; the research is clear that health habits are formed at a young age. Hendricks, Peterson, Windsor, Poehler, and Young (1988) stressed this imperative, stating that "habits formed early may affect directly the quality and quantity of life" (p. 21). Also of concern is that preschool age has been determined to be a critical period to predict later life weight status. In the first year, body mass index (BMI) decreases with growth in length; there is a second increase in BMI that occurs during the preschool years known as adiposity rebound (Drohan, 2002). Research indicates the earlier the child's body mass index (BMI) reaches maximum during these years, the higher the likelihood of obesity in later life. Previous efforts to improve health, specifically preventing and treating obesity in preschoolers, have proved effective (Dontrell, Bluford, & Scanlon, 2007). We have learned that genetics play a relatively minor role in weight differences among children (Birch & Fisher, 1998; Hendricks et al., 1988).   There are individual differences in the regulation of energy intake as early as the preschool period, influenced by differences in child-feeding practices and genetic make-up (Birch & Fisher, 1998). Physiologically, children have the innate capability to adjust energy based on growth-related needs. The environment is crucial however, as developing preferences sometimes override these internal cues. Children are born with a preference for sweet foods, rather than sour or bitter foods. This is problematic in that fruit and vegetable consumption is linked with preference for these foods. Preference for high-fat foods has not been proven; rather there may be positive physiological results of eating energy-dense foods (Birch & Fisher, 1998; Briley & McAllaster, 2011). Thus, the environmental impact on knowledge, beliefs and behaviors may be the most important aspect to explore. Concurrently, as consumption of preferred foods is more typical, it may be important to focus on attempts to increase preference for healthy foods in order to improve health outcomes (Rozin, 1990).

As greater numbers of children participate in child care outside of the home, the influence on development has been well established. The lives of families are increasingly complex, and as fewer families prepare meals in the home, for some children, child care may be one of the greatest opportunities to hear messages about health and nutrition. The meals that children receive in care vary from parent-provided to center-provided. In full-time care, centers typically offer lunch, two snacks, and in some situations breakfast as well. The quality of these food experiences serve as a springboard for learning. Briley and McAllaster (2011) may have captured this sentiment best: “In the past 3 decades, child-care centers have replaced the family table as the learning environment for young children’s food habits” (p. 1299). This offers a unique opportunity. With a significant number of preschool children overweight or obese, and factors such as poor diet and limited physical activity to blame, center-based approaches to health education could improve outcomes. As obesity-prevention interventions in the early childhood education setting become more common, as do efforts to gain and maintain system-level support, outcomes often must be quantified. Interestingly, while there have been numerous interventions to address the obesity epidemic among young children in the child-care setting, and as many measures of impact on nutrition knowledge and behavior, few studies have included the extensive process of psychometric measurement to ensure validity and reliability of the measures they use (Contento, Randell, & Basch, 2002).

Inherent in the development of health interventions is the hope that increasing knowledge in individuals will result in a change in beliefs, and also behaviors, thus resulting in improved health outcomes. Unfortunately, this does not appear to be consistent. In adults and children, the research identifies a gap between acquired knowledge and behavior (Eertmans, Baeyens, & Van den Berg, 2001; Sapp & Jensen, 1997; Tarabashkina, Quester, & Crouch, 2016). Outside of cognitive developmental theory, many have explored this phenomenon, and there are a great number of evolving beliefs about health choices. In the 1950's, disease prevention was the focus of the healthcare system, and the *health belief model* was developed as a framework to describe individuals' choices, as well as to explain patients' lack of adherence to clear messages for disease prevention and treatment. Its authors suggested that behavior was dependent on a combination of a variety of factors including: perceived susceptibility to disease, or risk; perceived severity of risk; perceived benefit of prevention; and perceived barriers to health behaviors (Janz & Becker, 1984). The authors believed that when the threat of disease became greater than the perceived benefits of a habit, the individual would make better health choices. Icek Ajzen further defined these concepts across all behaviors with the *theory of planned behavior*, as he described behavior as a result of influences of intention, attitude toward the action, social norms (expectations), and perceived behavioral control (Godin & Kok, 1996). Of particular interest were individuals with varying perceptions of power or self-efficacy in the face of perceived barriers including time, money, and social support. *Social learning theory* was the reaction of Albert Bandura, a comprehensive approach or framework that hypothesized behaviors were not only a result of direct experience, but that individuals were active participants in the acquisition of behaviors (Bandura, 1977, 1998; Sapp & Jensen, 1997). More recently, Bandura (1998, 2004) expanded his approach, describing the *social cognitive theory* as a comprehensive, multifactorial guide to understanding how behavior develops, in order to design appropriate interventions, offering "both predictors and principles on how to inform, enable, guide, and motivate people to adapt habits that promote health" (Bandura, 2004, p. 146). Inherent in this rich approach is consideration of not only personal health behaviors, but social influences on these as well. Along with an understanding of developmentally appropriate practice, this will serve as the framework for the primary focus of this research: to develop a scale to measure the nutrition knowledge, attitudes, and behavior of preschool-aged children.

The argument has further been made that using interactive technology can have positive effects on enacting change, in particular in the health field (Bandura, 2004; Bissell, Maxwell, Zhang, Bie, & McLemore, 2016). Traditional means of individualized human interaction have been costly and time consuming. As a result, health campaigns including mass communication about health topics is the approach that many agencies have utilized, particularly mass media including television and now the internet (Randolph & Viswanath, 2004). The success of such campaigns is dependent on their creative content, financial capacity and access to maximum exposure; success is also more likely when messages are founded in theory and include a community support component (Randolph & Viswanath, 2004). Further, interactive technology such as iPads offer opportunity for both instructional content as well as data collection (Bissell et al., 2016).

The importance of the viewer's perceived control or self-efficacy cannot be ignored. What is missing from many community-based interventions is an individualized approach to health that can be critical, with the myriad of influences on health decisions as described by social cognitive theory (Bandura, 2004). To incorporate change, the message must be received, risk perceived, and then beliefs of personal control supported. This individualized approach to education may be mimicked by use of technology that incorporates health messages and provides interactive platforms for children to practice behaviors, and to gain new knowledge in an environment that is less risky than the real world. The child is not simply a passive receiver of information. With this understanding, promotional interventions are incorporating interactive technology. For example, the United States Department of Agriculture's (USDA) Nutrition and Education and Promotion branch recently created interactive, emergent reader mini eBooks that can be downloaded and shared with young children to increase both literacy skills, as well as nutrition literacy about foods and food groups. Such education materials can be accessed by individuals and providers in child programs to promote healthy eating, and positive health behaviors. This scale, designed for use on interactive technology, could be an effective means to measure the impact of such nutrition interventions.

Significance of the Study

Instrumental knowledge has been described as "the skills people need to enable them to carry out specific behaviors…" (Contento et al., 2002, p. 3). It is this type of knowledge most commonly measured as a result of interventions. Sapp and Jenson (1997) suggest that beyond basic nutrition knowledge, it is the development of "knowledge structures about nutrition and health" that may improve outcomes (p. 64). While there is evidence that as children develop cognitively, they begin to understand complex concepts related to health, it is unclear as to the abilities of preschool-aged children, and whether they are aware of the long-term implications of these constructs (Rushforth, 1999). Determining the incidence of compliance with health-related behaviors in children may help to define a framework in which behavior relates to knowledge of concepts. This, in turn, may help experts develop interventions specific to the social and cognitive needs of young children.

This quantitative research study will include the development of a measure of nutrition knowledge, beliefs, and behaviors that is appropriate for use among preschool children, 3-5 years of age. The second aim is to determine the reliability and validity of the scale, so that it will applicable in practice. The following predictions will be addressed:

1. It is predicted that the scale developed will be a reliable and valid measure of nutrition knowledge, beliefs and behaviors among 3-5-year-old children.

2. It is predicted that there will be age-related differences in ability to complete the scale.

Definition of Key Terms

Adiposity: fat storage; obesity (www.dictionary.com).

Ideation factors: factors that influence the forming of attitudes or beliefs about foods; such as the nature or origin of the food item, and its social history (Rozin & Fallon, 1986).

Mixed entrée: a dish served as the main course of a meal (www.dictionary.com). This dish may contain several ingredients from more than one food group.

Nutritional gatekeeper: the person in a household who typically makes the purchasing and preparation decisions related to food (Wansink, 2006).

Social eating norms: appropriate consumption behaviors relative to a social group (Higgs, 2015).

CHAPTER 2

LITERATURE REVIEW

Theoretical Framework

Cognitive Developmental Theories

It is widely believed that health habits are developed at a very young age, and that these early determinants influence lifelong choices and health outcomes (Anzman-Frasca, Savage, Marini, Fisher, & Birch, 2012; Birch, 1999; Tinsley, 2003). Mobley (1996), through an investigation of health knowledge among preschoolers, found this to be true as early as the latter part of the third and during the fourth years of life. Interestingly though, research is inconsistent regarding specific age-related limitations to drawing connections between health concepts and acceptance of health behaviors and beliefs. In young children, cognitive development may affect their ability to acquire and use nutrition and health-related knowledge, as it is difficult for them to relate knowledge to long-term outcomes, in particular health concepts (Holub & Musher-Eizenman, 2010; Nguyen, 2007; Rushforth, 1999). For example, preschool-aged children may have a good understanding of anatomy, while more complex concepts such as function may be poorly understood until a more advanced age (Berk, 2012; Tinsley, 2003). Not unlike cognitive developmental theory, understanding of health concepts may follow similar stage-wise pathways (Michela & Contento; 1986; Tinsley, 1992; Zeinstra, Koelen, Kok, & de Graaf, 2007). This invites researchers to question cognitive development in preschoolers and what impacts the food choices they make, including whether young children are able to understand the impact of food choices on their health over the long-term or if simple sensory characteristics of food are the driving factor.

Arnold Gesell was among the early pioneers of maturational theory, the belief that children progress through a series of developmental milestones with age (Crain, 2011). According to this theoretical approach, individual, intrinsic differences determine the majority of a child's developmental path. While Gesell did include an environmental effect in combination with genetic predisposition, he described the child's development as inherently predetermined. Jean Piaget disagreed with this strictly genetic, stage-related approach to development, and described children as active participants in the learning process, who "construct knowledge as they manipulate and explore their world" (Berk, 2012, p. 19; Shayer, 2003). Piaget outlined cognitive development in relation to tendencies, describing four sequential periods of achievement including sensorimotor intelligence, preoperational thought, concrete operations, and formal operations (Crain, 2011). He described the period between ages two and seven as the preoperational stage (Berk, 2012). It is during this time that children, including preschoolers, experience an increase in make-believe play, language, and complexity during symbolic activity, allowing them to practice in the development of new ideas and schemas. Piaget described limits as well during this important time period. He felt children approach the world in an egocentric way, have difficulty with abstract thinking, and classifying objects into classes and subclasses (Berk, 2012). In relation to food choices and understanding of health-related food behaviors, this would hypothetically limit a child's ability to apply concepts learned about foods, such as group categories, and to identify healthy food choices based on an understanding of long-term health consequences.

Others have questioned Piaget's imposed stage-related limitations, hypothesizing that symbolic understanding may be more advanced than previously theorized, and that learning of more abstract concepts may be guided by knowledgeable adults and peers (Cook & Cook, 2005;

Crain, 2011). While Piaget's stages of cognitive development assigned limits to the young child's ability to understand complex concepts, constructivist theorists such as Susan Carey have spoken of children as active participants who "constantly seek to make sense of the world on the basis of that which they know and experience" (Rushforth, 1999, p. 684). They gather knowledge in much the same way as adults; the more knowledge about a topic, the more complex schema they will develop. The author provides examples of children who are experts in topics such as dinosaurs, snakes, or superheroes. Likewise, Eiser spoke of the "acquisition of knowledge, not cognitive development" as the source of the child's understanding (Rushforth, 1999, p. 684). Reality however indicates there are age-related differences. Current theory promotes a balanced approach between the two.

Lev Vygotsky described learning as a social process, with social interaction playing a fundamental role in the development of new ideas, interactions with culture where "opposing forces interact and produce new transformations" (Crain, 2011, p. 231). In Vygotsky's theory, interpersonal interactions with adults or more skilled peers teach or mediate cognitive structures. He described the zone of proximal development, addressing the limitations of previous theories, by including the possibility that able instruction could provide the support a child needs to exceed the expectations of what his/her age-related development should be. Mediation is the process of introducing concepts, knowledge, skills, and strategies to the child. For the adult, or older peer, as nutrition concepts are shared with young children, it is important to consider where a child is developmentally, in order to scaffold, or support, their learning with new information. This process involves choosing which concepts to introduce to the child, deciding when and how to teach them, and helping the child understand their usefulness (Crain, 2011; Shayer, 2003). Like Piaget, Vygotsky considered age-related limitations to understanding concepts. He hypothesized that young children, four to eight years old, may make decisions without utilizing psychological strategies, while older children are more advanced in their metacognition, or awareness about these thought processes. Vygotsky spoke of the development of behaviors as influenced by extrinsic, or social exposure, as the child first views a behavior and then incorporates that meaning into his or her own understanding (Crain, 2011). He also described the development of self-control, or self-regulation, which helps a child make decisions; first we acquire self-talk around right and wrong from social situations and family who provide signals to teach children appropriate rules or manners. Children then begin to use self-regulation through inner speech to gain self-control, make decisions, or delay gratification. Vygotsky suggested this may happen by ages five and six years old (Crain, 2011). These influences on the developmental process must be considered, particularly when discussing nutrition and health-related choices.

Bronfenbrenner (1994) went on to describe development of a child, not in a vacuum, but as a complex, interrelated, and evolving system that included subsystems, or "nested structures, each inside the other like a set of Russian dolls" (p. 39). These structures included the individual; the immediate environment; and the influence of social, cultural, and historical context (Bronfenbrenner & Morris, 2006; Darling, 2007; Shepherd, 2005). Individual development is dependent on the reciprocal relationships of all these elements (Figure 1).

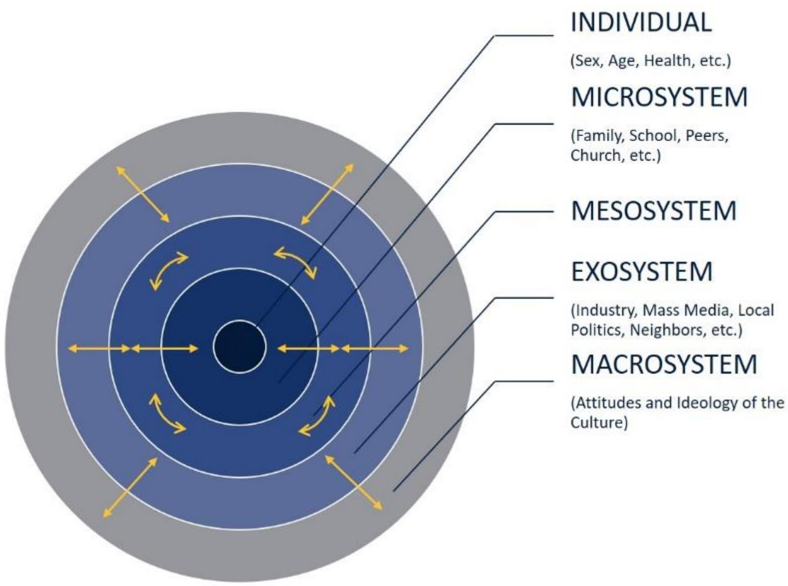

Figure 1- Bronfenbrenner's (1994) ecological framework for human development.

There is vast importance in designing appropriate interventions to address health topics among young children that consider this complex developmental structure. Likewise, in order to create an effective measure, one must consider the connection between cognitive development and the development of nutrition and health-related behaviors. There are both external and internal factors that influence food intake and other nutrition behaviors. These can be quite different among age groups. In adolescents for instance, primarily hunger, taste, and food cravings drive selection, facilitated by convenience, while food selection in preschool children may be most influenced by taste perception (Neumark-Sztainer, Story, Perry, & Casey, 1999; Nguyen, Girgis, & Robinson, 2015; Tarabashkina et al., 2016).

Theories of Development of Nutrition Beliefs and Behaviors

As is true of many health behaviors, there are numerous theories that attempt to describe food-related behavior. The common thread among them is the vast complexity of influences on the behaviors of humans, in particular young children. Food choice is perhaps among the most complicated of behaviors to unpack. A vast number of authors have discussed the development of food preferences (Eertmans et al., 2001; Furst, Connors, Bisogni, Sobal, & Winter-Falk, 1996; Rozin, 1990). Rozin and Fallon (1986) were among the first to undertake a thorough examination of the psychological factors that impact food selection. They described preference as a choice, unique to humans in economically-developed nations; food attitudes and preferences begin to take shape as young children begin to differentiate between substances that are edible and those that should not be ingested. With increased variety and availability, preferences become behavioral, guided by pleasure rather than need. Sensory properties such as flavor, smell, and texture are dominant in determining choice, though not exclusively so. Choices are also guided by anticipated consequences, whether social, emotional, satiation-related pleasures, or physical rejections including allergic responses and foodborne illness. Finally, there are ideation factors that range from cultural norms to taboos that render foods inappropriate, or even disgusting (Myer-Rochow, 2009; Rozin & Fallon, 1986). These preferences are not static and may change as a result of experience.

Researchers have developed models to build on Rozin and Fallon's (1986) findings, to further explore external influences on preference and explain the complex process of developing food habits. One pioneer, Steenkamp (1993) suggested that there is a "taxonomy of determinants of food consumption behaviors," that shapes the individual's development, quite specifically in the area of food choices (p. 401). Imbedded in this multifactorial system are food properties, person-related factors, and environmental factors (Figure 2).

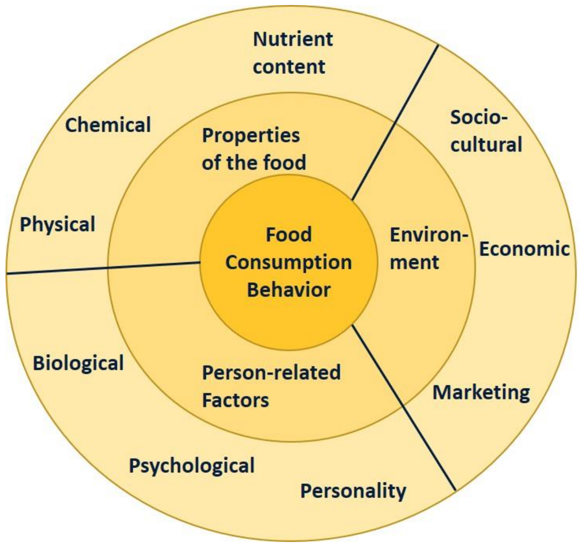

Figure 2. Steenkamp's (1993) Taxonomy of food consumption behaviors.

Steenkamp's (1993) taxonomy acknowledges food properties' primary importance, as intake of food is related to the physiological effects of its consumption, specifically hunger relief, or satiation. Satiation is associated with the physical properties and nutrient composition of foods, including energy containing macronutrients such as carbohydrates, proteins, and fats, as well as non-energy providing nutrients such as water, vitamins and minerals. High-energy or high-calorie foods provide greater satiation. What is of interest in obesity research, however, is that these innate hunger cues are often overridden in humans by preference and taste, which are induced by both environment and person-related factors. For example, a food with a positive association, such as birthday cake or a favorite food, may be chosen despite feelings of fullness (Brown, 2014; Steenkamp, 1993). Likewise, food aversions can be linked with foods relative to negative experience. Sensory characteristics of foods, including such attributes as taste, texture, flavor, smell, and visual appeal, affect intake as well. The perception of these, however, is highly individualized.

Person-related constructs that impact food consumption include biological factors, psychological factors, and personality (Steenkamp, 1993). Biological taste preferences are linked with the large presence of over 10,000 taste buds at birth, which contributes to early sensitivity to flavors (Breen, Plomin, & Wardle, 2006; Breslin, 2013; Brown, 2014; Chatoor, 2009; Rozin, 1990). Further, humans have an inborn distaste for bitter flavors, which are more common in plant sources (Steenkamp, 1993). Chatoor (2009) suggests "research with preschool and older children and with adults has related taste sensitivities to the bitter substances PROP (propylthiouracil) and PTC (phenylthiocarbamide) to strong food preferences and to the number of fungiform papillae and taste buds on the individual's tongue" (p. 72). Individuals may be categorized according to their sensitivity to these PROP flavors. Evidence indicates that we may have a genetic propensity to PTC as well. Some individuals, considered supertasters, have greater density of fungiform papillae, and high levels of sensitivity to these compounds, and as a result are more likely to reject bitter foods, such as coffee, dark chocolate, and some vegetables such as broccoli and cabbage (Chatoor, 2009; Dotson, Shaw, Mitchell, Munger, & Steinle, 2010). Even in utero, physiological responses have been observed as late-term fetuses reject bitter stimuli and are accepting of sweet-tasting substances (Ventura & Worobey, 2013). These unlearned preferences continue into childhood. As we age, our taste buds decline, and we become more tolerant (Brown, 2014). Biologically, acceptance of sweet flavors may also be related to the body's survival needs, including a preference for energy-dense foods, often characteristic of sweet foods (Birch, 1999; Steenkamp, 1993). Food neophobia, or the fear of novel foods, may be a component of this biological urge, as bitter foods have been associated with harmful substances in nature (Birch, 1999; Dovey, Stables, Gibson, & Halford, 2008; Knaapila et al., 2007; Ventura & Worobey, 2013). This self-protective mechanism may also extend to unfamiliar foods in general. These are greatly individualized, as children decide what they like, or deem to be acceptable or not (Reed & Knaapila, 2010). However, research, including twin studies, strongly suggests heritability of food neophobia, with perhaps as much as two-thirds genetically determined (Knaapila et al., 2007). Interestingly, with experience this evolutionary resistance may change, and preferences emerge. Researchers have discovered that with multiple exposures, food neophobia decreases, and acceptance of unfamiliar foods may improve (Anzman-Frasca et al., 2012; O'Connell, Henderson, Luedcike, & Schwartz, 2012; Lakkakula, Geaghan, Zanovec, Piearce, & Turri, 2010; Rozin, 1990). Food aversions, or negative beliefs about foods, may also be linked with negative experiences where unpleasant aromas have been linked with food spoilage, and related illness. Such beliefs translate to knowledge in some cases, as particular foods are known to cause foodborne-illness, or are shared over time and across generations through education (Rozin, 1990). Chatoor (2009) indicates that children may generalize negative experiences with one food to other similar foods, perhaps by food group or color. Pleasing aromas may have more positive associations (Breslin, 2013; Steenkamp, 1993; Ventura & Worobey, 2013).

As humans grow in age, biological determinants of preference begin to overlap with psychological. Food preferences continue to develop into adulthood, and determinants such as attitudes and beliefs begin to emerge (Ventura & Worobey, 2013). Foods that taste good to an individual's senses result in positive inner responses, thus creating positive psychological connections to foods. Other psychological aspects of food decisions stem from beliefs of social acceptability of food choices, and personal beliefs that particular food choices would be typical of a kinship or social group (Meyer-Rochow, 2009; Schultz & Danford, 2016; Steenkamp, 1993). For example, it would be unacceptable in most cultures to eat the family pet, yet a farm animal is typical fare (Guthrie, Lin, & Frazao, 2002. The regular rejection of such a food can develop into a food taboo, and this knowledge can greatly affect food acceptance. A taboo is not necessarily rooted in scientific evidence; it may be developed over time related to gender, class, spiritual, or community orientation (Meyer-Rochow, 2009).

Desire for variety is another personality characteristic that drives food behaviors. When presented with the same recurring menu, including favorite foods, versus a range of foods, individuals are more likely to choose variety (Steenkamp, 1993). This is observed readily in young children. While it is known that repeated exposure to unfamiliar foods will improve the intake of those foods in young children (Anzman-Frasca et al., 2012; Lakkakula, 2010; O'Connell et al., 2012), conversely, children who are exposed to favorites repeatedly may then refuse them after a period of time (Steenkamp, 1993).

Finally, Steenkamp (1993) speaks of the desire for quality as a characteristic, or driver of food decisions. Perceptions of quality begin to develop as well with age; branding begins to drive choice. Consumer psychology informs marketing approaches, where vendors attempt to influence food choices and behaviors (Gregoire, 2013; Steenkamp, 1993). For example, an individual might choose one fast food restaurant or cereal brand over another as a result of advertised superiority. Through advertising and media, companies guide attitudes and beliefs about foods, particularly in young children. Research indicates that greater number of hours spent watching television and commercials increases positive attitudes about junk foods, while positive messaging can improve beliefs about healthier choices (Dixon, Scully, Wakefield, White, & Crawford, 2007). While quality impacts choice, these choices are not made exclusive of demographics and environment.

In the field of nutrition, one cannot address the development of food knowledge, attitudes and behaviors without consideration of the environmental impact. Birch and Fisher (1998) addressed the factors that influence food preferences, food intake, and energy regulation in children, and investigated the role of genetics and environmental factors in the etiology of childhood obesity. Through a review of research, the authors found a genetic link between adiposity in parents and children, though it accounts for only 30-50% of body composition. Evidence suggests that modifiable environmental factors rather than genetics have a greater effect on BMI (body mass index), as early eating behaviors may indicate weight status: "the social context in which children's eating patterns develop becomes important because the eating behavior of people in that environment serves as a model for the developing child" (Birch & Fisher, 1998, p. 542). Family and the home environment provide the foundation for food preferences. This aspect is perhaps more complex than first imagined, as sociocultural constructs are engrained in every part of our lives. Family habits are driven by food access, which may be determined by household income, education, work schedules, eating patterns, among others (Crockett & Sims, 1995). Children's attitudes and behaviors around food are shaped by their microenvironment, including family, school and the immediate community, as well as the macroenvironment including socioeconomic status, food access, governmental policy, and economics (Lanigan, 2011; Larson & Story, 2009; Lytle & Achterberg, 1995; Patrick, 2005).

Parental Influences. Parental preferences do play important roles, affecting availability of foods in the home; children may develop these preferences by exposure and modeling of behaviors (Birch & Fisher, 1998; Lanigan, 2011; Scaglioni, Salvioni, & Galimberti, 2008). Research highlights this familial link to the diet composition of children. The individual or individuals who purchase and prepare food that the child eats serves as the *nutritional gatekeeper*; "A home's nutrition gatekeeper is the biggest food influence in the nutrition life of most people" (Wansink, 2006, p. 1324). This individual typically controls the nutrients that are available for consumption (Larson & Story, 2009). Parental food aversions are often translated to the child (Chatoor, 2009). We know that availability of fruits and vegetables at home and school improves likelihood of consumption in children. We know that children also learn food behaviors by observing and imitating others, particularly family members. In fact, parent modelling of foods, including fruit and vegetable intake, as well as snacks has been most closely linked with the child's (Brown & Ogden, 2004; Jones, Steer, Rogers, & Emmett, 2010; Larson & Story, 2009; Vereecken, Rovner, & Maes, 2010; Wardle & Cooke, 2008). Parental messages have an impact as well, and often are limited primarily to messages of *good* foods and *bad* foods (Birch & Fisher, 1998). The feeding environment can encourage positive and negative behaviors; parents may influence attitudes about food by using foods as a reward or aspect of control (Brown & Ogden, 2004).

Societal influences, such as the need for multiple incomes in one family, have impacted these meal dynamics as well, as family meal time has transformed. Today, families prepare less food in the home. Convenient, ready-prepared foods have become cheaper and more accessible with a plethora of fast food options. Meals, including an entrée and vegetable sides, are less common, as high fat, high calorie foods with less variety become more typical (Crocket & Sims, 1995; Guthrie et al., 2002). Whether families eat at a table together, the size of plates and serving utensils used, and media access during meals all are of influence as well on the nutrient intake of young children (Lanigan, 2011; Larson & Story, 2009; Patrick, 2005; Wansick, 2010).

Community Influences. We know that children who spend at least part of their day in child care will be influenced by the availability of the foods provided for them by centers (Kaphingst & Story, 2009; Lanigan, 2011; Larson, Ward, Neelon, & Story, 2011). Observing other children eating foods may increase the likelihood a child will eat a new food as well. As children increasingly spend a significant portion of time in care outside of the home, we must consider impact of this environment, including messages shared by care providers, and foods provided by the schools. Collective impact approaches consider this a unique opportunity to improve health outcomes (Kaphingst & Story, 2009).

Humans are uniquely influenced by cultural and religious practices among family and community members. Foods are determined acceptable or taboo, perhaps to protect a food source, or support a tradition among a society or religion, and these beliefs are then transmitted to children through time (Meyer-Rochow, 2009; Rozin, 1990; Steenkamp, 1993). Influenced by cultural norms, social settings are also a determinant of food choice. Decisions that are felt to be appropriate, or well accepted by peers or community members, are more likely to be repeated (Higgs, 2015; Higgs & Thomas, 2016; Rozin, 1990). Individuals, children included, tend to adjust their own eating habits relative to the social norm modelled. For example, a parent or member of a peer group may choose dessert only after others have done so first, or not choose a healthy vegetable when it has first been rejected by friends. This moderation of behavior may increase with the need to feel accepted among a particular group (Higgs, 2015). These choices, or preferences, may be mediated further by gender norms, or social class (Higgs & Thomas, 2016). Overeating or restricting intake among peers can also be a result of social norms, or approval. Higgs (2015) suggests that evolution and the need for collective experience to ensure health, and that hunter-gatherer societies need to share and cooperate for survival, may have contributed to this human attribute. Outside of acceptable foods related to social norms, religious beliefs may also impact the foods made available to young children as well as those the child chooses. Examples include restrictions for the consumption or preparation of particular types of meats for Jews, Muslims, and Hindus. Seventh-Day-Adventists choose no meats at all. Most religious ceremonies and periods of religious observance restrict intake, such as Ramadan or Lent (Meyer-Rochow, 2009; Steenkamp, 1993). The determinants of food preferences are not exclusive to those experiences in the home; these early experiences may not explain shifts in the food choices made in adulthood (Rozin, 1990).

Theories of Development of Nutrition Behaviors

Despite their different arenas of use, one can draw similarities between early childhood theories of development, such as Bronfenbrenner's *ecological systems theory*, and the various theories of multifactorial influences on the development of food behaviors, in particular Steenkamp's *taxonomy of food consumption behaviors* (Berk, 2012; Crain, 2011; Shepherd, 2005; Steenkamp, 1993). Bronfenbrenner (1994) described development as a complex, interrelated, and evolving system that included subsystems such as the individual, the immediate environment, and the influence of social, cultural, and historical context (Bronfenbrenner & Morris, 2006; Darling, 2007; Shepherd, 2005). Individual development is dependent on the reciprocal relationships of all these elements. Similarly, Steenkamp (1993) describes the mutual influences of these elements on food behaviors. One must only observe the consistent messages in the models by Bronfenbrenner and Steenkamp in Figure 3.

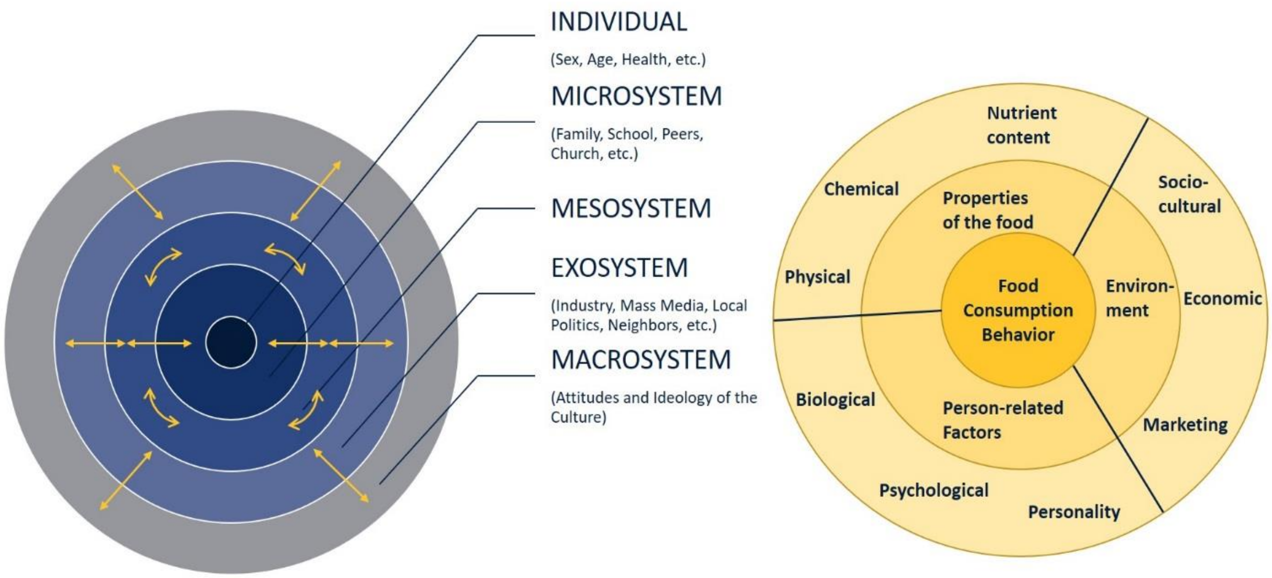

Figure 3. Bronfenbrenner's ecological systems theory as compared to Steenkamp's taxonomy of food consumption behaviors (Eisenmann et al., 2008; Steenkamp, 1993).

Steenkamp's (1993) taxonomy and similar explanatory models may provide insight into how preferences are developed; the choices individuals make are a result of sensory perception affected by an internal dialogue that include life experiences, health decisions, convenience, social influence and quality (Furst et al., 1996; Schultz & Danford, 2016; Steenkamp, 1993). However, Eertmans, et al. (2001) felt there was little ability to use these models as evidence to predict behavior. Consequently, they built on the larger understanding of factors that impact preferences, as described by Steenkamp (1993), and the work of Fallon and Rozin (1990) as they proposed a hypothetical model of eating behavior that described internal and external factors, including these psychological influences that affect food behaviors (Eertmans et al., 2001). The highly individualized, interactive model includes independent variables, aspects such as flavor preference or sensory perception, shaped by the social environment, the availability of health information, attitudes and degree of concern about nutrition and impact on health, as well as the ease with which a food can be obtained. Central to the model are moderating variables borrowed from Fallon and Rozin (1990): "three criteria for food acceptance or rejection: 1) sensory-affective responses (liking), 2) anticipated consequences and 3) ideational factors" (Eertmans et al., 2001, p. 444). The authors describe eating behavior as the dependent variable. These attributes are graphically depicted in Figure 4.

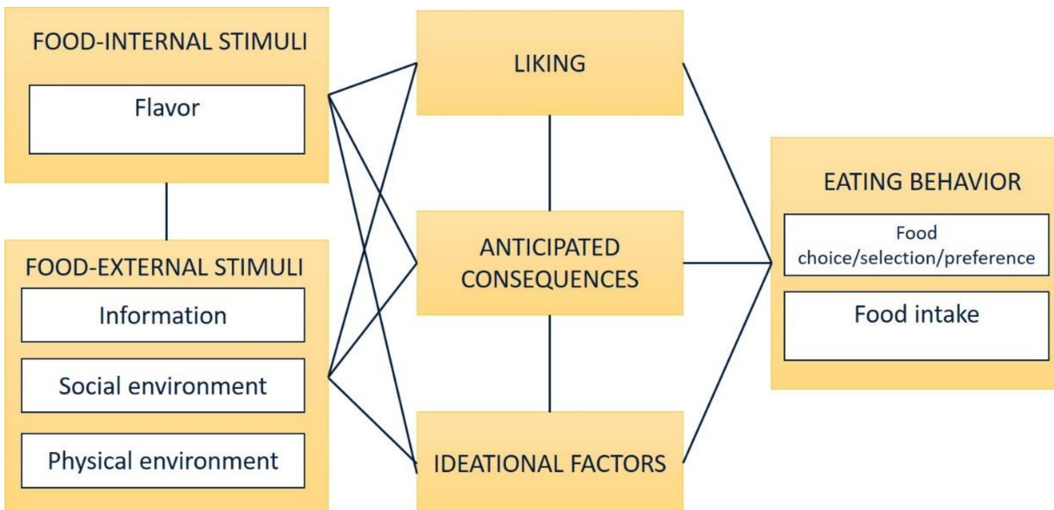

Figure 4. A hypothetical model of eating behavior (Eertmans et al., 2001).

While there are biological influences on behaviors, it may be primarily experiences that shape the choices we make; theory supports this belief. Again, knowledge is not necessarily predictive of behavior. Food choices as a result of health-related knowledge appear to play a minor role in the development of preferences, and the nutrition-related choices we make. Research indicates while knowledge may be present at early ages, application of knowledge is inconsistent. Lanigan (2011) utilized role-playing among a diverse group (n=663) of 3-5-year-olds who attended child care, to determine knowledge about healthy eating and exercise. Interestingly, children were inconsistent with food selection between meals and snacks. While children most often chose healthy meal items for dolls during breakfast and lunch activities, they did so significantly less during snack activities. This gap in understanding must be acknowledged as stakeholders strive to determine the best approach to creating a healthier public; the feasibility of developing appropriate interventions to improve food behaviors, is of concern.

Nguyen et al. (2015) investigated the effects of age, taste, and health perceptions on selection of foods among preschool children. Researchers found that taste is the significant predictor for selection, while health of food is not. Eertmans et al. (2001) point to liking or preference as the strongest determinant of food choice, specifically in comparison with the knowledge around food and health outcomes. Concurrently, health-related information results in varying responses among individuals. For example, knowing a particular food is low in a macronutrient, such as a fat or carbohydrate may encourage consumption based on beliefs or health goals; while another individual's expectations or assumptions about the taste of such a functional food may affect acceptance. The question remains: if we know a behavior is good for us, why do we make poor decisions? It is helpful to examine the theories that explain health behaviors.

There have been a number of seemingly comprehensive approaches to explaining health choices, among them Ajzen and Fishbein's (1980) *theory of reasoned action* (TRA) and Ajzen's (1985) later iteration *theory of planned behavior* (TPB) (Figure 5). The original model described behaviors that a person controlled, while the adapted version, the TPB, included those behaviors that were outside of the total control of the individual (Shepherd, Sparks, & Guthrie, 1995).

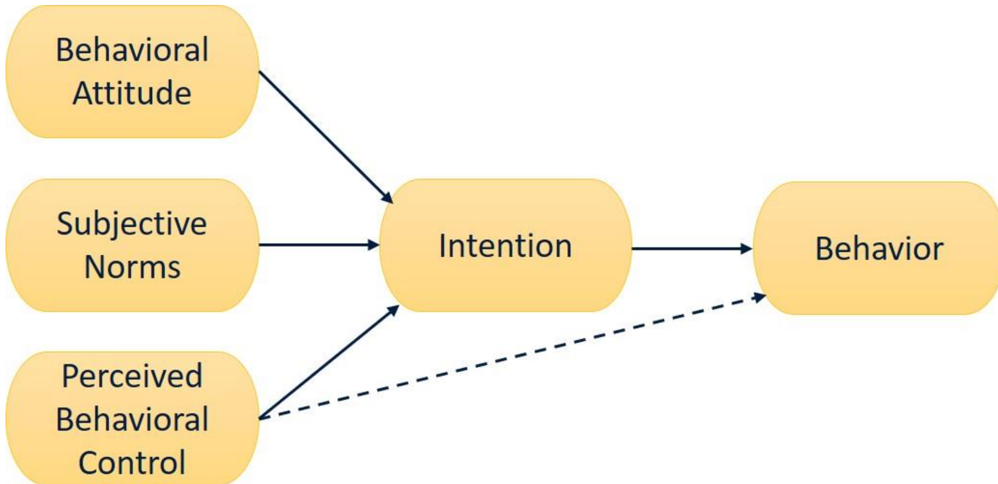

Figure 5. Theory of planned behavior (Azjen, 1991).

Both theories assumed behavioral intentions, or goals, and resulting behavior as "a function of salient information or beliefs about the likelihood that performing a particular behavior will lead to a specific outcome" (Madden, Ellen, & Ajzen, 1992, p. 3). Attitudes, or the value assigned to expected positive or negative outcomes about the behavior, and consideration of subjective norms, or perceived societal influence, impact whether an action is taken (Madden et al., 1992). The TPB also takes into account the influence of perceived control over a particular outcome (Andrews, Silk, & Eneli, 2010; Godin & Kok, 1996; Madden et al., 1992). Figure 5 depicts this relationship. While this model has been widely applied, and successfully so in the field of food behavior, it has been criticized for the assumption that there is a causal relationship between attitudes about a particular behavior, such as wanting to incorporate healthy food choices, and the actual behavior of choosing healthy foods. The TPB has been influential in designing interventions for children that include parent involvement, but fails to quantify perceived control of children, and does not take into account the environmental influences that impact behaviors of all individuals, in particular young children (Shepherd et al., 1995).

Research suggests the child's perception of control related to food behaviors may be limited nutritional gatekeepers, and that children may be more likely to consider external factors such as modeled behaviors, peer influence, and attitudes (messages) they receive from caregivers and family and incorporate as their own when making food choices.

Social Cognitive Theory

Perhaps one of the most widely applied theories in health behavior, and perhaps the most descriptive of social influences and related behaviors is Albert Bandura's social cognitive theory (SCT), which is rooted in understanding both how knowledge is acquired, and how one manages behaviors. Bandura (2004), in *Health Promotion by Social Cognitive Means*, describes behavior as influenced not only by experiences in the environment, but also through those actions of others that are observed, and outcomes of those behaviors. Bandura theorized that children could acquire new knowledge through cognitive means rather than hands-on experience; that through observation of others rather than through practice, children could replicate a new skill (Crain, 2011). Observational learning includes four steps: attention, affected by interest; retention, of a behavior and related symbolic processes; display of skills appropriate to level of motor development; and performance of a new task mediated by expected reinforcements, both extrinsic and intrinsic. Age-related abilities guide this process. Through observation of others' successes and failures, rewards, and punishments, such vicarious reinforcement allows us to predict outcomes of our own behavior. Those behaviors with rewards are most likely to be replicated. Bandura distinguishes between what we teach children and the behaviors we model. Children are influenced more by the habits we exhibit, rather than the verbal messages we encourage children to follow. Children will practice what we practice, not practice what we preach (Crain, 2011). Models need not be physically present according to Bandura, but can be virtual, such as those observed through visual media. This has implications for creation of virtual instruction models of both desired and non-desired behaviors for technology such as iPads, and scales to measure behaviors (Bandura, 1998; Bandura, 2004).

While there is overlap between SCT and TPB, Bandura explains that knowledge and awareness of expected outcomes, while necessary to impact decisions, does not predict behavior; nor is behavior solely a result of acting upon social norms or expectations. Perhaps as important are feelings of self-efficacy and perceived control over outcomes as shown in Figure 6 (Bandura, 1998; Bandura, 2004).

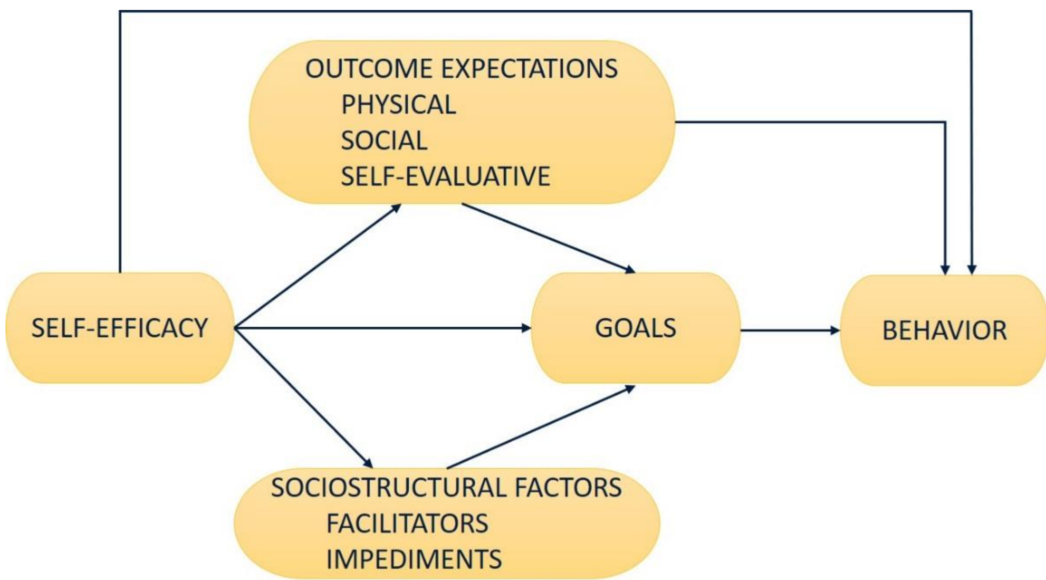

Figure 6. Social cognitive theory (Bandura, 2004).

Bandura describes humans as active agents in their own circumstances, and health behavior a result of three expectations: physical effects such as pleasure or discomfort; social relations and reactions of those one desires approval of; and finally self-evaluation or belief of self-approval. It is this aspect, and the perception of power to overcome barriers to health behaviors that can be most influential. Also of importance is the individual's intention or goal for performing specific behaviors. Bandura (2004) argues that TPB includes short-term goals, but is limited in consideration of self-evaluation, and distal goals. He suggests that an individualized approach, that includes an understanding of a person's feelings of control or efficacy in their own health outcomes, and the support needed to help that person be successful, may be the best approach to public health interventions, rather than population-based campaigns. Efficacy combined with outcome expectations may lead to adoption of health habits. Effective educational interventions for health change may include both a focus on increasing knowledge and perceptions of self-efficacy in improving outcomes through healthy behaviors (Bandura, 2004). An example that has gained popularity in early childhood education centers is family-style dining, which mimics real life, where foods are served in bowls, and children participate in serving themselves appropriate portions, and observe adults eating healthy foods during mealtime. Through this process, children are exposed to healthy behaviors and foods, practice self-control, and gain self-efficacy as the process fosters independence. Interactive technology can include these same concepts, with opportunities through hands-on practice of nutrition concepts.

Eertmans et al. (2001) also questioned the emphasis of health outcomes for nutrition interventions. Selecting foods related to anticipated health benefits may not be the driving force; they promoted global, collective interventions that impact access to healthy foods and positive messages for families. Lytle and Achterberg (1995) also posited that effective nutrition education programs must take a similarly multi-factorial approach. They outlined the elements of effectiveness for young children: behaviorally based, intensive instruction, with a strong foundation in theory that includes a family component, an intervention in the school environment, and application to the larger community.

More recently, Higgs and Thomas (2016) suggested that following social norms for eating supports the need for "positive emotional experience" (p. 2). The authors hypothesized that humans behave differently in a social context, shaping their eating habits. They believe that there is a desire for the social acceptance that follows modeling an admired peer, dependent on the value placed on that social norm by all parties involved. The result is a model of eating behavior in which intentional targeting of these norms can help to encourage healthy behaviors (Figure 6). This is thought to be a potential new area of research in obesity prevention, and a support of education centers as a target for nutrition interventions.

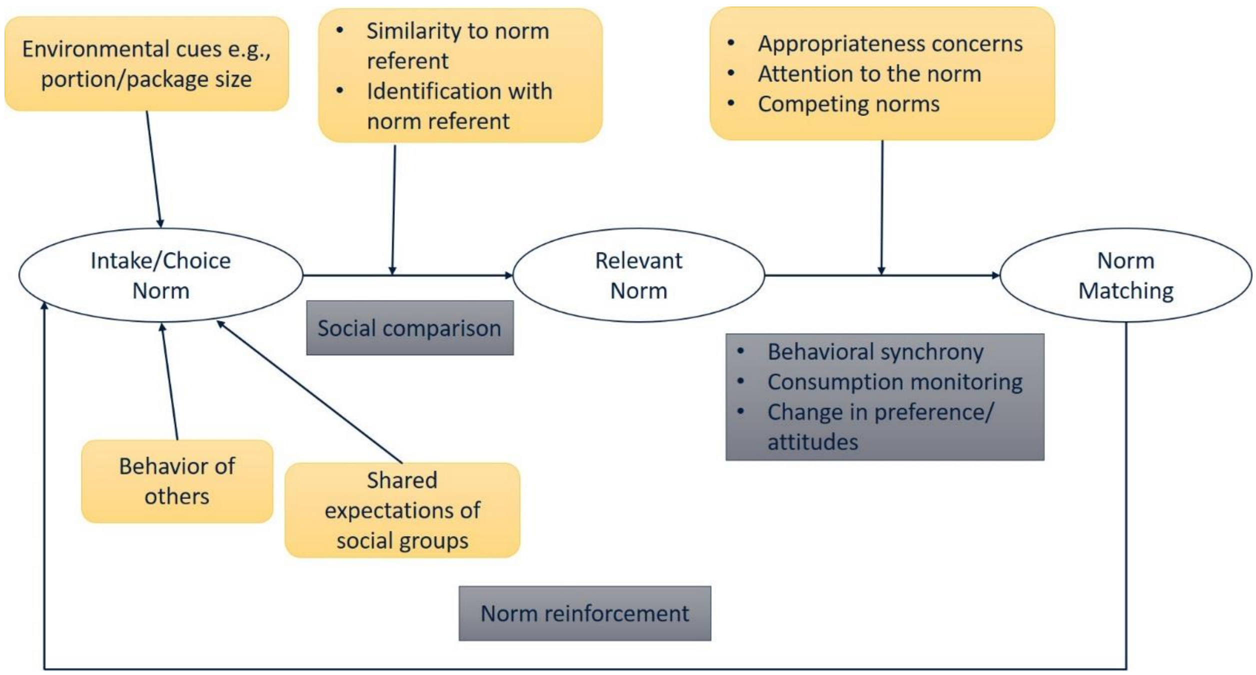

Figure 7. Social influences on eating (Higgs & Thomas, 2016).

Developmental Theory and Nutrition Interventions

Developmentally appropriate practice guides us to create health interventions that emphasize hands-on, play-based approaches, sensitive to children's readiness to learn, and built on current thinking (Bredekamp & Copple, 2009). Epstein, Myers, Raynor, and Saelens (1998) suggest that "interventions should modify eating and exercise behaviors such that new, healthier behaviors develop and replace unhealthy behaviors" (p. 554). It is as important to utilize age-appropriate, individualized assessments of knowledge and behavior, as measured by success at applying newly-learned concepts. Complicating matters, while researchers have found that developmentally appropriate curriculum can improve knowledge about healthy eating, behaviors often do not reflect knowledge gained (Contento et al., 2002; D'Agostino, D'Andrea, Talbot, & Williams, 2013). In other words, despite having knowledge about healthy behaviors, people often continue to make poor food choices, or those based on preference alone; poor health outcomes result. Unfortunately, in the field of obesity prevention, it has been difficult to quantify the impact of educational interventions.

Dontrell and colleagues (2007) evaluated obesity programs designed to target preschool children in a range of settings. While there were numerous programs, only a few proved statistically effective. School-based programs have shown promise. Fitzgibbon, Stolley, Dyer, VanHorn, and Christoffel (2002) introduced Hip-Hop to Health Jr., a randomized control trial (RCT) targeting 12 Head Start preschool programs in Chicago, Illinois. The program included healthy nutrition and exercise curriculum; outcomes were measured by trends in BMI over a two-year period, and parent reported dietary intake. Results were encouraging with limited BMI increase over the two-year period, and overall lower saturated fat intake at year one.

Williams, Strobino, Bollella, and Brotanek (2004) attempted to improve the cardiovascular health of Head Start children in nine centers in upstate New York. Enhanced food service meals along with nutrition education resulted in improved cholesterol levels, and some improvement in weight-to-height ratios among a select group of participants, but not across all ethnicities (Williams et al., 2004). School-based approaches are limited by lack of family inclusion.

Epstein, Paluch, Consalvi, Riordan, and Scholl (2002) included a family-based, behavioral approach to obesity treatment. Researchers utilized an adapted version of the Traffic-light diet, which focused on the nutrient density of foods, or the ratio of beneficial nutrients compared to non-beneficial, empty calories. Foods were grouped by health and paired with a color from a stoplight, with green-light foods considered most healthy, yellow-light foods for occasional consumption, and red-light foods least healthy, and only eaten occasionally (Epstein & Squires, 1988; Graziano, 2015). Intake of unhealthy foods was discouraged, while adequate nutrient balance for developmental growth promoted (Epstein & Squires, 1988). An exercise component included both parent and child. This behavioral approach included the caregiver, who kept food records, modelled behaviors, and provided stars on behavior charts as reinforcements. The intervention led to an overall decrease in caloric intake for participants, yet normal growth patterns indicating nutritional adequacy. Results were significant; participants' percent ideal weight decreased over the two-year period, while growth in stature remained typical (Epstein et al., 2002).

Other researchers have promoted behavior modification techniques (Drohan, 2002; Stark et al., 2011). Drohan (2002) promoted a holistic approach to early obesity treatment among pediatric practitioners. Focusing on weight maintenance with growth in stature over time, the author promoted a family-based approach of teaching healthy habits while utilizing behavior modifications. These included keeping food records, increasing awareness about healthy eating environments, incorporating and tracking adherence to the adapted Traffic-light Diet, modeling healthy behaviors, and including praise and non-food rewards for healthy activities (Drohan, 2002). More recently, a pediatric practice-based pilot RCT was conducted that included a blend of clinic and home-based behavioral management strategies (BMSs). Parents were taught healthy eating and activity concepts, and encouraged to employ BMSs at home with their children. Results of the initial 6-month trial, and subsequent 12-month follow up indicated improved BMI status for children participants, as well as family members (Stark et al., 2011). Such studies reinforce the need for a multi-level approach to nutrition intervention; strategies that are individualized, and include a socio-cultural, family component may be the most effective.

Systematic Nutrition Education

The United States Department of Agriculture (USDA) takes ownership of providing nutrition education, as well as important feeding programs to the people of the United States. The Center for Nutrition Policy and Promotion (CNPP) is the agency that generates the dietary recommendations and campaigns provided (USDA, 2017). The findings and recommendations of this agency guide federal nutrition policy and education that reaches millions of Americans. While there are a plethora of resources available to the public, conflicting or confusing nutrition messages can be an issue for those seeking to improve health behaviors. While the 2015 USDA's Dietary Guidelines for children over the age of two reflect those of adults, there are developmental variations that predict the needs of young children. It follows that there should be more than one approach to sharing nutrition information with adults and children about the health of foods. Messages around the importance of eating fruits and vegetables are simple, and easily remembered. It is more difficult to teach young children the more complex messages outlined in the USDA's key recommendations. For example, while the USDA encourages inclusion of low-fat dairy, and less than 10% of fats as saturated fats, such specifics translate better to adults than preschoolers. In children, messages are further blurred, as the foods that are determined to be good or bad do not allow for many of the foods they often choose, and within the context of their diet, they may indeed be allowed, but are not encouraged every day. For children, foods such as these provide confusion as the choices of healthy and unhealthy do not include moderation. To further complicate matters, these foods may be regularly provided by schools as well as parents. Examples include cheese pizza, breakfast foods such as pancakes and muffins, and snacks such as crackers. In accordance with the USDA recommendations, a focus on eating patterns, variety, and nutrient density are increasingly of concern (USDA, 2015). Innovative, developmentally-appropriate approaches are needed. Favorably, research now indicates that even in young children, clear, developmentally appropriate, behavioral interventions such as the Traffic-light Diet, or the revised Go, Slow and Whoa methods are effective even in young children in bringing about positive outcomes (Drohan, 2002; Epstein et al., 1998; Graziano, 2015).

What has also been evident in past research, is that there are fewer complex messages, such as food group categories (FGC's) outside of fruits and vegetables, and specifics about healthy and unhealthy foods taught in preschools, and it is likely that educators have had less training about these. While children are typically comfortable identifying fruits and vegetables, they are less comfortable with higher-level classification tasks. Tatlow-Golden, Hennessy, Dean, and Hollywood (2013) found that during play-based food identification tasks, preschool children (n=172) had difficulty choosing whether a character should have *lots of* a food item as an indication of the health of the food.

Scale Development

Crucial to the design of community-based interventions for young children are valid and reliable measures that can be widely applied across diverse social settings (Anderson, Bell, Adamson, & Moynihan, 2002). Despite the breadth of research regarding nutrition interventions to improve health outcomes, including assessment of efficacy, there have been a limited number of attempts to validate measures of nutrition knowledge and beliefs, and fewer still to measure the impact of nutrition interventions on behaviors among preschool-aged children. Of importance in developing this scale is determining whether it is possible to create a valid and reliable measure of nutrition knowledge and attitudes in a population of this age. A number of studies have focused on age-related capabilities of children in understanding and applying nutrition concepts and found consistency with development theory that with age grows the ability to understand more complex relationships (Holub & Musher-Eizenman, 2010; Jacques & Zelazo, 2001; Nguyen, 2007; Tatlow-Golden et al., 2013). Holub and Musher-Eizenman (2010), in an attempt to clarify this concept, examined age and gender influence on nutrition knowledge among preschoolers, as well as the cognitive ability of young children to provide explanations as to why they believe the foods to be healthy and unhealthy, and to classify foods by food groups. Using photo identification techniques, researchers identified significant age-related differences as older children were better able to classify food groups and to explain their choices. The researchers aimed to incorporate an ecologically sound approach, such as challenging preschoolers to select healthy meals from a large array of foods (more similar to real-life experiences like cafeterias and vending). The results of the research delineated between age, knowledge, and higher-level functions, supporting Piaget's stages as a factor in knowledge and behavior.

Similarly, other research has found through their efforts to measure health-related knowledge, classification accuracy improved with maturation among 3-5-year-olds (Hendricks et al., 1998; Nguyen, 2007). Nguyen (2007) investigated the developmental differences among age groups as they attempted to categorize foods as healthy and "junky," and were interested in understanding how children "conceptually represent and organize information about food…forming evaluative categories" of food based on their nutritional value (p. 114). Findings indicated that three-year-olds are able to identify foods and categorize them as healthy and unhealthy, but are limited in ability to describe why they make choices related to health. Increasingly, four- and five-year-olds were able to carry out these executive functions, determining subtle nuances of healthy and unhealthy related to food selections. The results are consistent with developmental theory that suggests while most three-year-olds are unable to understand and communicate reasoning behind choices, by age four, these skills are more developed. For practical use, it is important to note that children of all ages had difficulty categorizing unhealthy foods, comparable to adult measures (Nguyen, 2007).

Other approaches to design explored the executive functions among preschoolers, including the development of abstraction and flexible thinking in young children. Jacques and Zelazo (2001) used flashcards, combining dimensions of shape, color, size, and number, to test children's ability to categorize and then re-categorize items, an approach known as the Flexible Item Selection Task (FIST). Results indicated an age effect: 2-year-olds were unable to demonstrate even simple categorization; abstract thinking was limited among 3-year-olds, demonstrating a more concrete approach to knowledge; in 4- and 5-year-olds abstract and flexible thinking was evident, and grew with chronological age (Jacques & Zelazo, 2001). Implications guide researchers to measure impact among these older children (3-5 years of age) rather than toddlers.

Scale Quality

Wiseman and Harris (2015) demonstrated the range of approaches in an extensive review of scales used for data collection among preschoolers between 1980 and 2013. Among the 157 relevant studies that included nutrition and health concepts among preschool-aged children, only twenty met the authors' criteria of a well-defined methodology for measuring nutrition knowledge. Among those, seven were exclusively quantitative, eleven included mixed assessment methods, and only two were solely qualitative. Six of the twenty techniques explored included pre-post testing, while only two were included in a randomized controlled trial. Eleven included structured, play-based activities, and only one study was strictly interview, without use of material stimulus and prompts (p. 348). Extensive psychometric testing of scales was not typical, limiting their generalizability, however of these scales, four employed Cronbach's α as a measure of reliability, and six included test-retest reliability analysis. Face and content validity were determined in seven.

Scales are often specific to the intervention design, limiting their generalizability to the larger population and across interventions (Musser & Malkus, 1994). One such example includes Gorelick and Clark (1985), who developed extensive materials, creating a nutrition education kit for preschool children, including an assessment scale. Researchers utilized a quantitative, experimental design, with randomization of 187 participants. Pre- and post-test assessment included food identification, food group categorization, and identification of healthy and unhealthy food concepts. While statistical significance indicated that play-based learning was an effective method of instruction, there were age-related, stage-wise differences in acquisition of more complex concepts. Assessment of validity and reliability were not included in the study.

While Nix, D'Angostino-Ibanez, Strobino, and Williams (1999) adapted the Healthy Start Knowledge Quiz to measure gains related to the curriculum Healthy Start, they did employ psychometric testing to ensure wider application. The population of the study included Head Start participants, engaged in Healthy Start Health curriculum, a "three-year comprehensive preschool nutrition and health education program and food service intervention, with a 12-unit curriculum guide" (Nix et al., 1999, p. 9). The measure included 40 questions related to safety, dental hygiene, and nutrition. Items were assessed for difficulty, and those deemed too difficult or easy eliminated, and wording assessed for age-appropriateness. The revised, computer version of the scale included 36 measured items, including 16 nutrition questions. Pictures for testing were also evaluated for quality. Test-retest reliability for the total computer version was determined after one week, and results indicated a high level of reliability (r = .82), though lower for the nutrition subscale (r =.68). Cronbach's α for the nutrition subscale was calculated (α = .50). Anecdotally, the computer version of the scale was better accepted by young children than the original paper version, with greater numbers completing the scale (Nix et al., 1999).

More recently, D'Agostino et al. (2013) investigated the hypothesis that the Healthy Start Project, the nutrition and health curriculum designed for preschool children, could be effectively implemented and outcomes measured reliably. The researchers assessed six subscales of health, including 15 items specific to nutrition, to examine the effectiveness of a nutrition education program used with 814 children at nine Head Start centers in New York State. Pre- and post-intervention testing showed increased knowledge. While there were limitations to the design (length) and validity of the scale itself, it was evident that the intervention was effective (D'Agostino et al., 2013).

Sigman-Grant et al. (2014), utilized an adapted version of the Traffic-Light Diet, the Preschool Snack Selection Instrument (PSS), which prompted children to identify foods as either Go foods, or Whoa foods to indicate their understanding of the health of foods. The scale was given to 247 preschool children before and after the 9-week nutrition curriculum *All 4 Kids*, and 191 of these were appropriate for analysis. Psychometric testing of the scale included pilot testing a larger number of items among 625 low-income parents to determine face validity, with 18 common healthy and unhealthy snack foods chosen to be piloted in children. Content validity was determined by a panel of nutrition and early childhood experts. Children completed food identification tasks, as well as classification of foods as healthy or unhealthy. Test-retest reliability and other measures of validity were not measured, though the PSS was piloted across several states, generalizability was supported for the target population. Analysis determined that children had improved performance on tasks after the 9-week nutrition intervention, and increased stated preference for healthy foods (Sigman-Grant et al., 2014).

Hendricks and colleagues (1988) pioneered nutrition measures with a picture identification instrument designed for use in young children. The design incorporated guidelines of developmentally appropriate practice (DAP), and School Health Education Evaluation (SHEE) requirements, with its limited length, individualized administration, multi-age use, and limited time for administration (Hendricks et al., 1988). Researchers adapted a picture identification measure previously utilized in a longitudinal health assessment, which included 30 hand-drawn representations of target items on health-related topics. Item correlation for this adapted version was determined, and items omitted based on item discrimination and difficulty index. Items were further revised for clarity of terminology, and new items included based on nationally recognized guidelines for health to increase content validity. Testing across a diverse group of centers further improved validity (Hendricks et al., 1988). The adapted scale was administered to a convenience sample of 288 preschool children, by trained university students. Twenty percent of the children were retested after 2 weeks to determine reliability. Item discrimination was determined, and three were omitted. The remaining scale included 27 items, with acceptable test-retest reliability among all age groups (r = .89), stronger for 3- and 4-year-olds. Internal consistency was shown across all age groups (KR 21 = .83). Analysis of variance and post-hoc testing indicated developmental differences in performance. Findings suggested that children with developmental delays, vision, and hearing impairment may not be appropriate for inclusion in testing (Hendricks et al., 1988).

Calfas, Sallis, and Nader (1991) developed a paper-based photo pair food and activity questionnaire (PPFEQ) which specifically measured knowledge and preferences about diet and exercise related to cardiovascular disease. This play-based scale utilized matching of photo pairs, and was assessed for validity and reliability. Statistical analysis indicated item discrimination, with Cronbach's α determined to be .75, and test-retest administration indicated a reliability coefficient of .72 (Calfas et al., 1991).

Slaughter and Ting (2010), through an interest in creating DAP nutrition education programs, utilized an open-ended questionnaire adapted from several previous interviews to determine age-related understanding of nutrition as related to health, and growth among a convenience sample of 100 individuals of mean ages 5 to 20, including 10 preschoolers. Questions included concepts around quantity, effects of eating specific foods, and overall diet quality. Answers were coded, and reliability determined with a Cohen's Kappa of .70. Results confirmed that while preschoolers understood basic health-related concepts around food, such as food for growth, there was a significant increase between ages 5 and 8 in understanding of more complex reasoning around food choices. While this information would inform potential age-appropriate interventions, further psychometric testing was not carried out (Slaughter & Ting, 2010). Plum, Hertzler, Brochetti, and Stewart (1998) designed a scale that included both food identification as well as open-ended questions about 3 typical vegetables, administered by high-school students to preschoolers, in card game-like format. Results proved helpful in gaining a better understanding of how children think and their attitudes about specific vegetables, but were limited across food groups. While inter-rater reliability was determined (75%), generalizability of this scale across nutrition interventions was not determined.

Singleton, Achterberg, and Shannon (1992) interviewed 60 young children ages 4-7 years using open-ended and follow up, closed-ended questions to examine their cognitive aptitude to acquire knowledge about the relationship between nutrition and health. Face and content validity were determined for questions, and pilot tested. Coding was completed, with interrater reliability of .83. Cronbach's α showed internal consistency among closed-ended questions. Pre- and post-testing were carried out along with a 4-week nutrition education program, Hearthrob, for targeting heart disease prevention and health. While open-ended questions showed a significant effect of education interventions on health perceptions of nutrition, the closed-ended measure did not appear adequately sensitive to be a valid indicator of knowledge growth (Singleton et al., 1992).

Mobley and Evashevski (2000) investigated knowledge about health and safety topics in a convenience sample of 308 preschool children with an adapted version of the computerized

Preschool Health and Safety Knowledge Assessment (PHASKA), which included 6 nutrition-related questions with identification of healthy and unhealthy foods. Role-play activities were employed, where children acted as caregivers to dolls, feeding them meals and snacks, with prompts from researchers, including "failure to finish food, spills, refusal to try an unfamiliar food, repeatedly asking for more; and addressed barriers to physical activity such as inclement weather, inability to master a skill and preference for watching television" (Mobley & Evashevski, 2000, p. 371). Children also completed a series of tasks, including sorting of food models into healthy and unhealthy categories, describing the health effects of healthy and unhealthy food intake, and identification of healthy physical activities. Researchers determined power for this study sample size to be strong at 99%. Face and content validity were determined utilizing expert opinion. Test-retest reliability correlated at .88, and Cronbach's $\alpha = .51$. Responses were coded and interrater reliability determined to be .764. Statically significant results indicated that there were age-related differences among scores. Researchers discovered that preschool children could more easily identify health aspects of foods rather than physical activity, but that capability of learning these constructs was present, and the shift should be to more diverse subject instruction to include various formats, including media (Mobley & Evashevski, 2000).

Of all previous studies, two studies are perhaps most similar to the methodology used in this research study. One Australian study by Wiseman, Harris, and Downes (2017) measured the validity and reliability of an iPad-based scale in preschool children (*N* = 86). In a multi-stage process, a validated, paper-based scale, which measures nutrition and physical activity knowledge, was adapted for use on interactive technology. The photo pair food and activity questionnaire (PPFEQ) designed by Calfas et al. (1991) previously discussed in this review was adapted for use on interactive iPad technology, and underwent testing for reliability and validity. Culturally appropriate photographs were paired in this measure, and these were updated and initially validated among children. Initial item discrimination informed the 18 question Pre-FPQ, containing 10 food questions and 8 activity questions, designed so that children would answer them about their application to a doll, rather than themselves to control for personal preference, and were focused on healthy and unhealthy choices. The iPad version of the test was given to children, twice, with 7 days between interactions to determine reliability. In a third phase, researchers determined validity of the measure by comparing preferred food and physical activity indicators, determined during initial interviews with the same children, and those chosen during the iPad testing. Preference and knowledge testing were administered to children in different orders, to ensure that order of administration did not affect the measure's validity. The fourth phase included pre- and post-testing of knowledge and preferences after an educational session. Results of psychometric testing indicated that reliability and internal consistency of nutrition knowledge and preference constructs increase with age, and that food knowledge and preference were more reliable that activity knowledge. Results were not as positive for physical activity constructs. Validation of preference as measured by comparing stated food preference and food choices indicated a strong percent agreement of 73%, increasing with age. Researchers found that participants younger than 4 years old did not produce valid and reliable information.

A second study by Graziano (2015) addressed the failure of nutrition knowledge measures to assess "children's ability to understand moderately healthy foods" (p. 111). This researcher has acknowledged similar concerns during initial scale development. Graziano (2015) created the Dietary Interview Assessing Nutritional Awareness (DIANA) tool, designed to measure preschoolers' knowledge of foods through food identification and awareness of the health of particular foods. This scale incorporated the concepts of the Traffic-light diet, as measured by a 3-part hedonic scale with a Smiley Face (green), Neutral Face (yellow), and Sad Face (red) by children. The scale was initially revised to improve face and content validity, as well as cultural appropriateness, and the resulting 24-item scale subjected to psychometric evaluation for validity and test-retest reliability. The scale was pre-tested in 69 children participating in summer preschool programming for school readiness or healthy lifestyle training, and post-test completed by 67 of these children. Among food identification tasks, while a large percentage of foods were correctly identified (60%), results showed that children were least able to identify the healthiest foods (green), and most capable of identifying unhealthy foods (red). Interestingly, statistical significance indicated that children further classify foods within each health category differently, most easily distinguishing healthy (green) foods, and least easily moderately healthy foods (yellow). Task performance did not differ across gender or SES, but did across age groups. Internal consistency was .83 for food identification and .82 for health classification. Item total correlation did not differ for individual items removed. Test-retest reliability was .86 for food identification, and .81 for classification of foods. Discriminant validity was determined, as children who participated in the healthy lifestyle summer program performed better on post-testing as compared to those participating in a school-readiness program, particularly in classification tasks of foods into healthy, moderately healthy, and unhealthy categories (Graziano, 2015).

Holub and Musher-Eizenman (2010) suggest it is important to choose an ecologically designed measure that mimics real-world choices that young children may make, to gain the true picture of their knowledge. In a study examining nutrition knowledge in preschoolers, they utilized a game-like meal creation task that required children to create three meals, including a preferred meal, a healthy meal, and an unhealthy meal, by choosing from a wide variety of pictures of foods and beverages. Meals were analyzed for caloric and fat content, then healthy and unhealthy meals were compared. Foods available for selection (*N* = 21) were categorized as entrees, side dishes, fruits and vegetables, desserts, and drinks. Children were asked to describe how they knew meals were healthy or unhealthy, and responses were coded. Two health-related themes emerged. Some participants chose foods based on their belief in the nutritional content of the foods, and some reported choosing foods based on expected health outcomes, such as growing strong bodies. Other themes were related to preference rather than health-related concepts (Holub & Musher-Eizenman, 2010). Children were also asked to complete a food group classification task during which they viewed groups of 4 common foods, and were asked to select the 3 that belonged to the targeted food group category, including fruits, vegetables, dairy, and grains. Of interest was the variation in ability to identify common fruits and vegetables, in comparison to more complex categories such as grain foods and dairy. Researchers found, through the assessment of the caloric and fat content of healthy and unhealthy meals, that children were able to differentiate between fruits and vegetables as healthy foods, and desserts as unhealthy foods as they chose lower caloric foods overall for healthy meals, and higher caloric meals for preferred and unhealthy meals (Holub & Musher-Eizenman, 2010). Researchers also found correlations between performance on meal creation tasks and their ability to identify healthy and unhealthy foods and health-related concepts. The study indicated that children are capable of selecting from a large number of food options to create meals, and that they are able to identify common nutrition messages including health outcomes of eating fruits and vegetables as well as desserts (Holub & Musher-Eizenman, 2010). Age-related increases in ability to recognize food group categories were identified. Young children were also limited in their ability to differentiate between cooking methods within a category. For instance, fried foods were not a determinant of a healthy or unhealthy choice. Interestingly, children did demonstrate the use of moderation in food choice, including less unhealthy foods as they created their preferred meals, as they did in their unhealthy meal choices. These researchers reported that the homogeneity of their sample may have been a limiting factor, decreasing generalizability across demographics, such as ethnicity, family structure, and socio-economic status. They also recommended psychometric evaluation of the measure (Holub & Musher-Eizenman, 2010). This research aims to address these limitations.

Also of concern is that measures often assess knowledge but fail to describe the relationship between knowledge and behaviors (Anderson et al., 2001). Traditional assessment theory suggests that children may trend towards simple memorization of basic concepts, rather than mastery of the underlying constructs (Shepard, 2000). Such historical behavioral approaches assume:

> Learning occurs by accumulating atomized bits of knowledge; learning is tightly sequenced and hierarchical; transfer is limited, so each objective must be explicitly taught; tests should be used frequently to ensure mastery before proceeding to the next objective; tests = learning; motivation is external and based on positive reinforcement of many small steps (Shepard, 2000, p. 5).

This may not be true learning; the transfer of knowledge, or a robust understanding as evidenced by the ability to apply concepts widely is the underlying goal of instruction and assessment (Shepard, 2000). This social constructivist approach to cognitive development has been applied in this research to the development of measures of knowledge, attitudes, and behavior. Just as child-centered, multi-faceted approaches to sharing new information with children, allowing children to construct new understanding of constructs, are best practice, age-appropriate measures that allow children to apply learned information in their own lives may provide a more accurate picture of acquired knowledge. Vygotsky suggested this when he described make-believe play as imagination, but also as a practice of applying rules and learned constructs (Crain, 2011). It stands to reason that play-based demonstrations of knowledge and behavior would then exhibit true understanding.

Methods of Scale Development

Methods of scale development and their uses have been widely explained. Hendricks et al. (1988) described ideal design of instruments for use with young children: instruments must follow developmentally appropriate practices (DAP), be limited in length with no more than three responses per item, and allow individualized administration to acknowledge variation in cognitive development. Wiley and Hendricks (1998) described direct observation of activity and behavior as the best practice for determining knowledge among children. This process can be cumbersome, and at times not feasible. In these cases, it is necessary to determine and use other methods that would provide valid and reliable results when measuring these constructs. Through a review of validity and reliability with use of picture identification (PI) in multiple studies, the researchers developed a list of recommendations for its use in early childhood education programs, and particularly with 3-5-year-olds. Research confirmed that PI is effective as a measure of knowledge as a supplement to observation (Wiley & Hendricks, 1998). Similarly, in a 2006 study, the effectiveness of photo elicitation interview (PEI) was explored among children ages 6-16, in the context of a therapeutic summer camp for children with cancer (Epstein, Stevents, McKeever, & Baruchel, 2006). Findings indicated using pictures in the interview process was an effective method for children to use in support of their limited language, and assisted with the development of relationships between the child and interviewer, allowing children to expand upon their personal experiences (Epstein et al., 2006). Wiseman and Harris (2015) found consensus; in their review of measures of preschool nutrition knowledge, 18 of the 20 studies carried out utilized pictures as provocations in assessment activities, and findings were further supported through psychometric evaluation of an interactive technology measure (Wiseman et al., 2017) . Researchers also tended to employ play-based activities to mimic real-world application of knowledge.

Validity

Experts have further identified best practice in scale development as the use of careful technique, employing a methodical process that includes clear criteria for assessment of reliability as well as verification of various types of validity, in order to provide a clearer indication of effectiveness of interventions, and pinpoint appropriate placement of measures in the span of an intervention (Frongillo, Tofail, Hamandani, Warren, & Mehrin, 2014; Hinkin, Tracey, & Enz, 1997; Parmenter & Wardle, 1999; Peterson et al., 1988; Pittayachawan, 2008; Rattray & Jones, 2007). Validity describes the accuracy of measures, and includes content, criterion and construct applications (Contento et al., 2002; Creswell, 2009; Elliott, Regal, Elliott, & Renier (2001). Such scales of measurement require multiple revisions, extensive administration, and psychometric statistical analysis (Parmenter & Wardle, 1999; Sapp & Jensen, 1997). Also of great importance is ensuring that the scale is administered correctly and reliably by researchers. This often requires a great deal of training for researchers (Frongillo et al., 2014). Creating a scale that can be administered with little effort and training is ideal.

Hinkin et al. (1997) described a multi-step process required to develop a scale for use in research with psychometric determination of reliability and validity, in particular internal consistency, construct validity, and replication. These writers differentiated between two common approaches to scale development, each dependent on the breadth of understanding about a construct. The first, an inductive methodology, would utilize descriptive and open-ended inquiry in an effort to determine areas or themes to create questions. The second approach includes identifying constructs based on well-established theory, in order to develop scale items. This research, builds on nutrition assessment techniques that have been well established, thus the deductive approach will be incorporated for scale development (Hinin et al., 1997).

Elliott et al. (2001) investigated the methodology involved in creating such instruments, in particular to measure the impact of health education. Through a review of the process of design, Elliott et al. (2001) defined eight phases to creating an effective measure. These include:

> 1) determining purpose, objectives, target populations, and conceptual framework; 2) review of the literature and existing instruments; 3) design of draft instrument; 4) perform content validation with resulting revision of draft; 5) pilot-testing of draft two with resulting revision; 6) construct validation with resulting revision; 7) reliability testing (test-retest reliability) and resulting revision; 8) final version suitable for use in field (p. 157).

Item Development

Clark and Watson (1995) argue that the stage of scale development, item creation, is critical to the validity of a scale, and that despite careful data analysis, it is impossible to correct for failing to include relevant and possible aspects of constructs as questions in the initial pool.

The number of questions required to adequately test constructs has been debated; based on the literature, it is not required to provide exhaustive testing of each construct in a scale, and there is evidence that 4-6 items for each target can provide a quality measure (Hinkin et al., 1997; Wells & Wollack, 2003). However, Hinkin et al. (1997) do recommend including twice the desired number of items within each area, with the understanding that through the phases of psychometric evaluation, half of these will be eliminated for the final scale, to ensure validity and reliability. Clark and Watson (1995) go on to suggest that "good scale construction typically is an iterative process involving several periods of item writing, followed in each case by conceptual and psychometric analysis" (p. 315). Also of interest is the choice of answer type. Forced-choice approaches with dichotomous options are convenient for time constraints and allow for greater numbers of questions; however, they may limit the sensitivity of a tool. Scales that include multiple-choice options may improve reliability and quality (Clark & Watson, 1995).

Reliability

Often, the first phase of determining a measure's potential use is evaluating its reliability. Reliability is consistency and repeatability. Wells and Wollack (2003) describe this as consistency of scores among individuals when presented with similar measures. Error within scales can be a result of poorly designed questions, with unclear items, and inconsistent administration or calculation errors, resulting in poor reliability. Humans are certainly subject to fatigue and carelessness as well, limiting the reliability of measures. This unpredictable or random error does not allow us to draw conclusions about what an individual has learned using scores or statistics. Rather any differences are a result of chance. However, if scales are well designed, performance in individuals should be similar across more than one encounter, when administered over a fairly close time period. This is certainly an important aspect of determining validity, as it is said that reliability is instrumental in a scale being valid (Tavakol & Dennick, 2011; Wells & Wollack, 2003).

Item Discrimination

During development of a scale, item quality can be measured to increase reliability and validity. Item-total correlation (ITC), or point-biserial, is this measure. This relates to measures of item discrimination that occur between groups with expected variance in understanding of a concept, such as experts in a field compared to those with little knowledge about a topic (Camilli & Shepard, 1994). Wells and Wollack (2003) give examples of "better" and "poorer" students. Items with good discrimination are correctly answered by "better" students than those who are "poorer." In this case, it would follow that item bias could be measured by comparing scores on items within the scale between five-year-old children with a greater degree of cognitive development, and three-year-olds tested. Items on an exam that are highly discriminating are those answered correctly by individuals who were prepared, and those incorrect answers by those who performed poorly overall. The point-biserial correlation (r_{pbi}) is a measure of discrimination, with a range of -1.0 to 1.0. Negative discrimination scores indicate the test is poorly designed, with less knowledgeable individuals getting correct answers and experts choosing incorrect answers. Research guides scale developers to utilize large, diverse samples (100-200 participants) for initial pilot testing and item discrimination determination (Clark & Watson, 1995).

Internal Consistency

Internal consistency is perhaps the most common measure of reliability, as it can be obtained during a single administration (Tavakol & Dennick, 2011). Similar to an exam given in the classroom, a scale provides an overall score, but often includes multiple domains of knowledge within (Wells & Wollack, 2003). For example, while an exam may cover a broad construct such as digestion and absorption, each question or grouping of questions about individual nutrients and the role of digestive enzymes would be indications of overall understanding. Statistically, Cronbach's coefficient α is the most common indicator of internal consistency, or each item's dependability to indicate mastery of the overall construct (Tavakol & Dennick, 2011). Cronbach's α falls between 0 and 1.00, and minimum standards of acceptability vary, but typically fall between 0.70 and 0.95 (Clark & Watson, 1995; Tavakol & Dennick, 2011; Wells & Wollack, 2003). Further squaring this number, and subtracting from 1.0 will determine the measure's error variance, or random error. The greater the reliability of a measure, the less error inherent in the measure among the population studied. Such results would indicate the scale could be used reliably among different populations across time (Elliott et al., 2001; Paramenter & Wardle, 1999). Also of importance is the length of the scale when determining reliability. If the scale is short, the measure will have a smaller coefficient alpha; thus it is important to include multiple items measuring similar concepts (Tavakol & Dennick, 2011). The question of appropriate length may be difficult to determine, but the Spearman-Brown prophecy formula is a key statistical indicator of length-related strength (Wells & Wollack, 2003). It can be used to determine Cronbach's α after adding or removing similar test items. Cronbach's α calculated for each area of measure of knowledge and beliefs will indicate a correlation between the item and the overall score, or the reliability and importance of each item. Alpha will determine which items contribute to the overall validity of the scale versus which items detract from the validity, and also to see which items result in the most variation. Corrected scores that improve in relation to the overall alpha indicate that question may be eliminated to improve the reliability and validity of the scale.

Further, Cronbach's α assumes homogeneity of questions measuring a construct, and it has been suggested that when multiple constructs are measured within a scale, such as knowledge and behavior, it is of value to report the coefficient alpha for each of these, rather than for the whole. The result of developing such scales will be the ability to measure knowledge as it relates to behaviors. Within the context of the gap between nutrition knowledge and behavior, one could measure whether poor compliance is related to misunderstanding of the information heard, limited knowledge, forgetting over time, or simply a result of preference over knowledge (Paramenter & Wardle, 1999).

Content Validity

Content validity refers to how well the items in a measurement scale accurately represent the ideas it is designed to measure, and has been described as the most important aspect of validation (Elliott et al., 2001). Content validity is identified by face validation, or using experts to initially review a measure for appropriateness during development of the scale (Contento et al., 2002). It is through content validation that experts review the clarity of terminology and appropriateness of terms used. This is common in the development of most scales (Contento et al., 2002). Statistical analysis is not often used for content validation, but the use of Likert scales is often employed, allowing the designer to eliminate questions with measured ineffectiveness (Elliott et al., 2001).   The authors go on to suggest that establishing a relationship between psychosocial and behavioral variables would be best practice, but this is less often the case for preschool measures. More common are convergent and discriminant validity. Convergent validity compares two tests that are reported to measure similar constructs. This measure includes a clear hypothesis, and statistical analysis to pinpoint statistical correlations, thus determining whether a measure measures what it says it does, and whether predictions can be made based on an instrument's findings (Elliott et al., 2001). Discriminant validity helps pinpoint the differences between groups that typically would vary in results (Elliott et al., 2001).

Construct Validity

As measurements are developed, construct validity is "about the extent to which respondents' scores on an instrument provide a good measure of a specific construct" (Contento et al., 2002). To determine this type of validity, the scale might be given to both experts and non-experts in an area of interest, and the expectation would be the scores would be greater for those with extensive knowledge in that area (Contento et al., 2002).

Criterion Validity

A third type of validity, criterion validity, is established in two ways: by determining whether a measure allows researchers to use data to predict an outcome accurately (predictive validity), and by determining whether two distinct measures can give you the same information (concurrent validity) (Contento et al., 2002). It is the second type of criterion validity we strive to determine. Food frequency questionnaires are one example of a standard against which observed behaviors might be validated. In this case, nutrition knowledge will be initially measured by food identification, food group categorization, and classification of foods as healthy and unhealthy. Subsequent classification of all foods utilizing the Traffic-Light diet will allow knowledge scores to be interrelated to determine concurrent validity. Future testing may allow for actual behaviors to be evaluated as well.

Research Tasks

Creating a well-developed, valid, and reliable scale to measure preschoolers' nutrition knowledge, attitudes and behaviors was the aim of this study. Building on established theory and nutrition assessment techniques, this researcher set out to complete these research tasks across multiple phases, as defined by Elliott et al. (2001):

Research Task 1: Determine the purpose, objectives, target populations, and conceptual framework.

Research Task 2: Review the literature and existing instruments.

Research Task 3: Design a draft instrument.

Research Task 4: Perform content validation and revise the draft scale.

Research Task 5: Pilot-test draft two and revise.

Research Task 6: Determine construct validation, and revise.

Research Task 7: Conduct reliability testing (test-retest reliability) and revise.

Research Task 8: Create final version suitable for use in field (p. 157).

CHAPTER 3

METHODOLOGY

Research Design

This research is a quantitative design, focused on the creation, and determination of validity and reliability of a scale to measure nutrition knowledge, beliefs, and behaviors among preschoolers. This research builds on the work of Holub and Musher-Eizenman (2010) who suggest it is important to choose an ecologically designed measure that mimics real-world choices that young children may make, to gain the true picture of their knowledge, and aims to address the limitations of this earlier research, expanding the reach of the project across demographically-diverse populations including children enrolled in independent child care centers, Head Start Centers, including those that serve children eligible for CACFP reimbursement for meals, and school-based afterschool programs serving preschool children. Approval for each phase of the study was obtained from East Tennessee State University's Institutional Review Board. Research tasks completed with the creation and validation of the scale were carried out in three phases and will be described sequentially.

Elliott and colleagues (2001) outlined the research tasks required to create a valid and reliable scale; the process was cyclical, and many of the steps were revisited throughout the development of this scale to measure preschoolers' nutrition knowledge, attitudes and behaviors.

Phase I- Draft of Instrument

The first iteration of the scale was created and piloted through an investigation of the effects of the comprehensive nutrition program Rainbow in My Tummy® (RIMT) in the childcare setting (Johnson, 2017). During this phase, the first three research tasks: determining the purpose, objectives, target populations, and conceptual framework for the scale; reviewing the literature and existing scales; creating a draft of the scale for testing, were completed. The first draft scale was created specific to the RIMT intervention, and was inspired by Holub and Musher-Eizenman's methodology (2010) including the use of lifelike digital images of foods, and game-like scenarios that required children to demonstrate their knowledge and beliefs about foods and included several tasks to indicate knowledge and predict behavior. Pre- and post-testing was completed to measure nutrition knowledge, beliefs and behaviors among participants, ages 2-5 years of age before and four months after exposure to the comprehensive menu program Rainbow in My Tummy®. This draft scale utilized physical laminated copies of pictures. The 27 item version included five distinct tasks. Prior to data collection, pictures of foods were reviewed to determine face and content validity, and designated as healthy, somewhat healthy, and unhealthy by the Registered Dietitian (RD) involved.

Pictures for each task were grouped in separate envelopes. Considering the short attention span of young children, assessments were continued only as long as the child showed interest. During testing, researchers sat with each child individually in the natural classroom setting. Children were presented with lifelike photos of foods, and interviewers discreetly documented responses on the scoresheet, including any nutrition language, vocabulary or phrases stated by the child (Appendix B).

Measures

Nutrition Knowledge. To measure nutrition knowledge, children were asked to complete two tasks: food identification and categorization of foods by food groups including fruits, vegetables, dairy, and grains. The tasks were described as games, and children were provided with positive encouragement, whether answers were right or wrong in order to decrease any potential anxiety that children might feel during testing. The food identification task required children identify 10 foods including avocado, dried beans, corn on the cob, eggs in the shell, prepared oatmeal, spaghetti squash, peppers, raw spinach, tortillas, and pineapple. Children were shown each picture, one at a time, and asked if they knew what the food was. Answers were recorded on the scoresheet (Appendix B). After testing, scores (0-10) were assigned based on the number correct out of 10.

Food group categorization required children identify the food that best fit the categories: fruits (berries, bananas, and apples); vegetables (Brussel sprouts, carrots, and potatoes); dairy (milk, yogurt, and cheese), and grains (pasta, sliced bread, and rice). Pictures were displayed together on the table, and the researcher asked children to select the fruits, vegetables, dairy, and grains in that order. Answers were recorded on the scoresheet. After testing, scores (0-12) were assigned based on number correct out of 12.

Nutrition Beliefs. To measure beliefs, children were asked to complete two tasks. Children were first asked: "What do you think healthy means?" They were then asked "What do you think unhealthy means?" Answers were recorded on the scoresheet. They were then asked to select foods that were healthy and unhealthy from groups of 13 digital images. The pictures were arranged on the table, so all could be seen, and the researcher asked children to choose the three healthy foods. Selected pictures were returned to the table, and children were asked to identify the three unhealthy foods. Healthy food options included tomatoes, grapes, melon, a garden salad, a grilled chicken breast, grilled salmon, and cooked spinach. Somewhat healthy foods included: cheese pizza, and tacos, and unhealthy foods included French fries, chicken nuggets, a cupcake, and a doughnut. Choices were recorded. Prior to testing, foods were designated as healthy, somewhat healthy, and healthy by the Registered Dietitian (RD) involved. Scores (0-6) were assigned for the healthy category by adding the score for each choice (0- unhealthy, 1-somewhat healthy, and 2- healthy.) Scores (0-6) were assigned to selections in the unhealthy category by adding the score for each choice (0- healthy, 1-somewhat healthy, and 3- unhealthy).

Predicted Nutrition Behavior. To measure predicted behavior, children were asked to create a favorite meal, choosing from a selection of images of healthy, somewhat healthy, and unhealthy foods. Children were shown a diverse selection of 16 images of foods, which were placed on the table, and asked to create a plate of their favorite foods, by selecting and placing five of the pictures on a plain, white paper plate. Healthy food options included strawberries, watermelon, green beans, a garden salad, quinoa, deli ham, sushi, a baked chicken leg, and spaghetti with marinara sauce; somewhat healthy options included macaroni and cheese, a burrito, a hot dog, and a grilled cheese; unhealthy food options included fried chicken tenders, a cupcake, and cookies. Scores for each plate (0-10) were assigned by adding the score for each choice (0- unhealthy, 1-somewhat healthy, and 2- healthy.)

Population

Inclusion. Participants were (1) enrolled at the laboratory preschool, full day child-care center located on the campus of East Tennessee State University; (2) parental agreement was obtained for participation.

Exclusions. Children who were not present at both testing sessions were eliminated analysis of data in each category. There were five children with significant language barriers that were eliminated from analysis due to their inability to successfully complete the surveys. One child left the center and did not complete post-testing.

Preliminary Analyses

This phase included a convenience sample of participants, and included 51 children (23 girls, 28 boys) at East Tennessee State University's lab preschool serving the community and faculty. Children, in preschool classrooms, were two-year-olds (n=2), three-year-olds (n=24), four-year-olds (n=22), and five-year-olds (n=3) at the initiation of the study. Ages ranged from 34 months to- 61 months old during initial testing, with a mean age of 3.98 years. The majority of children were Caucasian (n=36), followed by Asian (n=7), Middle Eastern (n=5), and African American (n=3) respectively; families served by the lab school were primarily middle and upper-middle class.

Utilizing the Statistical Package for the Social Sciences (SPSS) software version 22, the following were calculated: 1) a students' paired t-tests was used in each of these measures to determine the effect of a comprehensive meal program on nutrition knowledge after a 4 month period (4 menu cycles) for each knowledge test; 2) a students' paired t-tests was used in each of these measures to determine the effect of a comprehensive meal program on nutrition beliefs after a 4-month period (4 menu cycles); 3) a students' paired t-tests was used to determine the effect of RIMT implementation on health of selected favorite foods after a 4 month period (4 menu cycles).

Age-Related Differences in Knowledge and Behavior

Related interests included understanding the relationship between age and performance on all tasks. SPSS software version 22 was used to calculate, a one-way ANOVA was to evaluate the relationship between scores among two age groups: ages 2-3.99, and those 4-years-old or greater at the time of pre-test data collection.

Results

Knowledge: Food Identification. Results indicated that the mean score (out of 10) achieved on the food identification test after four months (M = 5.70, SD = 1.75) was significantly greater than initial mean score (M = 5.09, SD = 1.58), $t(33) = 2.41$, p = .02.

Knowledge: Food Group Categorization. Results indicated that after four months, there was not a significant increase in this ability in any food group category. Individually: the mean score for categorization of fruits (out of 3) after four months (M = 2.11, SD = 1.02) was not significantly greater than initial mean score (M = 2.28, SD = 0.99), p = 1.92; the mean score for categorization of vegetables (out of 3) after four months (M = 1.94, SD = 1.02) was not significantly greater than initial mean score (M = 1.66, SD = 1.08), p = .088; the mean score for categorization of dairy (out of 3) after four months (M = 1.11, SD = 1.10) was not significantly greater than initial mean score (M = 1.51, SD = 3.68), p = .269; and the mean score for categorization of grains (out of 3) after four months (M = .94, SD = 1.08) was not significantly greater than initial mean score (M = 0.69, SD = 0.93); p = .119. While results were not significant, I was encouraged to see an improvement in both areas of vegetable categorization and grain categorization.

Identification of Healthy and Unhealthy Foods. Results indicated that after four months, there was not a significant increase in this ability, however the ability to identify unhealthy foods approached significance. Individually, the mean score for categorization of healthy foods (out of 6) after four months (M = 3.71, SD = 1.74) was not significantly greater than initial mean score (*M* = 3.94, *SD* = 1.53), *p* = .527; the mean score for categorization of unhealthy foods (out of 6) after four months (*M* = 3.11, *SD* = 2.08) was greater than initial mean score (*M* = 2.34, *SD* = 1.91), *t*(34) = 1.769, *p* = .086.

Pre- and Post-Implementation Predicted Nutrition Behavior Among Participants. The results indicated that the mean score (out of 6) achieved on the food selection test after four months (*M* = 4.44, *SD* = 1.71) was not significantly greater than initial mean score (*M* = 4.78, *SD* = 1.70), *p* = .192. Behavior did not reflect improved knowledge.

Age-Related Differences in Knowledge and Behavior. Differences among age groups were found to be non-significant for food identification, as well as the ability to identify healthy and unhealthy foods. Results were also non-significant for categorization of fruits, vegetables, and dairy foods. Among age groups however, there was a significant difference in ability to identify grain foods, *F*(1,33) = 5.592, *p* = .024, η^2 = .145. While results were not significant in all areas as hoped, there were some improvements that I saw including improved food identification, and identification of unhealthy foods that I found very encouraging. Being exposed to a variety of foods, including healthy fruits, vegetables, dairy and grains is important to widening a child's food vocabulary. Identifying which of these foods is healthy and unhealthy for the body is becoming more literate about nutrition. These are key components in understanding nutrition, and improved nutritional literacy which in turn helps to shape behaviors.

It was not surprising to note that behavior, as indicated by creating favorite plates was not improved over this short period of time. It is known that even adults fail to make good food choices based on knowledge of health benefits. When presented with foods such as grilled cheese, hot dogs, pizza and treats like cupcakes and cookies, rather than healthier options, children will be influenced by taste preference often, rather than perceived health of the foods (Neumark-Sztainer et al., 1999; Nguyen et al., 2015; Tarabashkina et al., 2016). What is important is to limit the availability of these foods, and provide a wider variety of healthy foods.

Age-related differences in cognitive development are a concern with the measurement of nutrition knowledge among young children. It is for that reason that I chose to measure knowledge among preschool-aged (3-5-years) children, rather than across all children at the preschool eating solid foods. Anecdotally, teachers among toddlers indicated acceptance of new foods in greater numbers than among preschool teachers. There were reports of increased nutrition-related play among toddlers as well as preschoolers, including table-setting, pretend play in kitchen areas, and changes in mealtime behavior for children and teachers. This would be an interesting area to research further.

Limitations

As measures were related to specific foods served at the preschool, the limitations were clear regarding the draft scale. There was a lack of psychometric evaluation of the scale. Though the design was drawn from previous literature described here, selection of photographs was somewhat arbitrary, from available electronic images, and specific to foods served with the RIMT menus. These were not necessarily generalizable, nor the exclusive property of this researcher. Another limitation was that the photos chosen for use were recognizable to the researchers, but unclear or unfamiliar to many of the children; some were consistently mistaken for other foods. For example, a photo of tortillas resembled pancakes to many children. Despite the organization of the photos into individual tasks, delivery of the measure utilizing physical laminated pictures was cumbersome and children became somewhat distracted by the handling of the photos, and overwhelmed by the number of choices. Regarding the measure of nutrition knowledge utilizing application through food group categorization, it also became obvious that the scale did not include the protein food group. Lastly, administration of the draft scale was limited to a convenience sample of children, with little diversity among participants. The process of creating and validating a scale is cyclical, as previously stated, and at this point, it was necessary to revisit the first tasks associated with developing a quality measure.

Phase II - Revising and Piloting the Scale

The limitations of phase I indicated a need to more carefully identify the purpose, objectives, target populations and conceptual framework for this tool, as outlined in research task 1. In order to do so, a more thorough review of literature was completed to identify best practice for design of the scale. Inherent in the validity of the scale was utilizing images with strong face validity.

Initial Selected Digital Photos for Testing of Quality and Ease of Identification. To address limitations regarding the property rights of digital images, and also to improve the quality of the photographs used in the future phases of scale development, this researcher, with the assistance of two students took 175 photos of healthy, somewhat healthy, and unhealthy foods, including an exhaustive list of fruits and vegetables, some grains, protein foods, dairy foods, mixed entrees, and beverages. Foods were photographed in the form thought to be most commonly served to a child. Though some, such as apples were photographed whole and cut for identification. Foods typically served cooked, such as grilled cheese and baked chicken were prepared and photographed. Examples of the photos are shown below Figure 8.

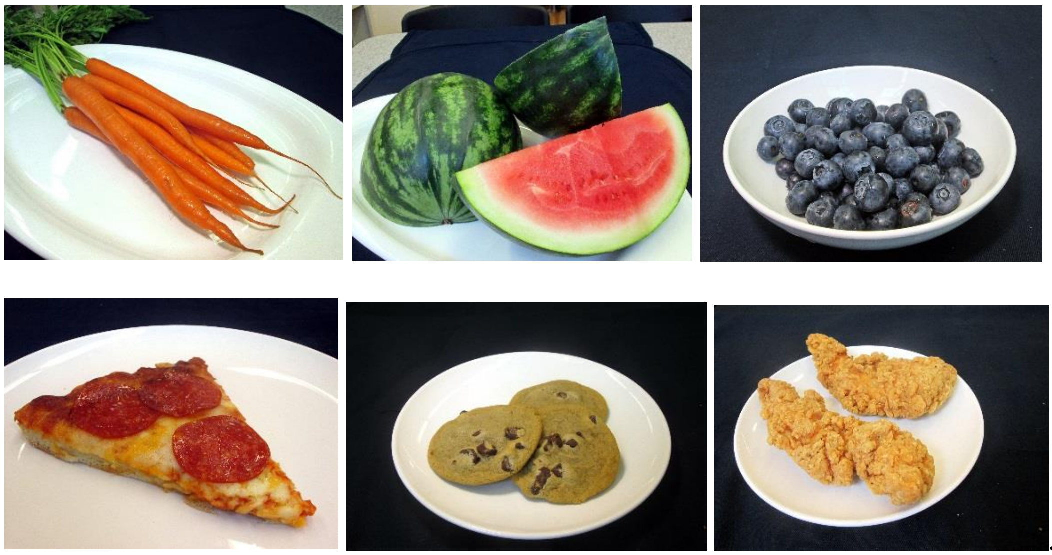

Figure 8 Examples of pictures of healthy, unhealthy, and somewhat healthy foods used in the creation of the scale.

These photos were tested among 46 preschool children (22 boys, 24 girls), across varied populations including the university laboratory preschool serving the children of community and faculty members at East Tennessee State University (n= 18), children attending the laboratory preschool, but who are also Head Start participants (n=8), an independent childcare center in the community serving primarily low-income families (n=12), and an additional laboratory preschool that serves children of students attending East Tennessee State University (n=8). Among the children were 19- 3-year-olds, 26- 4-year-olds, and 1- 5-year-old. Individually, children were shown random selections of 25 images, as determined utilizing a random list generator function in Excel 2013.Ink. Words used to describe each image were recorded, and later scored as 1- correct, and 0- incorrect. Total scores were calculated for each image, and percent correct determined based on the number of times completed (Appendix C). Several children chose to stop participating before identifying all 25 photos; scores were included for only the number they chose to complete. Of these, 29 images were eliminated related to poor quality, and of these 146 images were determined to be high quality photos, recognizable by children ages 3-5-years. These photos were used in the next phases of scale development.

Phase II- Draft of the Instrument

The fourth research task of scale development, perform content validation with resulting revision of the draft scale, was completed in this phase. Further building on the design of the first draft of the scale tested in phase I, Holub and Musher-Eizenman's methodology (2010) was again adapted, with the intent for a broader application, not specific to a group or intervention. The revised measure in phase II included questions across three areas: nutrition knowledge; nutrition beliefs; and nutrition behaviors. There were independent subscales to measure each construct: food identification; food group categorization; identification of healthy and unhealthy foods, and a behavior task. In this phase, the tool was created in digital, PowerPoint format, appropriate for presentation on an iPad or other portable tablet. The scale included the digital images of foods validated following the first phase of the study. Hinkin et al. (1997) recommend developing twice the desired number of items within each test domain, with the understanding that through the phases of psychometric evaluation, roughly half of these will be eliminated for the final scale, to ensure validity and reliability. This version of the scale included 77 items.

Population

A convenience sample was selected, with some consideration of demographic diversity, in particular, socio-economic variety of centers. Utilizing the Child Care Provider list for Washington County, TN, provided by the Department of Health and Human Services (DHHS), this researcher contacted the directors of each center serving greater than 20 preschool children, as determined by listing in alphabetical order, by phone. If the director was available to talk, I explained the purpose of the study, and asked them to consider allowing the preschool-aged children in their centers to participate in the piloting of the draft measurement. If the director was not available, a message was left with contact information. Those directors who agreed to allow their centers to participate were given a description of the protocol of the second phase of the study, and a copy of the modified Informed Consent document as approved by East Tennessee State University's Institutional Review Board. Directors were asked to provide information about the number of children between ages of 3-5 years they serve, and whether they were independently operated, a Head Start Center, or designated as another childcare entity. Directors were asked to provide information regarding participation in meal reimbursement programs, such as the USDA's Child and Adult Care Food Program (CACFP) reimbursement programs, and other nutrition related curriculum currently employed at the center. The goal of the researcher was to include a diverse population of children: 1) centers that participate in Head Start (HS) programs employing nutrition specialists and requiring regular CACFP training; 2) traditional child care centers following CACFP meal patterns for reimbursement, but who develop their own menus without the regular assistance of nutrition professionals (CACFP); and 3) independent centers that do not participate in the CACFP reimbursement program (IC). The process of including centers continued until the total number of participants was estimated to exceed 100.

Participants were 112 children (56 girls, 56 boys) of preschool ages 3 (n=32), 4 (n=46), and 5 (n=34); mean age was 4.01 years. Children included in this phase of the study were from a fairly diverse group of centers including a Head Start center (n=35), an independent, full-day, church based center (n=32), the university lab preschools (n=34) serving a blend of professors, community members, students and Head Start participants (5 of the 34 above), and a private preschool (n=11). The demographics were reflective of East Tennessee with a similar population in diversity economically as well as racially, with ~63% Caucasian (n=71), 19.6% African American (n=22), 10% Hispanic (n=12), 4.4% Asian (n=5), and 2.6% Middle Eastern (n=3). Ten of the children completed only one interaction, or half of the scale. Their data was included for analysis of data for the knowledge tasks.

Inclusion Criteria.

Centers. Centers who met the following criteria were included in the study: 1) >20 children ages 3-5 enrolled in the center; 2) provide care for more than 4 hours during the day.

Participants. Children 3-years-of-age or greater at the time of data collection, and less than 6-years-of-age at the time of data collection with signed informed consent by parent or guardian.

Exclusion Criteria.

Centers. Centers that did not meet inclusion criteria.

Participants. Children that did not meet inclusion criteria were excluded. Children who were not developmentally appropriate due to a developmental disorder were excluded from data analysis.

Measures

Randomization of items was addressed at this stage of scale development. Due to the large number of available images, and hundreds of possible combinations of pictures for items within the scale, it was unrealistic to build a tool that could be randomized during administration for this project. Instead, 6 versions of the 77-item scale were created, with images randomly assigned within each subscale from the total pool appropriate for that item. Random number generator props (dice and playing cards) were utilized for each of the subscales. Exceptions occurred when duplicates pairs arose or if two items were similar (such as two types of bean) for the same category. In these cases, a random number was generated to determine the new food. Finally, when appropriate, child-determined quality digital images of nutritionally equivalent foods were substituted (ex: spaghetti noodles were included instead of rotini pasta, kidney beans were substituted for black beans, and blueberries were included instead of raspberries) to align with the foods included in the USDA's education materials, such as the Discover MyPlate emergent reader mini books, designed to teach food groups to young children. These included: apples, blackberries, bananas, watermelon, strawberries, kiwi, grapes, oranges, cherries, carrots, broccoli, snow peas, raw spinach, kidney beans, spaghetti noodles, wheat sandwich bread, cheerios, brown rice, popcorn, graham crackers, baked chicken leg, ham, boiled egg, almonds, cottage cheese, cubed cheddar cheese, milk and yogurt. These substitutions will allow the scale to be utilized in later interventions for further reliability and validity testing. These 6 versions of the scale were created in PowerPoint format for administration on iPad, or tablet technology, but also to allow for computer administration as needed.

Nutrition Knowledge: Food Identification. Twenty randomized pictures of foods were included for identification. Foods included real-life images of foods across food groups including 4 fruits, 4 vegetables, 4 dairy foods, 4 grain foods, and 4 protein foods. Children were asked to name the food in the picture.

Nutrition Knowledge: Food Group Categorization. Combinations of two foods, including one correct, and one incorrect choice were selected for a forced-choice format. One randomized image reflected the target food group (fruit, vegetable, protein, dairy, and grain), and a second randomized image did not reflect the target food group. There were 7 pictures from each food target group included, for a total of 35 items. Foods were offered in equal numbers for each category.

Nutrition Beliefs: Healthy/Unhealthy. A forced-choice approach was utilized. Combinations of two randomized pictures of typical foods and mixed entrees were included. Only one food fit the target category (healthy or unhealthy). The scale included 10 opportunities to identify a target healthy food and 10 opportunities to identify a target unhealthy food for a total of 20 items.

Predicted Behavior. Measuring behavior through observations is not always feasible. Research indicates that food preference has been highly correlated to behavior in young children (Birch, 1979; Contento et al., 2002). Because actual consumption of foods was not practical for this research, food preference was chosen as a predicted behavior item for the scale. For the final 2 items of the scale, 15 digital images of foods, including equal selections of healthy and unhealthy foods from various food groups and mixed entrees, were included on a slide. The task was to create a favorite meal by selection of the four foods most desired for the target meal. Breakfast selections were included in two versions of the scale, 2 versions included lunch selections, and 2 versions included snack selections. A selection of beverages were included on a final slide, to determine a preferred drink.

Procedures

Due to the length of the scale, children with parental informed consent to participate in the study were administered the draft version of the scale in two individual interview sessions, in the classroom setting. The teacher chose each child who was not engaged in activity, and asked if they would like to 'play a game' for a few minutes with researchers. Sessions were approximately 5-10 minutes each, and took place in a quiet spot in the classroom, away from the other children. The first half of the scale including Food Identification and Food Group Categorization were completed during the first interaction, and the Healthy/Unhealthy Classification, and preference tasks were completed during the second interaction. The study was administered by the primary researcher, and a graduate student assistant. Researchers introduced themselves and said "We are going to show you pictures of foods and ask you some questions about the foods. Is this okay?" If the child agreed to go on, the following procedures were followed. If not, the child returned to their usual activities in the classroom.

To begin, each child was given a six-sided die, and asked to roll it to determine which of the 6 versions they would complete. Of the 112 children, 17 completed version 1; 25 completed version 2; 20 completed version 3; 16 completed version 4; 14 completed version 5; 20 completed version 6.

Nutrition Knowledge: Food Identification. The researcher showed the child 20 pictures, one at a time, and prompted to 'tell me what this food is.' Responses were recorded as 1- correct, and 0- incorrect on the answer sheet. The researcher recorded any incorrect word/words provided, and if child stated that they did not know.

Nutrition Knowledge: Food Group Categorization. Utilizing a forced-choice approach, children were shown combinations of two foods, including one correct, and one incorrect choice, and asked to point to the one picture that represented the target food group (fruit, vegetable, protein, dairy, and grain). For example: if the prompt was 'point to the fruit' there may have been a picture of an apple and a glass of milk. There were 7 target foods from each food group included, and participants were shown random combinations for a total of 35 questions. Foods were offered in equal total numbers for each category. Answers sheets included both foods, and the researcher recorded the selection. These were scored (1-correct, and 0-incorrect).

Nutrition Beliefs: Healthy/Unhealthy. Utilizing a forced-choice approach, each child was offered combinations of two pictures of typical foods and mixed entrees. Children were asked to identify the target healthy or unhealthy food. Only one food fit the category in question (for example: if the prompt was 'point to the food that is healthy' there may have been a picture of French fries and a piece of fruit.) These foods have previously been determined to be healthy, and unhealthy by a panel of nutrition experts. An effort was made to exclude foods deemed somewhat healthy by nutrition professionals included in this stage of assessment to decrease ambiguity. Answers were assigned scores 1- correct and 0- incorrect. Children were offered 10 opportunities to identify the target healthy food and 10 opportunities to identify the target unhealthy food for a total of 20 items.

Predicted Behavior. Children were shown a screen of 15 digital images of foods, including equal selections of healthy and unhealthy foods from various food groups, including proteins, vegetables, fruits, grains, mixed entrees, beverages, and desserts, and asked to create a plate or meal by "choosing the four foods they would choose for the target meal, and recorded in order of selection. Breakfast selections were included in two versions of the scale, 2 included lunch selections, and 2 included snack selections. Choices were recorded and scored according to predetermined degrees of health (0-unhealthy, 1-somewhat healthy, 2-healthy) for ten possible points. Participants were then shown a slide including 8 beverages, also with varying degrees of health. One choice was requested for their beverage. Choices were scored (0-unhealthy, 1-somewhat healthy, 2-healthy) for 2 possible points.

All children in the classroom were given stickers after each interaction, even if they chose not to participate, or chose to stop before the scale was completed. Children without informed consent were also given stickers.

Phase III: Draft III

Phase II allowed this researcher to revisit research tasks 1-4, more carefully identifying the purpose, objectives, target populations and conceptual framework for this tool based on the existing literature, through a revision, designing a scale appropriate for use in this population, and testing validity of the revision. Pilot-testing was completed in 112 children of preschool age. Statistical analysis allowed this researcher to determine the validity of the pool of items among subscales, and to revise the draft scales to create one 45-item version to pilot test in Phase III among preschool children. This phase contributed to the completion of research tasks 5 and 6, further determination of the validity of the scale, with a resulting revision.

Population

Utilizing the same Child Care Provider list for Washington County, TN, this researcher contacted the directors of each center, not previously included in the study, serving greater than 20 preschool children, as determined by listing in alphabetical order, by phone, and explained the purpose of the study, and asked them to consider allowing the preschool children in their centers to participate in the piloting of the final draft of the scale. Those who agreed to participate were given a description of the protocol of the phase of the study, and a copy of both the letter to parents and the modified Informed Consent document as approved by East Tennessee State

University's Institutional Review Board.   Directors were asked to provide information about the number of children between ages of 3-5 years they serve, and whether they were independently operated, a Head Start Center, or designated as another childcare entity. Directors were asked to provide information regarding participation in meal reimbursement programs, such as the USDA's Child and Adult Care Food Program (CACFP) reimbursement programs, and other nutrition related curriculum currently employed at the center.   The goal of the researcher was to include a diverse population of children: 1) centers that participate in Head Start (HS) programs employing nutrition specialists and requiring regular CACFP training; 2) traditional child care centers following CACFP meal patterns for reimbursement, but who develop their own menus without the regular assistance of nutrition professionals (CACFP); and 3) independent centers that do not participate in the CACFP reimbursement program (IC). The process of including centers continued until the total number of participants was estimated to exceed 50.

Participants included 54 children (30 girls, 24 boys), ages 3 (n=13), 4 (n=15), 5 (n=23), and 6 (n=3), with a mean age of 4.3 years, who attended a school-based summer pre-kindergarten program without a meal provided (n=13) and two childcare centers serving area hospitals (n=41), both providing meals, and utilizing CACFP reimbursement for a some, but not all children enrolled in their center. Of the children, 51 were Caucasian, 2 African American, and one of Middle Eastern descent. Two children, 5 year-old twins with diagnosed developmental disabilities participated in data collection, and while they completed tasks with assistance, their scores were eliminated from data analysis as their true developmental age was not determined. It was stated that they performed at the ability level of a typical 3 year-old. Interestingly, there was also a set of boy-girl, 5-year-old twins included. The female twin scored 14 points higher (out of 67 possible points) than her male twin brother.

Inclusion Criteria.

Centers. Centers met the following criteria to be included in the study: 1) >20 children ages 3-5 enrolled in the center; 2) provide care for more than 4 hours during the day.

Participants. Children 3-years-of-age or greater at the time of data collection, and less than 6-years-of-age at the time of data collection with signed informed consent by parent or guardian.

Exclusion Criteria.

Centers. Centers that did not meet inclusion criteria.

Participants. Children that did not meet inclusion criteria were excluded. Children who were not developmentally appropriate due to a developmental disorder were excluded from data analysis.

Measures

Based on analysis results from Phase II, items were selected for inclusion in the final draft of the scale, to measure nutrition knowledge, beliefs, and behaviors (Appendix D).

Nutrition Knowledge: Food Identification. Ten pictures of foods were included for identification based on results from analysis in Phase II. Foods included real-life images of foods including yogurt, bacon, blueberries, chocolate ice cream, corn, peppers, French fries, kidney beans, spaghetti noodles, and shrimp.

Nutrition Knowledge: Food Group Categorization. Combinations of two foods, including one correct, and one incorrect choice were selected for a forced-choice format. One randomized image reflected the target food group (fruit, vegetable, protein, dairy, and grain), and a second randomized image did not reflect the target food group. There were 4 pictures from each food target group included, with the exception of proteins where a fifth, non-animal protein was included, for a total of 21 items.

Nutrition Beliefs: Healthy/Unhealthy. A forced-choice approach was utilized. Combinations of two randomized pictures of typical foods and mixed entrees were included. Only one food fit the target category (healthy or unhealthy). The scale included 5 opportunities to identify a target healthy food and 5 opportunities to identify a target unhealthy food for a total of 10 items.

Predicted Behavior. For the final scale, 15 digital images of foods, including equal selections of healthy and unhealthy foods from various food groups and mixed entrees appropriate for breakfast, lunch or snack were included on 3 separate slides. The tasks were to create plates to be eaten, by selection of the four foods most desired for the target meal or snack. A selection of beverages were included on a final slide, to determine a preferred drink.

Procedures

Children with parental informed consent to participate in the study were administered the final version of the scale in an individual interview session on one occasion, in the classroom setting. The teacher chose each child who was not engaged in activity, and asked if they would like to 'play a game' for a few minutes with researchers. Sessions were approximately 5-10 minutes each, and took place in a quiet spot in the classroom, away from the other children. The study was administered by the primary researcher, and a graduate student assistant. Researchers introduced themselves and said "We are going to show you pictures of foods and ask you some questions about the foods. Is this okay?" If the child agreed to go on, the following procedures were followed. If not, the child returned to their usual activities in the classroom. All children in the classroom were given stickers when the scale was completed, even if they did not participate, or chose to stop before the scale was completed.

Nutrition Knowledge: Food Identification. The researcher showed the child 10 pictures, one at a time, and prompted to 'tell me what this food is.' Responses were recorded as 1- correct, and 0- incorrect on the answer sheet (Appendix E). The researcher recorded any incorrect word/words provided, and if child stated that they did not know.

Nutrition Knowledge: Food Group Categorization. Utilizing a forced-choice approach, children were shown combinations of two foods, including one correct, and one incorrect choice, and asked to point to the one picture that represented the target food group (fruit, vegetable, protein, dairy, and grain). For example: if the prompt was 'point to the fruit' there may have been a picture of an apple and a glass of milk. There were 4 target foods from each food group (fruit, vegetable, grain, dairy), and 5 from the protein group to include at least one vegetable protein source for a total of 21 items. Answers were scored (1-correct, and 0-incorrect).

Nutrition Beliefs: Healthy/Unhealthy. Utilizing a forced-choice approach, each child was offered combinations of two pictures of typical foods and mixed entrees. Children were asked to identify the target healthy or unhealthy food. Only one food fit the category in question (for example: if the prompt was 'point to the food that is healthy' there may have been a picture of French fries and a piece of fruit.) Children were offered 5 opportunities to identify the target healthy food and 5 opportunities to identify the target unhealthy food for a total of 10 items. Answers were scored scores 1- correct and 0- incorrect.

Predicted Behavior. Children were shown a screen of 15 digital images of foods, including equal selections of healthy and unhealthy foods from various food groups, including proteins, vegetables, fruits, grains, mixed entrees, beverages, and desserts, and asked to create a plate or meal by pointing to the four foods they would choose for the target meal or snack, and recorded in order of selection. Selections for breakfast, lunch or snack were included on 3 separate slides. A selection of beverages were included on a final slide, to determine a preferred drink. Choices were recorded and scored according to predetermined degrees of health (0-unhealthy, 1-somewhat healthy, 2-healthy) for ten possible points on each food task. One choice was requested for their beverage. Choices were scored (0-unhealthy, 1-somewhat healthy, 2-healthy) for 2 possible points.

Phase IV- Go, Slow, and Whoa

Similar to the initial findings of Sigman-Grant et al. (2014), this researcher noticed in pilot testing that children were often categorizing their preferred foods as healthy foods, rather than considering the health benefits of that particular food; this seemed to improve with age. As a result, alternate approaches were considered for the scale to better measure applied knowledge about foods, and to decrease confusion. Previous efforts indicated that adaptations of the Traffic-Light diet were effective measures of applied nutrition knowledge in young children (Epstein et al., 1998; Epstein et al., 2002; Epstein & Squires, 1988; Graziano, 2015; Sigman-Grant et al., 2014). With this in mind, each of the 74 images of foods and beverages included in the final scale draft were classified as Go (Green), Slow (Yellow), or Whoa (Red) foods according to established guidelines (Appendix F). This subscale was then presented to preschool children in an attempt to determine which approach, healthy versus unhealthy, or Go, Slow, Whoa would be more reliable and valid in this population as measured by Cronbach's α, corrected ITC, and Cronbach's α if the item were deleted.

Population

Utilizing the same Child Care Provider list for Washington County, TN, this researcher contacted the directors of each center, not previously included in the study, serving greater than 20 preschool children, as determined by listing in alphabetical order, by phone, and explained the purpose of the study, and asked them to consider allowing the preschool children in their centers to participate in the piloting of the Go, Slow, Whoa portion of the scale. Those who agreed to participate were given a description of the protocol of the phase of the study, and a copy of both the letter to parents and the modified Informed Consent document as approved by East Tennessee State University's Institutional Review Board. Directors were asked to provide information about the number of children between ages of 3-5 years they serve, and whether they were independently operated, a Head Start Center, or designated as another childcare entity. Directors were asked to provide information regarding participation in meal reimbursement programs, such as the USDA's Child and Adult Care Food Program (CACFP) reimbursement programs, and other nutrition related curriculum currently employed at the center.

The adapted Go, Slow, Whoa subscale was administered to 35 preschool children (16 girls, 19 boys) from a university based lab preschool (n=30), and a school-based summer preschool program (n=5) who had previously agreed to participate as needed. Informed consent was obtained from parents prior to initiation of the study. Participants included three year-olds (n= 3), four year-olds (n=23), and five year-olds (n= 9), with a mean age of 4.17 years. Of the children, 26 were Caucasian, 5 African American, 1 Hispanic, and 1 Asian. One 5 year-old, and two 3 year-olds failed to completed the tasks and their scores were eliminated from analysis. The majority of children were Caucasian (n=24), followed by African American (n=5), Middle Eastern (n=2), Asian (n=1) and Hispanic (n=1) respectively. One set of twin boys, age 4, participated. Two participants are engaged in the Head Start program that is blended with the university lab preschool.

Procedures

Children with parental informed consent to participate in the study were administered the adapted Go, Slow, Whoa scale in an individual interview session on one occasion, in the classroom setting. The teacher chose each child who was not engaged in activity, and asked if they would like to 'play a game' for a few minutes with researchers. Sessions were approximately 5-10 minutes each, and took place in a quiet spot in the classroom, away from the other children. The study was administered by the primary researcher. The researcher introduced herself and said "I am going to show you pictures of foods and ask you some questions about the foods. Is this okay?" If the child agreed to go on, the following procedures were followed. If not, the child returned to their usual activities in the classroom. All children in the classroom were given stickers when the scale was completed, even if they did not participate, or chose to stop before the scale was completed.

Children were given a brief description of the Traffic Light Diet, with descriptions of GO foods "These are very healthy foods and drinks. They are lowest in fat and sugar. They can be eaten any time; they are good for your body, five you energy, and help you grow big and strong;" SLOW foods "These foods and drinks may have some fat or some sugar. These foods are not as healthy as GO foods, but they are better for you than WHOA foods. They should not be eaten every day;" and WHOA foods "These foods and drinks are sugary, or high in fat, including fried foods. These foods should be eaten only once in a while." Utilizing an iPad, children were shown images of 74 foods, each with a picture of a stoplight and the question "GO, SLOW, or WHOA?" asked of them (Appendix F). Answers were recorded and scored with degrees of accuracy based on initial assignment of the health of the food (0-incorrect, 1-somewhat correct, 2-correct) by a nutrition professional (Appendix G). For example: if a child was asked to identify bacon as GO, SLOW, or WHOA, and they said "go" the answer would be assigned a score of 0, but if they said "slow" the answer was assigned a score of 1 as somewhat correct. All items were included for analysis.

CHAPTER 4

RESULTS

This study was designed to create a scale including valid and reliable measures of nutrition knowledge, beliefs, and behaviors among preschool children. Scale development is a complex and multi-staged process, and items were piloted and revised in several phases. Phase I, carried out during a related research study, and included 51 children, 23 girls, and 28 boys, ages 2-5. Results were previously discussed in the methodology section of this report. Results of phases II-IV, which included revisions and piloting to develop the final scale, will be discussed here. These iterations were administered to 252 preschool children. Of these participants, 125 were girls and 128 were boys; ages 2 (n=2), 3 (n=74), 4 (n=104), 5 (n=67), and 6 (n=3), with a mean age of 3.95 years.

Phase II Analysis

In Phase II, statistical analysis was limited to determinants of item discrimination and item consistency. Utilizing IBM SPSS Statistics Version 22, for each of the 6 versions of the scale, Cronbach's α was calculated for each subscale, excluding the behavior subscale (Table 1).

Table 1

Cronbach's Alpha for Versions within Knowledge and Behavior Constructs

Cronbach's Alpha	Version 1	Version 2	Version 3	Version 4	Version 5	Version 6
Food Identification	0.091	0.609	0.505	0.632	0.434	0.263
Food Group Categories	0.238	0.65	0.393	0.664	0.362	0.677
Healthy vs Unhealthy	0.546	0.355	0.064	0.662	0.684	0.582

Versions were then ranked from highest to lowest in each subscale for selection of items based on item-total correlation. Within each subscale, item-total correlation (ITC) was calculated for each item (450 total items), indicating the correlation between the item and the overall score of that subscale, determining its reliability and relative importance. Alpha was identified with each item deleted to determine which contributed to the overall validity of the subscale versus which items detracted from the validity, and also to see which items resulted in the most variation. Items were reviewed in each version with the highest Cronbach α scores, within each subscale in order of ranking, until the appropriate number of items for the final scale was reached. Items with corrected scores that improved in relation to the overall alpha were eliminated to improve the reliability and validity of the scale. Further, items with an ITC score >0.30, with the majority >0.40, were considered good or very good measures, and reviewed for inclusion in the final scale. Other considerations included variety of items, with repetitive items eliminated. Final items chosen with respective corrected scores and ITC are listed below (Table 2). These items were included in the draft scale for pilot-testing in Phase III of this research.

Table 2

Item-Total Correlations and Corrected Cronbach's Alpha of Selected Items

	Item	Cronbach's Alpha if Item Deleted	Item-Total Correlation
Food Identification- 10 items			
Version 4 CA: 0.632	Yogurt	0.571	0.591
	Bacon	0.573	0.526
	Blueberries	0.579	0.513
	Chocolate ice cream	0.59	0.45
	Peppers	0.601	0.369
Version 2 CA: 0.609	French fries	0.582	0.365
	Corn	0.578	0.337
Version3 CA: 0.505	Kidney beans	0.371	0.705
	Spaghetti noodles	0.443	0.421
	Shrimp	0.441	0.397
Food Group Categories- 21 items			
Grains			
Version 6 CA: .677	Oatmeal and pears	0.619	0.75
	Pears and wheat pasta	0.647	0.46
Version 4 CA: 0.664	Popcorn and Lemonade	0.631	0.478
Version 2 CA: 0.650	Green beans and wheat bread	0.609	0.544

Table 2 continued

Dairy			
Version 6 CA: .677	Green beans and Gogurt	0.634	0.603
	Grapes and string cheese	0.641	0.522
Version 4 CA: 0.664	Yogurt and Cheerios	0.62	0.626
	Cottage cheese and lettuce	0.626	0.555
Protein			
Version 6 CA: .677	Ham and baked potato	0.658	0.352
Version 4 CA: 0.664	Almonds and white rice	0.612	0.698
Version 2 CA: 0.650	Kidney beans and cookies	0.606	0.570
Version 5 CA: 0.362	Sausage patties and oranges	0.17	0.813
	Chicken leg and kiwi	0..216	0.647
Fruit			
Version 4 CA: 0.664	Pop Tart and pears	0.642	0.402
Version 2 CA: 0.650	Watermelon and peppers	0.619	0.47
	Kiwi and sweet potato	0.631	0.361
	Popcorn and Mandarin oranges	0.634	0.345
Vegetable			
Version 4 CA: 0.664	Asparagus and applesauce	0.638	0.438
	Cabbage and salmon	0.643	0.43
Version 2 CA: 0.650	Potato chips and graham crackers	0.626	0.411
	Gogurt and broccoli	0.638	0.306
Healthy Vs Unhealthy Choice- 10 items			
Unhealthy			
Version 5 CA: 0.684	Gogurt and sausage biscuit	0.653	0.439
Version 4 CA: 0.662	Corn dog and cantaloupe	0.635	0.367
	Buttery crackers and sweet potato	0.59	0.727
Version 6 CA: 0.582	Carrots and Doritos	0.518	0.55
	French fries and yogurt	0.531	0.439
Healthy			
Version 5 CA: 0.684	Milk and Sprite	0.634	0.619
Version 4 CA: 0.662	Fruit loops and cherries	0.617	0.515
	Chocolate ice cream and beans	0.62	0.507
Version 5 CA: 0.582	Applesauce and tater tots	0.533	0.418
Version 1 CA: 0.546	Potato chips and carrots	0.444	0.645

Phase III Analysis

In Phase III, the draft scale was piloted to further determine validity. As this draft scale was initially considered a final version, in addition to item discrimination and internal consistency determinants, age- and gender-related differences in performance were considered.

Initially, Cronbach's α was considered for the total scale, and then determined for each subscale's ability to measure its underlying construct. Utilizing IBM SPSS Statistics Version 22, Cronbach's α was calculated for each subscale, excluding the behavior subscale. Within each subscale, item-total correlation (ITC) was calculated for each item, excluding behavior tasks (41 total items), indicating the correlation between the item and the overall score of that subscale, determining its reliability and relative importance. Alpha was identified with each item deleted to determine which contributed to the overall validity of the scale, which items detracted from the validity, and which items resulted in the greatest variation.

Total Draft Scale

Cronbach's α for the total scale with predicted behavior excluded was .775. Corrected Cronbach's α with the item deleted, and corrected ITC were calculated for each item of the scale (Table 3). Among food identification questions, one item's corrected Cronbach's α score improved with the item deleted*: FID2: bacon. One food group categorization item (FGC14): fruit- popcorn versus Mandarin oranges with fruit as the target had zero variance and was removed through SPSS analysis from the scale. Other items with an improved corrected Cronbach's α with item deleted included (highest to lowest)*: FGC12: protein- almonds and rice; FGC13: protein- oranges and sausage; FGC3: grain- green beans and wheat bread; FGC1: grain- oatmeal and pears. Among the food beliefs-healthy versus unhealthy tasks, one item's corrected

Cronbach's α score improved with the item deleted*: HVU2: Gogurt vs sausage biscuit with unhealthy as the target.

Table 3

Item-Total Correlations and Corrected Cronbach's Alpha: Preschool Nutrition Knowledge and Attitudes Scale

Item Number		Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
FID1	Yogurt	.217	.772
FID2*	Bacon	-.051	.780
FID3	Blueberries	.359	.769
FID4	Chocolate ice cream	.258	.770
FID5	Corn on cob	.193	.773
FID6	Peppers	.488	.759
FID7	French fries	.057	.775
FID8	Kidney beans	.311	.768
FID9	Spaghetti noodles	.103	.774
FID10	Shrimp	.452	.761
FGC1*	Grain- Oatmeal vs Pears	.132	.776
FGC2	Grain- Popcorn vs Lemonade	.291	.768
FGC3*	Grain- Green beans vs Wheat Bread	.091	.778
FGC4	Grain- Pears vs Wheat Pasta	.164	.774
FGC5	Dairy- Green beans vs Gogurt	.274	.770
FGC6	Dairy- Grapes vs string cheese	.156	.774
FGC7	Dairy- Cheerios vs yogurt	.272	.769
FGC8	Dairy- Cottage cheese vs lettuce	.278	.769

Table 3 continued

FGC9	Protein- Ham vs Potato	.249	.770
FGC10	Protein- Kidney beans vs cookies	.443	.762
FGC11	Protein- Kiwi vs baked chicken leg	.251	.770
FGC12*	Protein- Almonds vs rice	.022	.781
FGC13*	Protein- Orange vs Sausage	.041	.780
FGC14	Fruit- Popcorn vs Mandarin Oranges	Zero variance- removed from scale	
FGC15	Fruit- Pears vs Pop Tarts	.392	.766
FGC16	Fruit- Watermelon vs peppers	.468	.764
FGC17	Fruit- Kiwi vs sweet potato	.417	.764
FGC18	Vegetable- Asparagus vs applesauce	.191	.773
FGC19	Vegetable- Cabbage vs salmon	.455	.765
FGC20	Vegetable- Potato chips vs graham crackers	.344	.766
FGC21	Gogurt vs broccoli	.326	.768
HVU1	Corn dog vs cantaloupe	.197	.773
HVU2*	Gogurt vs. sausage biscuit	.021	.781
HVU3	Butter crackers vs sweet potato	.301	.768
HVU4	Carrots vs Doritos	.375	.765
HVU5	French fries vs yogurt	.158	.774
HVU6	Sprite vs milk	.273	.770
HVU7	Tater tots vs applesauce	.328	.766
HVU8	Fruit Loops vs cherries	.260	.770
HVU9	Kidney beans vs chocolate ice cream	.407	.763
HVU10	Potato chips vs carrots	.335	.767

Subscale: Food Identification

Cronbach's α for the food identification subscale was .642. Corrected Cronbach's α with item deleted, and corrected ITC were calculated for each item of the subscale (Table 4). Among food identification tasks, two items' corrected Cronbach's α scores improved with the item deleted (greatest to least improved)*: FID2: bacon, and FID5: corn on cob.

Table 4

Item-Total Correlations and Corrected Cronbach's Alpha: Food Identification Subscale

Item Number		Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
FID1	Yogurt	.355	.607
FID2*	Bacon	.059	.663
FID3	Blueberries	.411	.606
FID4	Chocolate ice cream	.259	.627
FID5*	Corn on cob	.193	.646
FID6	Peppers	.466	.576
FID7	French fries	.327	.618
FID8	Kidney beans	.371	.603
FID9	Spaghetti noodles	.285	.624
FID10	Shrimp	.433	.585

Subscale: Food Group Categorization

Cronbach's α for the food group categorization subscale was .644. Corrected Cronbach's α with item deleted, and corrected ITC were calculated for each item of the subscale (Table 5). Among food group classification tasks, four items' corrected Cronbach's α scores improved with the item deleted (greatest to least improved)*: FGC12: protein- almonds vs rice; FGC3: grain-green beans vs wheat bread; FGC13: protein- orange vs sausage; FGC18: vegetable- asparagus vs applesauce.

Table 5

Item-Total Correlations and Corrected Cronbach's Alpha: Food Group Categorization

Item Number		Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
FGC1	Grain- Oatmeal vs Pears	.270	.627
FGC2	Grain- Popcorn vs Lemonade	.300	.623
FGC3*	Grain- Green beans vs Wheat Bread	.057	.656
FGC4	Grain- Pears vs Wheat Pasta	.303	.623
FGC5	Dairy- Green beans vs Gogurt	.276	.630
FGC6	Dairy- Grapes vs string cheese	.162	.642
FGC7	Dairy- Cheerios vs yogurt	.164	.640
FGC8	Dairy- Cottage cheese vs lettuce	.332	.619
FGC9	Protein- Ham vs Potato	.249	.630
FGC10	Protein- Kidney beans vs cookies	.335	.619
FGC11	Protein- Kiwi vs baked chicken leg	.345	.617
FGC12*	Protein- Almonds vs rice	.-.042	.669
FGC13*	Protein- Orange vs Sausage	.076	.654
FGC14	Fruit- Popcorn vs Mandarin Oranges	.187	.640
FGC15	Fruit- Pears vs Pop Tarts	.410	.615
FGC16	Fruit- Watermelon vs peppers	.369	.622
FGC17	Fruit- Kiwi vs sweet potato	.335	.622
FGC18*	Vegetable- Asparagus vs applesauce	.035	.647
FGC19	Vegetable- Cabbage vs salmon	.369	.622
FGC20	Vegetable- Potato chips vs graham crackers	.198	.636
FGC21	Vegetable- Gogurt vs broccoli	.254	.632

Subscale: Food Beliefs, Healthy versus Unhealthy

Cronbach's α for the food beliefs subscale was .576. Corrected Cronbach's α with item deleted, and corrected ITC were calculated for each item of the subscale (Table 6). Among healthy versus unhealthy classification tasks, one item's corrected Cronbach's α scores improved with the item deleted*: HVU2: Gogurt vs sausage biscuit.

Table 6

Item-Total Correlations and Corrected Cronbach's Alpha: Nutrition Beliefs-Healthy vs Unhealthy

Item Number		Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
HVU1	Corn dog vs cantaloupe	.385	.518
HVU2*	Gogurt vs. sausage biscuit	-.024	.624
HVU3	Butter crackers vs sweet potato	.330	.529
HVU4	Carrots vs Doritos	.485	.494
HVU5	French fries vs yogurt	.235	.556
HVU6	Sprite vs milk	.201	.563
HVU7	Tater tots vs applesauce	.209	.563
HVU8	Fruit Loops vs cherries	.235	.556
HVU9	Kidney beans vs chocolate ice cream	.241	.554
HVU10	Potato chips vs carrots	.359	.525

Age- and Gender-Related Differences

Mean scores for each subscale, and total score of all subscales were calculated, eliminating scores for those participants who did not finish all tasks. The mean score for food identification was 6.629 out of a possible 10 points, with a standard deviation of 1.983; the mean score for food group categorization tasks was 14.81 out of a possible 21 points, with a standard deviation of 3.156; the mean score for healthy versus unhealthy classification tasks was 6.446 out of a possible 10 points, and the standard deviation was 1.976. The mean total score across participants for all three subscales was 27.885 out of a possible 41 points. For predicted behavior, the mean total score on meals, snacks and beverage selections was 13.076 out of a possible 26 points. Utilizing IBM SPSS Statistics Version 22, a 4 X 2 analysis of variance was conducted to determine if there was a relationship between age and gender and nutrition knowledge, beliefs, and predicted behavior between groups, as measured by total score on the final scale draft. The means and standard deviations for total scale score as a function of the two factors are presented in Table 8. The ANOVA indicated no significant interaction between age and gender, $F(2,43) = 1.828$, $p = .173$, partial $\eta^2 = .078$, and no effect of gender on performance $F(1,43) = .240$, $p = .627$, partial $\eta^2 = .006$. However, there were significant main effects for age, $F(3, 43) = 6.183$, $p = .001$, partial $\eta^2 = .301$. The strength of the relationship between age and performance on the scale, as assessed by η^2, was strong, with age accounting for 30% of the variance in performance on the scale. Post-hoc tests were conducted to evaluate pairwise differences among the means. Results indicated that there was a significant difference between the overall performance of children ages 3 and 5, but not between other age groups (3, 4, 5, and 6 included).

Table 7

Means and Standard Deviations for Scale Scores

Age	Gender	Mean	SD	N
3.00	Male	24.200	3.033	5
	Female	22.667	5.163	6
	Total	23.3636	4.20	11
4.00	Male	29.00	2.738	5
	Female	28.400	4.376	10
	Total	28.600	3.812	15
5.00	Male	28.454	5.922	11
	Female	32.700	3.020	10
	Total	30.476	5.134	21
6.00	Female	32.000	7.937	3
	Total	32.000	7.937	3
Total	Male	27.5714	4.965	21
	Female	29.069	5.737	29
	Total	28.440	5.425	50

Phase IV Analysis

Subscale: GO, SLOW, WHOA

In Phase IV, the GO, SLOW, WHOA adaptation of the beliefs subscale was piloted to determine validity. Utilizing IBM SPSS Statistics Version 22, Cronbach's α was calculated for the subscale. Item-total correlation (ITC) was calculated for each item (74 total items) indicating the correlation between the item and the overall score of that subscale, determining its reliability and relative importance. Alpha was identified with each item deleted to determine which contributed to the overall validity of the scale versus which items detracted from the validity, and also to see which items resulted in the most variation.

Cronbach's α for the food beliefs subscale was .924. Corrected Cronbach's α with item deleted, and corrected ITC are displayed below (Table 7). Among GO, SLOW, WHOA classification tasks, seven items' corrected Cronbach's α scores improved with the item deleted*: yogurt, blueberries, shrimp, cherries, cantaloupe, Cheerios, and sausage patties. Based on the strength of the analysis in phase IV in comparison to the limitations of the Healthy vs Unhealthy version of the beliefs subscale, it was decided that 25 of the 74 items from the GO, SLOW, WHOA subscale would be included in the final draft of the scale. With that in mind, items with corrected scores that improved in relation to the overall alpha were eliminated to improve the reliability and validity of the scale. Further, items with an ITC score >0.30, with the majority >0.40 were considered good or very good measures, and reviewed for inclusion in the final scale. Attempts were made to include similar numbers of items from each food group, as well as to avoid similar items were made (ex: cabbage and lettuce were similar). The decision table is included in Appendix H.

Table 8

Item-Total Correlations and Corrected Cronbach's Alpha: Go, Slow, Whoa

Item Number		Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
GSW1*	Yogurt	-.175	.927
GSW2	Bacon	.292	.923
GSW3*	Blueberries	-.056	.925
GSW4	Chocolate ice cream	.571	.921

Table 8 continued

GSW5	Corn	.224	.924
GSW6	Peppers	.246	.924
GSW7	French fries	.184	.924
GSW8	Kidney beans	.326	.923
GSW9	Spaghetti noodles	.067	.924
GSW10*	Shrimp	-.028	.925
GSW11	Tater Tots	.121	.924
GSW12	Applesauce	.135	.924
GSW13	Fruit Loops	.379	.923
GSW14*	Cherries	.088	.925
GSW15	Potato Chips	.334	.923
GSW16	Carrots	.214	.923
GSW17	Corn Dog	.291	.923
GSW18*	Cantaloupe	-.018	.925
GSW19	Gogurt	.182	.924
GSW20	Biscuit	.260	.923
GSW21	Butter crackers	.281	.923
GSW22	Sweet potato	.199	.924
GSW23	Doritos	.341	.923
GSW24	French fries	.388	.923
GSW25	Popcorn	.544	.922
GSW26	Mandarin oranges	.225	.923
GSW27	Pears	.650	.921
GSW28	Pop Tarts	.412	.922
GSW29	Watermelon	.385	.923

Table 8 continued

GSW30	Kiwi	.595	.921
GSW31	Asparagus	.650	.921
GSW32	Cabbage	.699	.920
GSW33	Salmon	.453	.922
GSW34	Graham crackers	.544	.922
GSW35	Broccoli	.639	.921
GSW36	Green beans	.671	.921
GSW37	Grapes	.568	.921
GSW38	String cheese	.356	.923
GSW39*	Cheerios	.023	.925
GSW40	Cottage cheese	.662	.921
GSW41	Lettuce	.675	.921
GSW42	Ham	.295	.923
GSW43	Baked potato	.591	.921
GSW44	Cookies	.486	.922
GSW45	Chicken leg	.477	.922
GSW46	Almonds	.761	.920
GSW47	Rice	.512	.922
GSW48	Orange	.448	.922
GSW49*	Sausage patties	-.243	.927
GSW50	Oatmeal	.636	.921
GSW51	Wheat bread	.353	.923
GSW52	Wheat pasta	.225	.924
GSW53	Cupcake	.634	.920
GSW54	Banana	.505	.922

Table 8 continued

GSW55	Waffles	.510	.922
GSW56	Lunchables	.533	.922
GSW57	Chicken tenders-fried	.126	.924
GSW58	Boiled eggs	.646	.921
GSW59	Pepperoni pizza	.262	.924
GSW60	Cubed cheddar cheese	.376	.923
GSW61	Animal crackers	.549	.922
GSW62	Doughnut	.483	.922
GSW63	Turkey sandwich	.606	.921
GSW64	Grilled cheese	.371	.923
GSW65	Goldfish	.293	.923
GSW66	Pizza rolls	.191	.924
GSW67	Celery	.648	.921
GSW68	Cola	.217	.924
GSW69	Milk	.526	.922
GSW70	100% Juice box	.574	.922
GSW71	Chocolate milk	.580	.922
GSW72	Water	.581	.922
GSW73	Orange juice	.427	.923
GSW74	Fruit punch	.184	.924

Comparing Beliefs Subscales

A Pearson Correlation Coefficient was conducted to determine if there was a relationship between the scores on the Healthy and Unhealthy subscale and the GO, SLOW, WHOA subscale. The results of the correlational analyses did not indicate a relationship between the two scales at this stage.

Drafting the Final Scale

Based on analysis in phase III of the study, items with Cronbach's α scores that increased with item deletion were eliminated from the scale. Eight items were included for food identification. Three items were included for each of the five food groups for categorization, and were selected based on scores as well as practical considerations, such as duplication, for a total of 15 items. 25 items from the GO, SLOW, WHOA subscale were included. All 4 items for predicted behavior were included as statistical analysis of this construct was not initially conducted. It may be assessed in future follow-up studies. The 54 selected items are below (Table 9). The final version of the scale for administration on technology, as well as a scoresheet were then created for use (Appendices I &).

Table 9

Final Draft of Scale

FOOD IDENTIFICATION	
Item Number	Item
FID1	Yogurt
FID2	Blueberries
FID3	Chocolate ice cream
FID4	Peppers
FID5	French fries
FID6	Kidney beans
FID7	Spaghetti noodles
FID8	Shrimp

Table 9 continued

FOOD GROUP CATEGORIZATION

Item Number	Item
FGC1	Grain- Popcorn vs Lemonade
FGC2	Grain- Broccoli vs Wheat Bread
FGC3	Grain- Pears vs Wheat Pasta
FGC4	Dairy- Green beans vs Gogurt
FGC5	Dairy- Grapes vs string cheese
FGC6	Dairy- Cottage cheese vs lettuce
FGC7	Protein- Ham vs Potato
FGC8	Protein- Kidney beans vs cookies
FGC9	Protein- Kiwi vs baked chicken leg
FGC10	Fruit- Popcorn vs Mandarin Oranges
FGC11	Fruit- Pears vs Pop Tarts
FGC12	Fruit- Kiwi vs sweet potato
FGC13	Vegetable- Cabbage vs salmon
FGC14	Vegetable- Potato chips vs graham crackers
FGC15	Vegetable- Gogurt vs broccoli

GO, SLOW, WHOA

Item Number	Item
GSW1	Almonds
GSW2	Cabbage
GSW3	Cupcake
GSW4	Green beans
GSW5	Cottage cheese
GSW6	Boiled eggs

Table 9 continued

GSW7	Broccoli
GSW8	Oatmeal
GSW9	Kiwi
GSW10	Chocolate ice cream
GSW11	Grapes
GSW12	Chocolate milk
GSW13	Animal crackers
GSW14	Popcorn
GSW15	White Milk
GSW16	Rice
GSW17	Cookies
GSW18	Chicken leg
GSW19	Pop Tarts
GSW20	French fries
GSW21	Cubed cheddar cheese
GSW22	Wheat bread
GSW23	Doritos
GSW24	Bacon
GSW25	Ham

PREDICTED BEHAVIOR

BREAKFAST		LUNCH	
Yogurt Cheerios Wheat bread Pancakes Muffin Bananas Waffles	Biscuit Fruit loops Pastry Egg Oatmeal Doughnut Sausage biscuit Pop tart	Lunchables Pepperoni pizza Turkey sandwich Grilled cheese Chicken leg Chicken tenders French fries	Carrots Broccoli Salad Cupcake Cookies Potato chips Watermelon Apples

Table 9 continued

SNACK		BEVERAGES
Blueberries Wheat crackers Doritos Popcorn Apples Cheese cubes Celery	Animal crackers Doughnut Gogurt Pizza rolls Buttery crackers Almonds Cookies Goldfish	Orange juice Lemon lime soda Cola Chocolate milk White milk Juice box Fruit punch Water

CHAPTER 5

DISCUSSION

Understanding the influences on the development of young children's food preferences and subsequent food habits is important when designing interventions to combat the epidemic of childhood obesity. Likewise, examining the impact of education is a key factor; if efforts do not improve outcomes such as nutrition knowledge and behavior in young children, new strategies should be considered. Preschool children are of particular interest, as this critical period may be predictive of life-long health (Hendricks et al., 1988). Developmentally appropriate practice for this age group include play-based, individualized approaches, and opportunities to apply new concepts to reinforce newly acquired knowledge (Bredekamp & Copple, 2009; Contento et al., 2002; Crain, 2011; D'Agostino et al., 2013). Scales that measure nutrition knowledge, beliefs, and behaviors in preschool children are vital to effective measurement of nutritional interventions with this age group.

Scale development in the area of preschool health behaviors has been limited; many measures of nutrition-related concepts and behavior have been developed specifically for interventions, without the complex, and time-consuming process of psychometric testing (Musser & Malkus, 1994; Wiseman & Harris, 2015). Quality scale development includes careful design and analysis; established guidelines exist and have been well-reviewed (Clark & Watson, 1995; Elliott et al., 2001; Hinkin et al., 1997). Even the simplest of scales are based on a thorough review of the existing literature and scales that would inform their design. In this case, scale creation took into consideration cognitive developmental theory, theories of development of nutrition beliefs and behaviors, in particular preferences, and aspects of approaches to health instruction for young children.

It was Elliott et al. (2001) who defined the multi-stage process that has helped this researcher create a scale that could be used as a measure of knowledge and beliefs in preschool children, and has the potential to examine the relationship between knowledge and predicted behavior. In the first phase, a draft of the scale was created for use with the Rainbow in My Tummy® (RIMT) meal program, and while its target population, purpose and objectives were clear, the conceptual framework and review of the literature and existing instruments were limited during the design of the initial draft instrument. While it was hypothesized that knowledge and predicted behavior would improve over the four-month intervention, the 27-item scale, given to 51 children, showed lower-level knowledge items, such as food identification, were improved, while more complex classification concepts and predicted nutrition behavior did not improve across the board, with a menu-only intervention. Limitations of the tool at this stage were that while the scale itself was an adaptation of a previous scale used, the items had not been validated, including selection of pictures. Food identification tasks included foods that were on the menu but were not generalizable to other interventions.

Phase II of the study focused on the limitations of the first phase, and included a more thorough review of the literature to define the conceptual framework and design of the scale, revisiting the first research steps outlined by Elliott et al. (2001). Included in this phase was the selection of digital images that were quality depictions of foods in their natural state. Of 175 photos, 146 photos were retained based on a diverse group of children's (n=46) ability to identify the foods. The photos were assigned health ratings (i.e., healthy, somewhat healthy, and unhealthy) and food group categories by nutrition experts to lend to the images content and face validity. These images were then used in the second drafts of the tool for validation, but they will also be retained for use in educational interventions across constructs. Six versions of a 77-item scale were created. Multiple versions allowed for randomization of items, and to provide a more robust item pool to determine the structural validity. Scales were piloted among a diverse group of preschool children (n=112) to validate the measure across the range of ages (3 to 5 years) included in the population. From this, the goal was to retain items for the scale that contributed to the internal consistency of the scale while also covering the full range of food groups (i.e., grains, proteins, dairy, fruits, vegetables and beverages) and maintaining adequate levels of variance across items. At this stage, each of the subscales were statistically evaluated, rather than the total scale, due to their varied underlying constructs. From these, one final version of the scale would be drafted for use in Phase III. As testing began, one particular limitation began to emerge; young participants exhibited difficulty differentiating between the concepts of healthy/unhealthy and preferred/non-preferred foods.

Phase III included drafting of a 45-item scale, across knowledge, beliefs, and behavior constructs, and pilot-testing carried out, with hopes that this draft would be appropriate for use in later applications. Thorough this phase, items were further vetted, and several eliminated to enhance the strength of the scale. Research indicates that large numbers of items in a scale may overestimate reliability (Clark & Watson, 1995). In particular, the food identification subscale was decreased to 8 total questions, and the food group categorization subscale was decreased to 15 items, 3 to represent each of the 5 food group categories. While this version of the scale was administered to 54 preschool children, interestingly, it continued to become more obvious that children, in particular younger participants, seemed to classify the health of foods based on preference rather than the actual properties of the foods. This was of concern, as the objective of the scale was to determine whether knowledge and beliefs could be measured in this population. So, rather than consider the scale appropriate for use, it was important to revisit the design of the belief subscale. While gender-related differences in performance on this scale were not identified, ANOVA and post-hoc testing did identify age-related differences between 3 and 5-year olds, but not among other age groups included in the study, which would be expected based on cognitive developmental theory. As discrimination occurred between groups with expected variance in understanding of a concept, I believe this suggests increased reliability and validity of the overall scale (Camilli & Shepard, 1997).

Early in scale development, an initial goal was to evaluate the validity of the beliefs subscale by comparing the original with the already established Traffic Light diet (Epstein & Squires, 1988). Based on the weakness of this classification subscale, and the difficulty that children were having distinguishing healthy/unhealthy from preferred/non-preferred foods, it was decided that the scale may be improved greatly by using the same digital images of foods, but applied to the Traffic Light diet concept of Green Light = GO = Healthy, Yellow Light = SLOW= Somewhat Healthy, and Red Light = WHOA = Unhealthy. Phase IV was an extraction of the original Healthy/Unhealthy subscale and conversion to GO, SLOW, WHOA categories, complete with inclusion of an image of a traffic light and the words Go (written in green), Slow (written in yellow) and Whoa (written in red). It was believed that this would present the Traffic-light concept in a developmentally appropriate manner that could be easily understood by preschool children. Subsequent analysis allowed the researcher to select a group of 25 photos (from all 5 food categories, and including two beverages) for inclusion in the final version of the scale, which includes 8 food identification tasks; 15 food group categorization tasks; 25 GO, SLOW, WHOA tasks; and 4 predicted behavior tasks.

This process has allowed this researcher to complete 6 of the 8 appropriate research tasks required to produce a quality measure. After multiple revisions, the final 52-item version of the scale is now ready for initial use with preschool children in a variety of settings and for diverse purposes such as assessment, intervention, nutrition training, etc. Testing of the final version of the scale will be conducted through future research studies, and will add to the body of information regarding reliability (e.g., test-retest, internal consistency) and validity (e.g., predictive validity, convergent validity). This is a necessary next step if the scale is to be generalized to the greater public for use.

Limitations

The purpose of this research was to develop a reliable and valid measure of preschool children's nutrition knowledge, beliefs, and behaviors. This was largely achieved, but there were some limitations in this research that are worth noting. First, behavior is a difficult item to measure efficiently, though research suggests that game-like tasks including picture identification may be predictive of actual behavior (Wiley & Hendricks, 1998). In this study, a limited number of items were included to predict behavior. As a result, it was not statistically feasible to determine the reliability and validity of this subscale. This is, however, an important aspect to understanding the relationship between nutrition knowledge and how food behaviors emerge. This will be an important piece included in the next phase of research.

Second, although this scale was administered across a diverse population in East Tennessee, the demographics of this region are relatively homogenous, therefore the scale may not be as reliable or valid with more ethnically or religiously diverse populations. Likewise, food is a particularly culturally sensitive topic, and in addition to the language used in the scale, some food items might not translate well to other cultures (e.g., ham used as a food item for Jewish or Muslim children). Future research can focus on examining whether the scale is reliable and valid for use with multicultural populations, and if necessary, more culturally diverse versions of the scale may need to be created for use in other parts of the United States, and internationally. In particular, a Spanish version would be valuable in many parts of the country.

Finally, there may be limits related to atypical development to consider. Similar to Hendricks et al. (1988) it was noted that the two twin boys, age 5, who were reported to be developmentally delayed and functioning at the level of 3-year-olds, performed poorly on the more complex aspects of this scale, and scores indeed were more typical of those of 3-year-olds. It would follow that this scale may lack reliability or validity for children with atypical development. Additionally, since the scale was presented on the iPad, it might not be appropriate for children without sight or hearing in its current form. While the current scale can be presented in paper format, as it was developed in PowerPoint format, future research might focus on adapting the final version of the scale for use with children with sight and hearing difficulties, and then analyzing those results to provide reliability and validity data on the modified scale.

Future Research

The next step for this researcher will be to conduct reliability testing and further content validation in line with research task 7. This step will allow the final scale version to be considered a well-designed tool, as outlined in research task 8. The plan would include a 6-week education intervention study utilizing the USDA's MyPlate® emergent readers with pre- and post-testing in both groups to further determine the validity of the scale, in particular the Food

Group Categorization subscale of the final scale, as well as test-retest reliability. Design would include random assignment of centers from diverse populations to intervention and control groups; research will be a cluster randomized trial, which assigns groups, not individuals, to treatment or controls, as true randomization would not appropriate within centers (Natale et al., 2013).

Test-Retest Reliability. To obtain test-retest reliability, centers randomized to the control group will receive the same pre-post measures as the intervention group, four weeks apart to further determine reliability of the measure. After the second measure, these centers will be provided with the same materials used in the intervention, as well as suggestions for incorporating these materials into the regular curriculum.

Predictive Validity. To determine predictive validity, a diverse sample of preschool children will be given the scale on iPad technology. After four weeks, the same participants will be provided with actual food samples that the digital images represent in the predicted behavior subscale. Children will be asked to choose four items they would like for the target meal or snack, and place the foods on a plate they may consume that day (not to interfere with the regularly scheduled meal or snack that day). Scores will be assigned based on the health of the foods selected, and these mean scores compared to determine convergent and predictive validity of the scale.

Conclusion

Elliott and colleagues (2001) outlined eight important research tasks which should be completed if the end goal is to create a valid and reliable scale. Throughout this research, the first six of these tasks have been accomplished. In total, this multi-phase study included 298 preschool children ages 2-6 years (151 girls, 147 boys; mean age 3.936). Through four phases, several iterations of a scale were created, with 4 subscales to measure the nutrition knowledge (food identification and food group categorization), beliefs, and predicted behaviors among preschool children, and piloted. Initially, a 45-item scale was the result. Statistical analysis identified age-related differences in scale performance between 3 and 5-year olds; this discrimination between groups with expected variance in understanding of nutrition related concepts, may indicate a high level of reliability and validity of the items included in the scale. That said, while internal consistency was strong for the total scale, with a Cronbach's α of .775, and subscales measuring knowledge, food identification (0.642) and food group categorization (0.644), the beliefs, healthy versus unhealthy, subscale (.576) had internal weaknesses that required revision. As children were limited in their ability to distinguish between the quality of health of foods and food preference, an adaptation of the Traffic-light diet was created as a more developmentally appropriate variation of this subscale. The 74-item GO, SLOW, WHOA subscale was created and piloted, and narrowed to 25 items (Cronbach's α .924). This resulted in the final version of the scale, with 52 items including 8 food identification tasks, 15 food group categorization tasks, 25 GO, SLOW, WHOA tasks, and 4 predicted behavior tasks, for delivery on interactive technology. Limitations of this study will be addressed through pre-post testing with a six-week nutrition intervention to determine further validity and test-retest reliability. Future research will be carried out among age-diverse populations, include opportunities to test the predictive validity of the behavior tasks, and further determine the consistency of items within the beliefs subscale. It is predicted that Cronbach's α will be similar if not improved by further testing of this final scale, and aspects can then be utilized in numerous applications, including educational materials, games, and other nutrition interventions.

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APPENDICES

APPENDIX A

Letter to Parents

COLLEGE *of*
CLINICAL *and* REHABILITATIVE
HEALTH SCIENCES
EAST TENNESSEE STATE UNIVERSITY

Box 70690
Johnson City, TN 37614
P 423-439-7661
F 423-439-4030

Dear Family:

I am asking for your permission to allow your child to participate in this research project.

I would like to know more about how children learn about nutrition, and how they make food choices. Playing games using pictures can show how much a child knows about foods and health. Preschool children may not know which foods are healthy and how to choose foods that help their body. So, I am trying to create a tool to measure of how much they understand. Your child will help me pick what questions to use for the test. This study will take place December 2016 through March of 2017.

The protocol to be used with your child:

We will use picture games with your child. During these games, we will sit with your child in their classroom, show them pictures of foods, and ask questions about these foods. We will work with your child on two days, for 10-15 minutes each time. Your child will be given praise during the games, to help with any stress related to testing. If they say they do not want to play, or say they want to stop answering questions at any time during the games, they will be told that is okay.

Please feel free to contact me with any questions you may have about the study.

Thank you,

Michelle Johnson

Michelle Johnson, MS, RD, LDN
Doctoral Candidate, Early Childhood Education
Assistant Professor of Nutrition
JOHNSONME@mail.etsu
423-439-7661

APPENDIX B

Revised Letter to Parents

COLLEGE of CLINICAL and REHABILITATIVE HEALTH SCIENCES
EAST TENNESSEE STATE UNIVERSITY

Box 70690
Johnson City, TN 37614
P 423-439-7661
F 423-439-4030

Dear Family:

I am asking for your permission to allow your child to participate in this research project.

I would like to know more about how children learn about nutrition, and how they make food choices. Playing games using pictures can show how much a child knows about foods and health. Preschool children may not know which foods are healthy and how to choose foods that help their body. So, I am trying to create a tool to measure of how much they understand. Your child will help me pick what questions to use for the test.

The protocol to be used with your child:

We will use picture games with your child. During these games, we will sit with your child in their classroom, show them pictures of foods, and ask questions about these foods. We will work with your child on one day, for 5-10 minutes. Your child will be given praise during the games, to help with any stress related to testing. If they say they do not want to play, or say they want to stop answering questions at any time during the games, they will be told that is okay.

Please feel free to contact me with any questions you may have about the study.

Thank you,

Michelle Johnson

Michelle Johnson, MS, RD, LDN
Doctoral Candidate, Early Childhood Education
Assistant Professor of Nutrition
JOHNSONME@mail.etsu
423-439-7661

APPENDIX C

Phase I: Nutrition Knowledge, Beliefs, and Behaviors Questionnaire Scoresheet

Nutrition Knowledge, Beliefs, and Behaviors Questionnaire Scoresheet

Food identification:

Show the child 10 pictures, ask them "do you know what this food is?"

The pictures are: avocado, dried beans, corn on cob, eggs, oatmeal, peppers, spinach (raw), spaghetti squash, tortillas, pineapple.

Avocado	Peppers
Dried Beans	Spinach (raw)
Corn on Cob	Spaghetti Squash
Eggs	Tortillas
Oatmeal	Pineapple

Food Group Categorization

Show the child pictures of 12 foods: 3 fruits, 3 vegetables, 3 dairy, and 3 grains.

Ask them to pick the 3 foods that are: **(It's okay if they don't know, just say "give it your best guess")**

Each time, put all pieces back on the table after they are chosen so they have an opportunity to choose all 12 each time.

Fruits?

Berries	Banana	Apple

Vegetables?

Carrots	Brussel sprouts	Potato

Dairy?

Milk	Yogurt	Cheese

Grain?

Pasta	Bread	Rice

Ask the child what they think a "healthy" food is. What does healthy mean?

What were their comments?

____

____

Ask the child what they think an "unhealthy" food is. What does unhealthy mean?

What were their comments?

____

____

Healthy/Unhealthy Choices

Lay the following pictures on table:

Tomatoes, grapes, melon, a garden salad, a grilled chicken breast, grilled salmon, cooked spinach, tacos, cheese pizza, French fries, chicken nuggets, a cupcake, and a doughnut.

Ask them to select the three "healthy" foods.

Which foods did they choose?

____

Return selected pictures to the table. **Ask them to select the three "unhealthy" foods.**

Which foods did they choose?

____

"Favorites"

Meal assembly:

Lay the following pictures on the table:

Strawberries, watermelon, green beans, a garden salad, quinoa, macaroni and cheese, sushi, deli ham, a baked chicken leg, a hot dog, chicken tenders, a grilled cheese, spaghetti with marinara sauce, a burrito, a cupcake, and cookies.

Ask the child to choose the foods that would make their favorite meal!! (on a provided paper plate if they will)

What foods did they choose? What were their comments if any?

____

____

APPENDIX D

Results of Initial Selected Digital Photos for Testing of Quality and Ease of Identification

Food/drink	**# correct**	**# times offered**	**% correct**
Butternut squash	3	10	30%
Eggplant	0	4	0%
Onion	6	13	46%
Peppers	1	7	14%
Radishes	0	5	0%
Cabbage	2	10	20%
Sweet potato whole	0	2	0%
White baked potato whole	4	7	57%
Tomatoes whole	5	6	83%
Tomatoes cut	4	7	57%
Cucumber	6	10	60%
Cauliflower	1	8	13%
Zucchini	1	7	14%
Squash	1	11	9%
Corn whole	4	4	100%
Snow peas open	1	4	25%
Snow peas whole	0	8	0%
asparagus	1	2	50%
carrots	7	7	100%
garlic	0	6	0%
mushrooms cut	3	7	43%
lettuce leaf- whole	4	9	44%
celery	2	7	29%
broccoli whole	7	7	100%
broccoli cut	7	9	78%
sweet pot cut	1	8	13%
Brussel sprouts	1	9	11%
green beans	2	5	40%
spinach raw	0	11	0%
peppers cut	3	7	43%
cooked spinach	0	10	0%
blueberries	6	6	100%
raspberries	9	13	69%
blackberries	8	13	62%
strawberries	16	16	100%
red grapes	6	7	86%
watermelon cut	6	7	86%
grapes green	5	6	83%

Food/drink	**# correct**	**# times offered**	**% correct**
bananas	11	11	100%
cantaloupe	0	5	0%
coconut whole	0	5	0%
kiwi	3	8	38%
starfruit	0	10	0%
mango cut	0	4	0%
avocado	2	6	33%
orange slices	10	11	91%
red apple	7	7	100%
green apple	2	2	100%
mixed grapes	8	10	80%
peaches	5	8	63%
lime	2	5	40%
lemon	2	6	33%
pears	1	7	14%
plums	0	1	0%
apricot	0	5	0%
applesauce	2	5	40%
OJ	4	7	57%
Milk	10	10	100%
cottage cheese	1	6	17%
cubed cheddar cheese	9	9	100%
boiled egg	11	11	100%
sliced cheese	6	6	100%
cherries fresh	7	10	70%
Maraschino cherries	3	6	50%
grilled cheese	5	7	71%
pizza rolls	3	8	38%
chicken tenders	8	9	89%
fish sticks	7	9	78%
chocolate chip cookies	11	11	100%
cupcake	6	7	86%
corn dog	4	11	36%
lasagna	0	7	0%
French fries	6	8	75%
muffin	3	5	60%
chicken nuggets	5	8	63%
oatmeal	1	8	13%
pasta plain	4	5	80%
doughnut	8	11	73%
hot dog	6	7	86%

Food/drink	# correct	# times offered	% correct
almonds	3	6	50%
pasta with marinara	6	9	67%
spaghetti with meatballs	3	5	60%
macaroni and cheese	4	9	44%
peas	8	8	100%
tater tot rounds	1	8	13%
pineapple	4	7	57%
biscuit	0	7	0%
mandarin oranges	5	6	83%
white rice	3	4	75%
pancakes	5	5	100%
brown rice	4	8	50%
waffles	9	11	82%
sausage patties	2	6	33%
sausage biscuit	2	8	25%
whole roasted chicken	4	5	80%
toaster pastry	0	10	0%
Fig Newton	0	7	0%
chicken leg	10	10	100%
Doritos	8	9	89%
plain chips	4	5	80%
woven wheat crackers	6	10	60%
salmon baked	2	9	22%
pretzel twists	1	7	14%
goldfish	7	7	100%
cheerios	5	6	83%
graham crackers	3	9	33%
animal crackers	3	10	30%
popcorn	11	11	100%
granola	0	2	0%
ribeye steak	1	7	14%
wheat thins	4	5	80%
Ritz crackers	2	4	50%
shrimp boiled	3	6	50%
salad	0	4	0%
bagel	3	8	38%
chicken breast	2	9	22%
Pepperoni	2	5	40%
pita wedges	1	6	17%
tortilla chips	9	11	82%
flour tortillas	1	8	13%

Food/drink	# correct	# times offered	% correct
soft taco	9	10	90%
pepperoni pizza	12	12	100%
scrambled eggs	4	6	67%
Omelet	0	8	0%
wheat bread slices	9	10	90%
white bread slices	6	6	100%
Barbeque baked beans	5	6	83%
Lunchables	2	11	18%
deli turkey	1	8	13%
turkey sandwich on wheat	5	7	71%
Bologna	2	9	22%
bologna sandwich on white	4	4	100%
sliced ham	3	7	43%
hummus and pita	0	7	0%
Butternut squash	0	9	0%
Yogurt	3	4	75%
Bacon	3	8	38%
Black-eyed peas	0	7	0%
pinto beans	2	6	33%
kidney beans	1	7	14%
chick peas	0	7	0%
lima beans	6	10	60%
Cola	2	8	25%
oatmeal cooked	2	6	33%
chocolate ice cream	4	6	67%

Appendix E

Phase III Final Scale

Preschool Measure

Final Version

June 30, 2017

Part One: Food Identification
Food Group Categories

Tell me what this food is:

Tell me what this food is:

Tell me what this food is:

Tell me what this food is:

Tell me what this food is:

Tell me what this food is:

Tell me what this food is:

Tell me what this food is:

Tell me what this food is:

Tell me what this food is:

Point to the one that is a grain.


Point to the one that is a grain.


Point to the one that is a grain.


Point to the one that is a grain.


Point to the one that is dairy.

Point to the one that is dairy.

Point to the one that is dairy.

Point to the one that is dairy.

Point to the one that is protein.

Point to the one that is protein.

Point to the one that is protein.

Point to the one that is protein.

Point to the one that is protein.

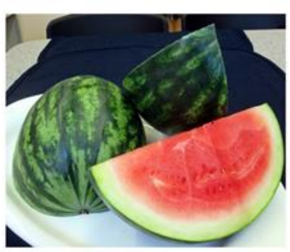
Point to the one that is fruit.

Point to the one that is fruit.

Point to the one that is fruit.

Point to the one that is fruit.


Point to the one that is a vegetable.


Point to the one that is a vegetable.


Point to the one that is a vegetable.


Point to the one that is a vegetable.


Part Two: Healthy and Unhealthy Foods
Making your Lunch Plate

Take a moment to talk with the child about the terms "healthy" and "unhealthy"

Ask the child: "Tell me what healthy/unhealthy means to you"

Then: Tell me about healthy/unhealthy foods"

Then: "Do you know what 'healthy foods' do for your body?

- Let them answer, then offer "they give you fuel, and help your body grow strong!"

Then ask the child: Do you know what unhealthy foods are?

- Let them answer, then offer "they slow you down, and are not as good for your body"

Point to the unhealthy choice.


Point to the unhealthy choice


Point to the unhealthy choice


Point to the unhealthy choice


Point to the unhealthy choice


Point to the healthy choice.

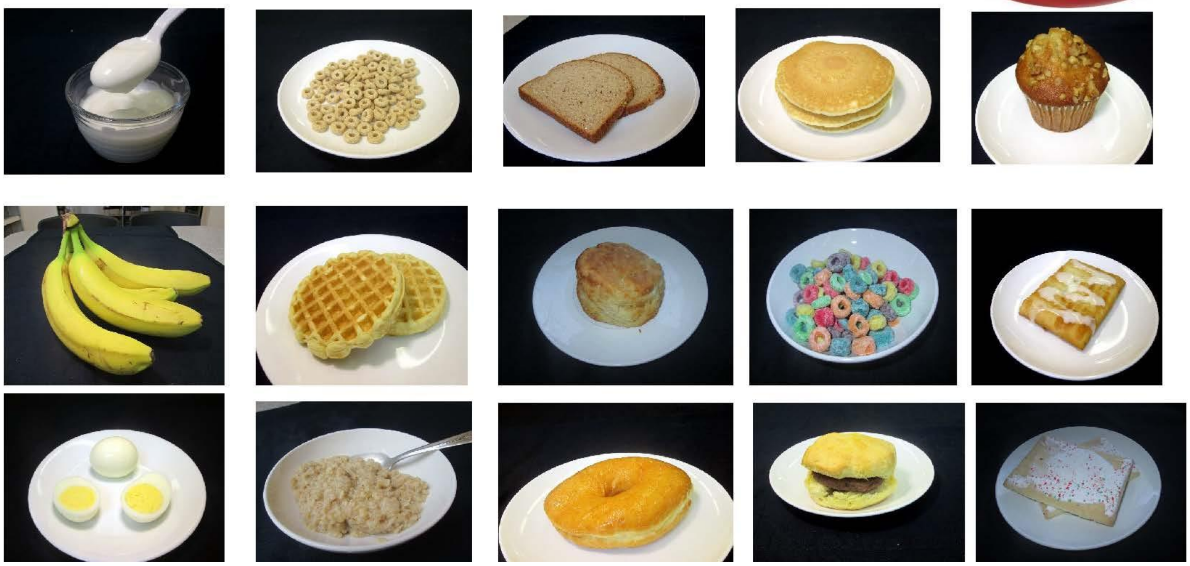

Point to the healthy choice.


Point to the healthy choice.

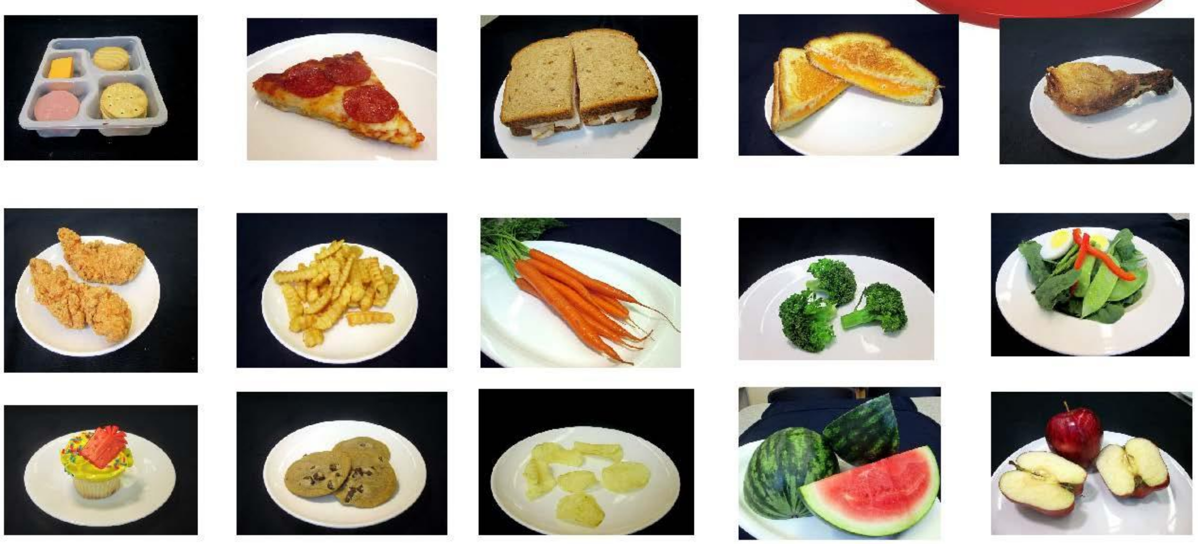

Point to the healthy choice.


Point to the healthy choice.


If you could choose from the foods below to make your breakfast, what 4 would you pick?



If you could choose from the foods below to make your lunch, what 4 would you pick?



If you could choose from the foods below to make your snack, what 4 would you pick?













What would you choose to drink?







APPENDIX F

Final Tool Data Collection Form

Version ________________

Age of child _____________

Boy or Girl

Part I

Can you tell me what this food is? (write answer) **(Please mark 0 if incorrect, 1 if correct)**

1_________________________________

2_________________________________

3_________________________________

4_________________________________

5_________________________________

6_________________________________

7_________________________________

8_________________________________

9_________________________________

10________________________________

Food Group Category (Please mark 0 if incorrect, 1 if correct)

1. 0 1
2. 0 1
3. 0 1
4. 0 1
5. 0 1
6. 0 1
7. 0 1
8. 0 1
9. 0 1
10. 0 1
11. 0 1
12. 0 1
13. 0 1
14. 0 1
15. 0 1
16. 0 1
17. 0 1
18. 0 1
19. 0 1
20. 0 1
21. 0 1

Version ________ Part II

Healthy vs Unhealthy (Please mark 0 if incorrect, 1 if correct)

1. 0 1
2. 0 1
3. 0 1
4. 0 1
5. 0 1
6. 0 1
7. 0 1
8. 0 1
9. 0 1
10. 0 1

Make your own plate (write in order the first 4 selections the child makes)

Breakfast

____

____

____

____

Lunch

____

____

____

____

Snack

____

____

____

____

What beverage would you choose?   Write the first beverage selected

____

APPENDIX G

GO, SLOW, WHOA Tool

Traffic Light Diet
"Go" "Slow" and "Whoa" Foods
7/19/17

TRAFFIC LIGHT FOODS

- **GO** foods- These are very healthy foods and drinks. They are lowest in fat and sugar. They can be eaten any time- they are good for your body, give you energy, and help you grow big and strong.

- **SLOW** foods- These foods and drinks may have some fat or some sugar. These foods are not as healthy as **GO** foods, but they are better for you than **WHOA** foods. They should not be eaten every day.

- **WHOA** foods- These foods and drinks are sugary, or high in fat, including fried foods. These foods should be eaten only once in a while.

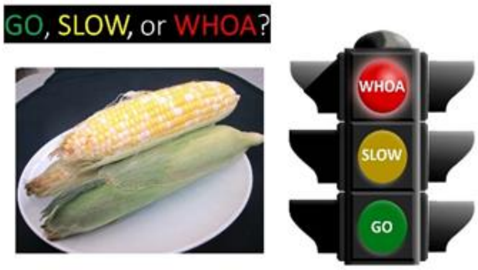
GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?



GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?


GO, SLOW, or WHOA?
WHOA
SLOW
GO


GO, SLOW, or WHOA?
WHOA
SLOW
GO


GO, SLOW, or WHOA?
WHOA
SLOW
GO


GO, SLOW, or WHOA?
WHOA
SLOW
GO


GO, SLOW, or WHOA?
WHOA
SLOW
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GO, SLOW, or WHOA?
WHOA
SLOW
GO


GO, SLOW, or WHOA?
WHOA
SLOW
GO


GO, SLOW, or WHOA?
WHOA
SLOW
GO

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

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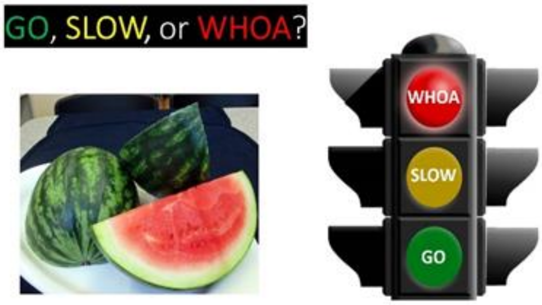
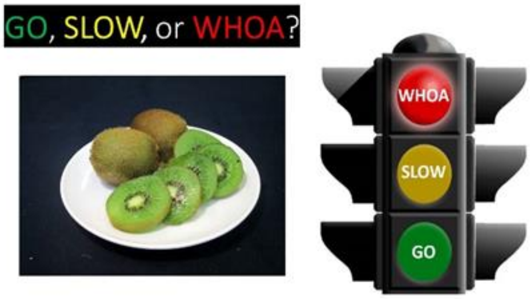
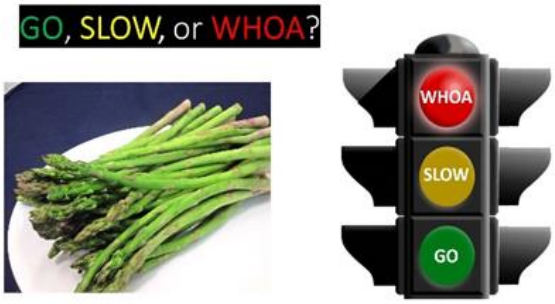
GO, SLOW, or WHOA?



GO, SLOW, or WHOA?



GO, SLOW, or WHOA?



GO, SLOW, or WHOA?

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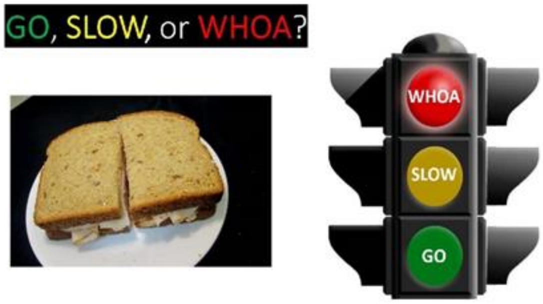
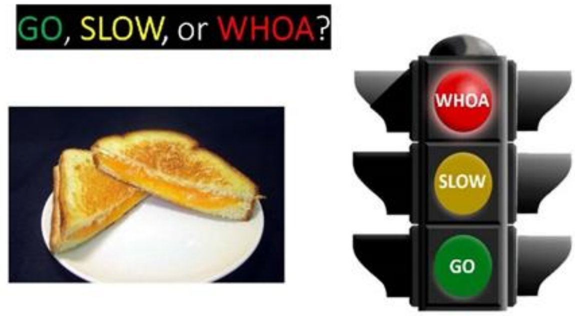
GO, SLOW, or WHOA?

GO, SLOW, or WHOA?



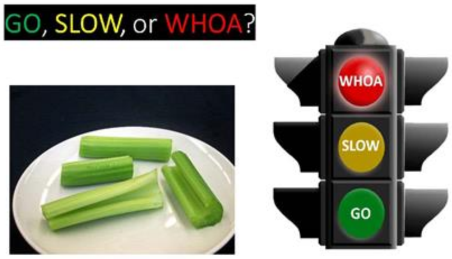
GO, SLOW, or WHOA?



GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?



GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

APPENDIX H

GO, SLOW, WHOA Scores and Collection Form

Go, Slow, Whoa Tool Answers

Age

Girl/Boy

				If incorrect, what did they say?
Yogurt	Go	0- incorrect	1- correct	
Bacon	Whoa	0- incorrect	1- correct	
Blueberries	Go	0- incorrect	1- correct	
Ice Cream	Whoa	0- incorrect	1- correct	
Corn	Go	0- incorrect	1- correct	
Peppers	Go	0- incorrect	1- correct	
French Fries	Whoa	0- incorrect	1- correct	
Beans	Go	0- incorrect	1- correct	
Spag Noodles	Slow	0- incorrect	1- correct	
Shrimp	Go	0- incorrect	1- correct	
Tater Tots	Whoa	0- incorrect	1- correct	
Applesauce	Slow	0- incorrect	1- correct	
Fruit Loops	Whoa	0- incorrect	1- correct	
Cherries	Go	0- incorrect	1- correct	
Potato Chips	Whoa	0- incorrect	1- correct	
Carrots	Go	0- incorrect	1- correct	
Corn Dog	Whoa	0- incorrect	1- correct	
Cantaloupe	Go	0- incorrect	1- correct	
Gogurt	Slow	0- incorrect	1- correct	
Biscuit	Slow	0- incorrect	1- correct	
Butter crackers	Slow	0- incorrect	1- correct	
Sweet Pot	Go	0- incorrect	1- correct	
Doritos	Whoa	0- incorrect	1- correct	
French fries	Whoa	0- incorrect	1- correct	

				If incorrect, what did they say?
Popcorn	Slow	0- incorrect	1- correct	
Can oranges	Slow	0- incorrect	1- correct	
Pears	Go	0- incorrect	1- correct	
Pop Tarts	Whoa	0- incorrect	1- correct	
Watermelon	Go	0- incorrect	1- correct	
Kiwi	Go	0- incorrect	1- correct	
Asparagus	Go	0- incorrect	1- correct	
Cabbage	Go	0- incorrect	1- correct	
Salmon	Go	0- incorrect	1- correct	
Grahams	Slow	0- incorrect	1- correct	
Broccoli	Go	0- incorrect	1- correct	
Green Beans	Go	0- incorrect	1- correct	
Grapes	Go	0- incorrect	1- correct	
String cheese	Go	0- incorrect	1- correct	
Cheerios	Go	0- incorrect	1- correct	
Cottage cheese	Go	0- incorrect	1- correct	
Lettuce	Go	0- incorrect	1- correct	
Ham	Slow	0- incorrect	1- correct	
Baked Potato	Go	0- incorrect	1- correct	
Cookies	Whoa	0- incorrect	1- correct	
Chicken leg	Slow	0- incorrect	1- correct	
Almonds	Go	0- incorrect	1- correct	
Rice	Go	0- incorrect	1- correct	
Orange	Go	0- incorrect	1- correct	
Sausage patties	Whoa	0- incorrect	1- correct	
Oatmeal	Go	0- incorrect	1- correct	
Wheat bread	Go	0- incorrect	1- correct	
Wheat pasta	Go	0- incorrect	1- correct	

				If incorrect, what did they say?
Cupcake	Whoa	0- incorrect	1- correct	
Banana	Go	0- incorrect	1- correct	
Waffles	Slow	0- incorrect	1- correct	
Lunchables	Slow	0- incorrect	1- correct	
Chick tenders	Whoa	0- incorrect	1- correct	
Eggs	Go	0- incorrect	1- correct	
Pepp Pizza	Whoa	0- incorrect	1- correct	
Cube cheese	Slow	0- incorrect	1- correct	
Animal crackers	Slow	0- incorrect	1- correct	
Doughnut	Whoa	0- incorrect	1- correct	
Turk Sand	Go	0- incorrect	1- correct	
Grilled Cheese	Slow	0- incorrect	1- correct	
Goldfish	Slow	0- incorrect	1- correct	
Pizza rolls	Whoa	0- incorrect	1- correct	
Celery	Go	0- incorrect	1- correct	
Cola	Whoa	0- incorrect	1- correct	
Milk	Go	0- incorrect	1- correct	
Juice Box	Slow	0- incorrect	1- correct	
Choc Milk	Slow	0- incorrect	1- correct	
Water	Go	0- incorrect	1- correct	
Orange juice	Slow	0- incorrect	1- correct	
Fruit punch	Whoa	0- incorrect	1- correct	

APPENDIX I

GO, SLOW, WHOA Scores Decision Table

Item Number	Food Group		Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
GSW46	Pro	Almonds	.761	.920
GSW32	Veg	Cabbage	.699	.920
GSW53	Grain	Cupcake	.634	.920
GSW41	Veg	Lettuce (repetitive of cabbage)	.675	.921
GSW36	Veg	Green beans	.671	.921
GSW40	Dairy	Cottage cheese	.662	.921
GSW31	Veg	Asparagus (repetitive of green beans)	.650	.921
GSW27	Fruit	Pears (rather include kiwi)	.650	.921
GSW67	Veg	Celery (rather include broccoli)	.648	.921
GSW58	Pro	Boiled eggs	.646	.921
GSW35	Veg	Broccoli	.639	.921
GSW50	Grain	Oatmeal	.636	.921
GSW63	Gr/Pro	Turkey sandwich	.606	.921
GSW30	Fruit	Kiwi	.595	.921
GSW43	Veg	Baked potato (3 veg already)	.591	.921
GSW4	Dairy	Chocolate ice cream	.571	.921
GSW37	Fruit	Grapes	.568	.921
GSW72	Bev	Water (not including here)	.581	.922
GSW71	Dairy	Chocolate milk	.580	.922
GSW70	Fruit	100% Juice box (not including here)	.574	.922
GSW61	Grain	Animal crackers	.549	.922
GSW34	Grain	Graham crackers (animal crackers)	.544	.922
GSW25	Grain	Popcorn	.544	.922
GSW56	Mix	Lunchables	.533	.922
GSW69	Dairy	Milk	.526	.922
GSW47	Grain	Rice	.512	.922

GSW55	Grain	Waffles (confusing without condiments)	.510	.922
GSW54	Fruit	Banana (multiple fruits)	.505	.922
GSW44	Grain	Cookies	.486	.922
GSW62	Grain	Doughnut (repetitive of cupcake)	.483	.922
GSW45	Pro	Chicken leg	.477	.922
GSW33	Pro	Salmon (confusing for some)	.453	.922
GSW48	Fruit	Orange (multiple fruits)	.448	.922
GSW28	Grain	Pop Tarts	.412	.922
GSW73	Fruit	Orange juice (unsure % fruit)	.427	.923
GSW24	Veg	French fries	.388	.923
GSW29	Fruit	Watermelon (multiple fruits)	.385	.923
GSW13	Grain	Fruit Loops	.379	.923
GSW60	Dairy	Cubed cheddar cheese	.376	.923
GSW64	Grain/dairy	Grilled cheese	.371	.923
GSW38	Dairy	String cheese (cheddar included)	.356	.923
GSW51	Grain	Wheat bread	.353	.923
GSW23	Grain	Doritos	.341	.923
GSW15	Veg	Potato Chips (chips above)	.334	.923
GSW8	Pro	Kidney beans (multiple pro items)	.326	.923
GSW16	Veg	Carrots (multiple vegetables)	.214	.923
GSW17	Grain/Pro	Corn Dog	.291	.923
GSW26	Fruit	Mandarin oranges (multiple fruits)	.225	.923
GSW2	Pro	Bacon	.292	.923
GSW20	Grain	Biscuit (multiple grain items)	.260	.923
GSW42	Pro	Ham	.295	.923
GSW65	Grain	Goldfish (repetitive)	.293	.923
GSW21	Grain	Butter crackers (repetitive)	.281	.923
GSW59	Mixed	Pepperoni pizza	.262	.924

GSW6	Veg/Fr	Peppers	.246	.924
GSW52	Grain	Wheat pasta	.225	.924
GSW5	Veg	Corn	.224	.924
GSW68	None	Cola	.217	.924
GSW22	Veg	Sweet potato	.199	.924
GSW66	Mixed	Pizza rolls	.191	.924
GSW7	Veg	French fries	.184	.924
GSW74	Fruit	Fruit punch	.184	.924
GSW19	Dairy	Gogurt	.182	.924
GSW9	Grain	Spaghetti noodles	.067	.924
GSW12	Fruit	Applesauce	.135	.924
GSW57	Pro	Chicken tenders-fried	.126	.924
GSW11	Veg	Tater Tots	.121	.924
GSW14*	Fruit	Cherries	.088	.925
GSW10*	Pro	Shrimp	-.028	.925
GSW39*	Grain	Cheerios	.023	.925
GSW18*	Fruit	Cantaloupe	-.018	.925
GSW3*	Fruit	Blueberries	-.056	.925
GSW1*	Dairy	Yogurt	-.175	.927
GSW49*	Pro	Sausage patties	-.243	.927

APPENDIX J

Final Scale

Tell me what this food is:

Tell me what this food is:

Tell me what this food is:

Tell me what this food is:

Tell me what this food is:

Tell me what this food is:

Tell me what this food is:

Point to the one that is a grain.

Point to the one that is a grain.

Point to the one that is a grain.

Point to the one that is dairy.

Point to the one that is dairy.

Point to the one that is dairy.

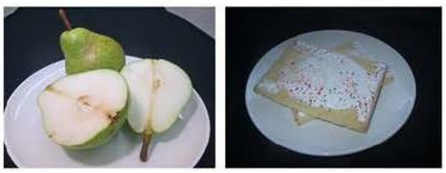
Point to the one that is protein.

Point to the one that is protein.

Point to the one that is protein.

Point to the one that is fruit.

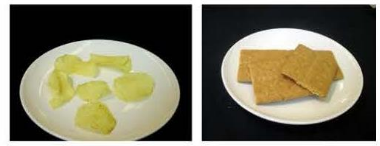
Point to the one that is fruit.



Point to the one that is fruit.

Point to the one that is a vegetable.

Point to the one that is a vegetable.



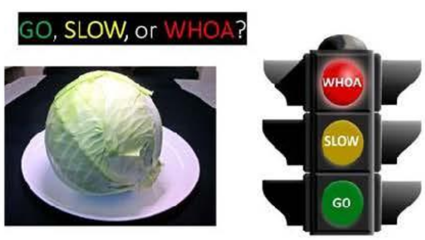
Point to the one that is a vegetable.

TRAFFIC LIGHT FOODS 

- **GO** foods- These are very healthy foods and drinks. They are lowest in fat and sugar. They can be eaten any time- they are good for your body, give you energy, and help you grow big and strong.

- **SLOW** foods- These foods and drinks may have some fat or some sugar. These foods are not as healthy as **GO** foods, but they are better for you than **WHOA** foods. They should not be eaten every day.

- **WHOA** foods- These foods and drinks are sugary, or high in fat, including fried foods. These foods should be eaten only once in a while.

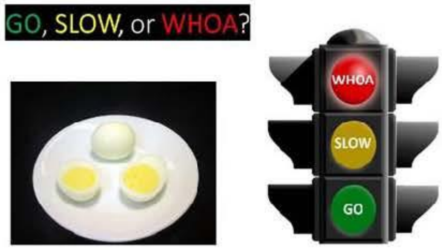


GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

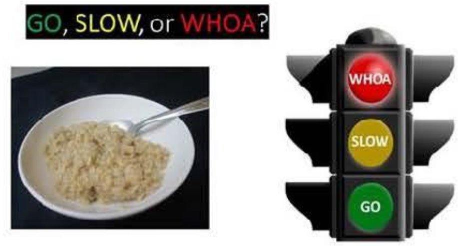
GO, SLOW, or WHOA?

GO, SLOW, or WHOA?



GO, SLOW, or WHOA?

GO, SLOW, or WHOA?



GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

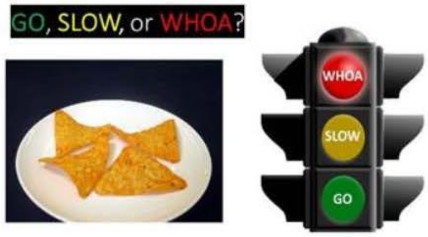
GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?



GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

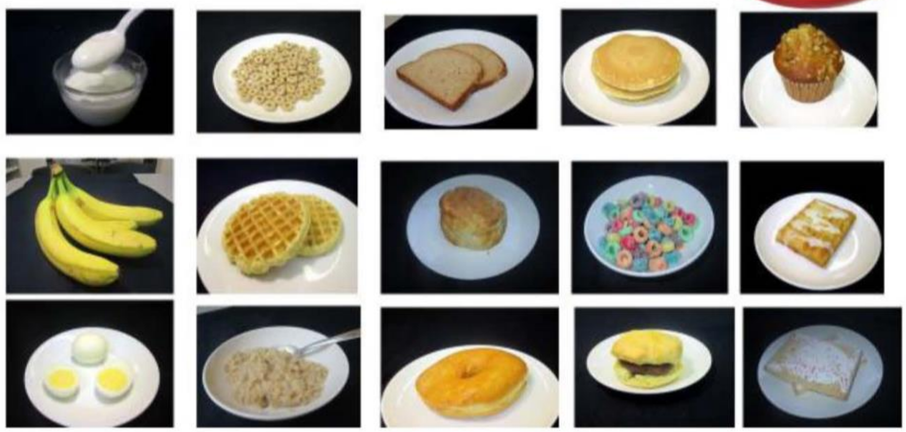
GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

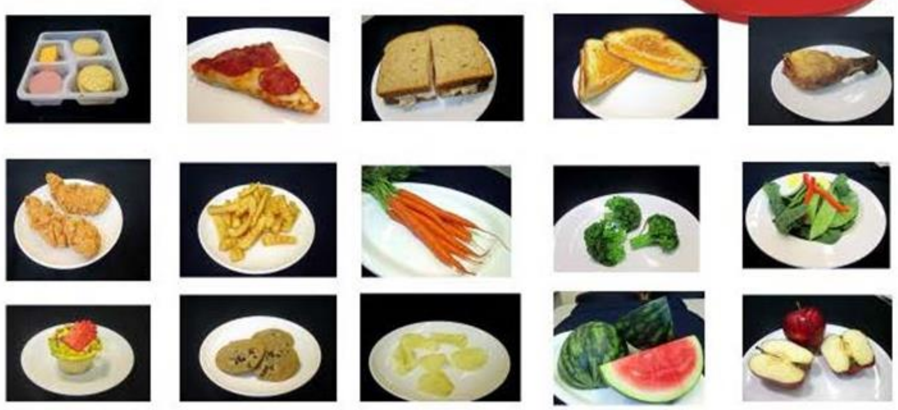
GO, SLOW, or WHOA?

GO, SLOW, or WHOA?

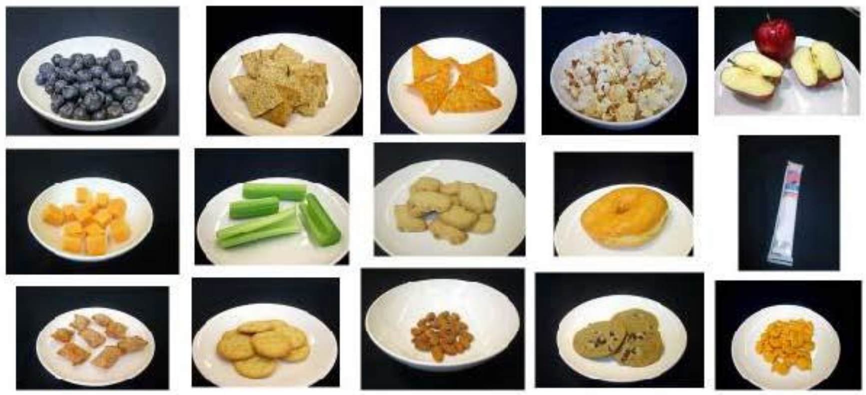
If you could choose from the foods below to make your breakfast, what 4 would you pick?



If you could choose from the foods below to make your lunch, what 4 would you pick?



If you could choose from the foods below to make your snack, what 4 would you pick?



What would you choose to drink?

APPENDIX K

Final Scale Data Collection and Scoring Tool

Version ________________

Age of child _____________

Boy or Girl

Score Sheet

Food Identification– correct answer is listed (Please mark 0 if incorrect, 1 if correct)

Yogurt	0- incorrect	1- correct
Blueberries	0- incorrect	1- correct
Chocolate Ice Cream	0- incorrect	1- correct
Peppers	0- incorrect	1- correct
French fries	0- incorrect	1- correct
Kidney beans	0- incorrect	1- correct
Spaghetti noodles	0- incorrect	1- correct
Shrimp	0- incorrect	1- correct

Food Group Category – correct answer is listed (Please mark 0 if incorrect, 1 if correct)

Grain	Popcorn	0- incorrect	1- correct
Grain	Wheat bread	0- incorrect	1- correct
Grain	Pasta	0- incorrect	1- correct
Dairy	Gogurt	0- incorrect	1- correct
Dairy	String cheese	0- incorrect	1- correct
Dairy	Cottage cheese	0- incorrect	1- correct
Protein	Ham	0- incorrect	1- correct
Protein	Beans	0- incorrect	1- correct
Protein	Chicken leg	0- incorrect	1- correct
Fruit	Oranges	0- incorrect	1- correct
Fruit	Pears	0- incorrect	1- correct
Fruit	Kiwi	0- incorrect	1- correct
Vegetable	Cabbage	0- incorrect	1- correct
Vegetable	Potato chips	0- incorrect	1- correct
Vegetable	Broccoli	0- incorrect	1- correct

GO, SLOW, WHOA – correct answer is listed (Please mark 0 if incorrect, 1 if somewhat correct, 2 if correct) (Ex: if answer is go, and participant selects whoa- the answer is incorrect; if they select slow it it somewhat correct; if they answer go it is correct) (If correct answer is slow, and participant selects either go or whoa, the answer is somewhat correct)

Almonds	Go	0- incorrect	1- somewhat correct	2- correct
Cabbage	Go	0- incorrect	1- somewhat correct	2- correct
Cupcake	Whoa	0- incorrect	1- somewhat correct	2- correct
Green Beans	Go	0- incorrect	1- somewhat correct	2- correct
Cottage cheese	Go	0- incorrect	1- somewhat correct	2- correct
Boiled Eggs	Go	0- incorrect	1- somewhat correct	2- correct
Broccoli	Go	0- incorrect	1- somewhat correct	2- correct
Oatmeal	Go	0- incorrect	1- somewhat correct	2- correct
Kiwi	Go	0- incorrect	1- somewhat correct	2- correct
Ice Cream	Whoa	0- incorrect	1- somewhat correct	2- correct
Grapes	Go	0- incorrect	1- somewhat correct	2- correct
Choc Milk	Slow	0- incorrect	1- somewhat correct	2- correct
Animal crackers	Slow	0- incorrect	1- somewhat correct	2- correct
Popcorn	Slow	0- incorrect	1- somewhat correct	2- correct
Milk	Go	0- incorrect	1- somewhat correct	2- correct
Rice	Go	0- incorrect	1- somewhat correct	2- correct
Cookies	Whoa	0- incorrect	1- somewhat correct	2- correct
Chicken leg	Slow	0- incorrect	1- somewhat correct	2- correct
Pop Tarts	Whoa	0- incorrect	1- somewhat correct	2- correct

Make your own plate **(write in order the first 4 selections the child makes)- score on last sheet**

Breakfast

____

____

____

____

Lunch

____

____

____

____

Snack

____

____

____

____

What beverage would you choose? Write the first beverage selected

____

Give the following point values for each answer:

BREAKFAST	LUNCH	SNACK	BEVERAGES
Yogurt 2	Lunchable 1	Blueberries 2	Orange juice 1
Cheerios 2	Pepperoni pizza 0	Wheat crackers 2	Lemon lime soda 0
Wheat bread 2	Turkey sandwich 2	Doritos 0	Cola 0
Pancakes 1	Grilled cheese 1	Popcorn 1	Chocolate milk 1
Muffin 1	Chicken leg 1	Apples 2	White milk 2
Bananas 2	Chicken tenders 0	Cheese cubes 1	Juice box 1
Waffles 1	French fries 0	Celery 2	Fruit punch 0
Biscuit 1	Carrots 2	Animal crackers 1	Water 2
Fruit loops 0	Broccoli 2	Doughnut 0	
Pastry 0	Salad 2	Gogurt 1	
Egg 2	Cupcake 0	Pizza rolls 0	
Oatmeal 2	Cookies 0	Buttery crackers 1	
Doughnut 0	Potato chips 0	Almonds 2	
Sausage biscuit- 0	Watermelon 2	Cookies 0	
Pop tart 0	Apples 2	Goldfish 1	

Add the total for each subscale

Food ID _______________

Food Group Categories ____________________

GO, SLOW, WHOA _____________________

Meal, Snack and Beverage Choice ____________________

Total scale score _______________________________

VITA

MICHELLE JOHNSON

Education:

Public Schools, Brevard, North Carolina

B.A. Psychology, North Carolina State University, Raleigh, North Carolina, 1994

M.S. Human in Nutrition, Winthrop University, Rock Hill, South Carolina, 2003

Ph.D. Early Childhood Education, East Tennessee State University, Johnson City, Tennessee, 2017

Professional Experience:

Graduate Assistant/ Teaching Assistant, Winthrop University; Rock Hill, South Carolina, 2000-2001

Adjunct Instructor**,** Queens University of Charlotte; Charlotte, North Carolina, 2004-2007

Adjunct Instructor, Winthrop University; Rock Hill South Carolina, 2005

Registered Dietitian**,** Morrison Healthcare; Charlotte, North Carolina, 2003-2005

Clinical Nutrition Manager, Morrison Healthcare; Charlotte, North Carolina, 2008-2009

Registered Dietitian**,** Morrison Healthcare; Charlotte, North Carolina, 2009-2011

Assistant Professor, East Tennessee State University; Johnson City, Tennessee, 2011-2017

Registered Dietitian, ETSU Physicians & Associates; Johnson City, Tennessee, 2017

Director, Dietetic Internship, East Tennessee State University; Johnson City, Tennessee, 2017

Publications:

Johnson, M. (2017, April). *Examining the Impact of Implementation of the Comprehensive Nutrition Program Rainbow in My Tummy® in the Child-Care Setting*. Poster session presented at the meeting of the American Society for Nutrition, Chicago, IL.

Johnson, Michelle. (2013). Examining the relationship between age of exposure and number of repeated exposures on consumption of fruits and vegetables in the child-care setting. *Journal of the Academy of Nutrition and Dietetics*. 113(9): A93.

Honors and Awards:

Patsyjane O'Malley Memorial Scholarship

Phi Kappa Phi