EVERYTHING I KNOW I LEARNED IN PRESCHOOL: A LOOK AT HOW THREE-TO-FIVE YEAR-OLDS CATEGORIZE FOODS INTO FOOD GROUPS

by:

LINDSAY E. MARSHALL

(Under the Direction of David Wright)

ABSTRACT

Over the last twenty years, childhood overweight has become a growing epidemic. In 2006 it was estimated that 15% of children in America were overweight or obese, which is almost twice as many as in 1996. One issue in addressing this problem is the fact that nutrition education typically isn't introduced to children until early adolescence and this late introduction of nutrition education may be missing a key audience in the battle against childhood obesity. The purpose of this study was to determine whether three- to five-year-old preschool children know about food groups and whether education increases that knowledge. Nutritional knowledge was assessed by a child food sort and data were analyzed using t-tests and ANOVAs. Children in this study were found to have a low to moderate level of understanding when it came to nutritional knowledge and this level of understanding did not increase with education.

INDEX WORDS: Childhood overweight, Nutrition education, Preschool children, Categorization, Food groups

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# DEDICATION

This research is dedicated to my parents, Paul and Karen Marshall, for being so proud, supportive, and encouraging thus far in my graduate career.

# ACKNOWLEDGMENTS

I would like to thank my family, friends, and committee, who have been so positive and encouraging throughout this process. I would especially like to thank Diane Bales, Mick Coleman, and Charlotte Wallinga for allowing me to use their data for this thesis.

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# CHAPTER 1

## INTRODUCTION

The prevalence of childhood overweight has dramatically increased in recent decades. Since the 1970s, the number of children over the age of six in the United States who fall under this category has tripled to nine million (Institute of Medicine, 2005). In 2002, 16.2% of California children under age five were overweight, compared to 13.5% of young children nationwide (Center for Health Improvement, 2005). These numbers are not only shocking, but they are a serious cause for concern because childhood overweight is not just an issue during childhood - it is a long-term health problem. Not only are overweight children more likely to be overweight as adults (Dietz & Robinson, 2008; Gable & Lutz, 2000; Krishnamoorthy, Hart, & Jalalian, 2006; Laessle, Uhl, & Lindel, 2001; Maffeis et al., 2000), these children are sometimes diagnosed with sleep disturbances and complicated, life-long diseases, such as diabetes (DeMattia & Denney, 2008), hypertension, and asthma (Krishnamoorthy et al., 2006).

Childhood overweight, the preferred term in use by the Centers for Disease Control and Prevention and the American Academy of Pediatrics, is currently defined as a child whose body mass index (BMI) is in the 95$^{th}$ percentile or higher (Jordan, 2008), with children whose BMI is between the 85$^{th}$ and 94$^{th}$ percentile being defined as at risk for overweight (Institute of Medicine, 2005; Jordan, 2008). However, as Jordan (2008) notes, using this terminology, only 18 percent of children are classified as overweight, which overlooks the nearly one-third of children who are too heavy for their height/age.

*Statement of the Problem*

It is extremely important to begin promoting healthy eating and activity habits at as early an age as possible (Rhee, 2008), yet nutrition education primarily takes place in late childhood and adolescence (Williams et al., 2002). Nutrition education primarily taking place in late childhood and adolescence is a problem in itself because primary age children's nutritional knowledge has been found to predict eating behaviors (Axelson, Federline, & Brinberg, 1985). Stolley et al. (2003) stresses that preschool children may be the critical age group in which nutrition education is needed in order to prevent childhood overweight in the future. However, it is not known if children this age are too young to fully understand nutrition education.

*Purpose of the Study*

Since nutritional knowledge is commonly assessed using sorting tasks, the purpose of this study is to determine whether three-to-five-year-old preschool children understand food group categorization and whether education increases their understanding.

# CHAPTER 2

## LITERATURE REVIEW

Childhood obesity has become a large scale international health problem over the past two decades (Birch et al., 2001; Chaput, Brunet, & Tremblay, 2006; Crawford, Timperio, Telford, & Salmon, 2006) and is rapidly getting worse (Birch et al. 2001; Faith et al., 2004; Faith et al., 2001; Johnson & Birch, 1994; Kaur et al, 2006) especially among low-income groups (Horodynski & Stommel, 2005). Between 1976 and 2004 the prevalence of obesity for children aged two-five increased from 5.0% to 13.9%; "for those aged 6–11 years, prevalence increased from 6.5% to 18.8%; and for those aged 12–19 years, prevalence increased from 5.0% to 17.4%" (Centers for Disease Control and Prevention, 2006; Krishnamoorthy, Hart, & Jelalian, 2006).

Childhood obesity does not end at adolescence or adulthood and it has long term effects into adulthood. One study found that 25% of obese adults had been overweight as children and that if children are overweight before they are eight years old, the severity of obesity in adulthood is likely to be greater (Centers for Disease Control and Prevention, 2006). Laessle et al. (2001) found that children who are overweight are two to four times more likely to become obese adults, while Maffeis et al. (2000) say 30-60% remain obese as adults. Regardless of the percentage the fact remains the same; obese children are more likely to become obese adults (Gable & Lutz, 2000).

So why has childhood obesity become so prevalent in society today? Very young children have the innate ability to self-regulate caloric and dietary intake, (Kaur et al., 2006), but a variety of environmental factors (Birch et al., 2001; Center for Disease Control and Prevention,

2006; Faith et al., 2004; Faith et al., 2001; Gable & Lutz, 2000; Hardus et al., 2003), including parents, school, media, and neighborhoods affect children's ability to respond to their internal cues (Kaur et al., 2006), thus leading to childhood obesity.

*Nutritional Knowledge in Preschool*

Stolley et al. (2003) stress that with the dramatic rise of childhood obesity in recent decades, preschool children may be a critical age group in which nutrition education is needed in order to prevent childhood obesity in the future. To this researcher's knowledge there is no research today on preschool children's knowledge of nutrition specifically as it relates to the food guide pyramid. In fact, studies that do look at preschool children's knowledge of nutrition typically ask children which foods are "good vs. bad" or ask them to sort foods according to "high in fat, high in sugar, or high in fiber" or "breakfast, lunch, and dinner." Axelon et al. (1985) argues that children's nutritional knowledge has been found to predict eating behaviors; however, in a study by Gibson et al. (1998) children's nutritional knowledge was not related to their eating behaviors when it came to fruit, vegetables, and fruit juice.

*Categorization Ability in Preschool*

Even young babies can categorize objects based on physical characteristics. In fact, seven-to-twelve month-old children can organize items into food items, animals, plants, cars, etc. (Mandler & McDonough, 1996, 1998; Oakes, Coppage, & Dingel, 1997). Between 12 and 15 months, although they do not physically sort items, children touch items that are alike, but by 16 months they can group items into individual categories, and by 18 months they can sort items into two groups (Gopnik & Meltzoff, 1987). At this age children also begin to categorize themselves based on social categories such as age, gender, appearance, and behavior (Stipek, Gralinski, & Kopp, 1990). For example, 18 month-old boys begin to realize that they are boys

and are different from girls. They may play with trucks or wrestle more than girls their age, and they realize that they are not babies.

When children enter preschool, they are in what Piaget termed preoperational thought (Inhelder & Piaget, 1963). Preoperational means that children's thoughts are not yet logical, thus they have difficulty ordering items hierarchically into classes and subclasses that are based on similarities and differences. Piaget demonstrated this concept through use of his class inclusion problem. In this example, he showed children four blue flowers and 12 yellow flowers, both of which were different types. Preschool children often categorized the flowers into two groups based on their color, and failed to see that they could all be placed in one group because they are all flowers. However, because many of Piaget's studies used items that may not have been familiar to the children, or too many pieces of information were shown to the children at one time, Piaget's findings were based on developmentally inappropriate methods. Therefore, he may have missed instances of children's categorization reasoning.

Indeed, although children's categorization abilities have been found to vary during the preschool years, by the time a child is three or four he can typically do well sorting items, and can easily move between basic-level categories, general categories, and even sub-categories (Gopnik & Nazzi, 2003). For example, children this age would typically do well sorting an apple as an object that is red, a fruit, or something they eat for breakfast or a snack.

*Categorization of Foods*

Since categorization tasks are not unreasonable to expect of preschool children, many studies have looked at how children between the ages of three and five categorize food items in attempts to infer nutritional knowledge. Although the desired outcome is similar for most studies, they tend use different methods to reach this outcome.

Turner (1997) had 70 teachers interview three children in each of their classrooms in order to determine the child's understanding of food and nutrition, including how they group foods. The children in the study ranged from five to twelve years of age. Pictures of food items that would be familiar to the children were used and included fruits and vegetables, meat and fish, and bread and cereal. Children were shown a maximum of 30 cards and foods which were unfamiliar to the children were not used. The children were asked to name the food depicted and simply place them into groups, giving their rationale for their selections. The researcher was able to identify eight common groups formed by the children in this study, and the majority of the children based their groupings on food groups. Within the food groups, fruits and vegetables were the most common groupings, followed by meat or fish. Grains and dairy groupings were rare, particularly among children ages five to seven. In her 1992 study however, Turner found that children as young as four years old can categorize foods into food groups when sorting actual food items, as opposed to pictures.

Matheson, Spranger, and Saxe (2002) had similar findings when they examined the criteria used by preschool children when categorizing foods through open-ended interviews and observations. The children were shown four pictures depicting food items and were asked to name them and then identify the food that did not belong and rationalize their selection. This was repeated four times, using pictures to represent four food groups: meat, fruit, vegetable, and dairy. They found that the justification provided by preschool children was often based on physical characteristics of the food, such as color or shape, not food groups.

In 2003, Nguyen and Murphy conducted a study using a series of five experiments to look at food through both script and taxonomic categories to determine four and seven year-olds' ability to categorize foods in both of these ways simultaneously, and if not, determine which one

children are able to do first. The purpose of their experiment one was to determine how children categorize foods and at what age these abilities appear and included 16 four-year-olds and 16 seven-year-olds. Children were shown pictures of a food item and then shown two other food items and asked which food item was the same as the first food item. They were interviewed individually in their classrooms and findings suggest that children had difficulty categorizing breads and grains, as the researchers hypothesized, due to the diverse selection of foods that are in this group. From this first experiment, the researchers were able to conclude that at the age of four, children are able to categorize food items by taxonomic, script, and evaluative categories. Experiment two sought to replicate experiment one, but with one to three-year-olds. The researchers found that by age three, children are able to categorize in both script and taxonomic categories, with neither dominating the other. In experiment three, the researchers wanted to know if children could cross-categorize a single food item and found that four-year-olds categorization of food items is flexible and that they can categorize the same food items into both taxonomic and script categories. Experiments four and five looked at children's inductive selectivity and for the purpose of this literature review their findings were not relevant.

Deviating from the "pick one" and free categorization styles presented above, Nguyen (2007) investigated how three, four, and seven year-old children categorized 70 pictures of food items as either healthy or junky, six of which children were asked to justify their reasoning. Healthy foods were defined as foods that are "good for your body if you eat a lot of them for a long time" whereas junky foods were defined as foods that are "bad for your body if you eat a lot of them for a long time" (p. 115). Findings suggested that all the children had difficulty in identifying junky foods, particularly foods made from vegetables (potato chips), meats (hot dogs and hamburgers), grains (poptarts), and beverages (soda and milk shakes). Contrary to

Matheson, Spranger, and Saxe (2002) the researcher did not identify the ways in which these three and four year-olds justified their categorizations.

*Gaps in Literature*

This review of literature did not reveal any studies of preschool children's nutritional knowledge specifically related to the food pyramid, as studies reviewed typically asked children to categorize foods into groups such as "good vs. bad" "high in fat, high in sugar, or high in fiber" or "breakfast, lunch, and dinner" or allow children to freely categorize foods into their own groups. Because of this gap in the literature, the purpose of this study was to see if three-to-five-year-old preschool children could understand food group categorization and whether education increased this understanding, in order to determine whether food categorization is an appropriate means of teaching nutrition education to preschool children.

*Theoretical Framework*

The theoretical basis for this study is informed by Bronfenbrenner's ecological framework and symbolic interactionism. The ecological framework places the child in the center of their own universe and illustrates that children are influenced by their interactions with their environment. These interactions can be both direct and indirect and, although we know there has to be a process through which the children are influenced, we do not know what it is. Symbolic interaction can help explain this process by explaining how children make meaning through the use of symbols.

*Ecological Framework.* Ecological theory posits that the relationship between a child and his/her environment is so defined that one cannot be understood without considering the other (Boss, Doherty, LaRossa, Schumm, & Steinmetz, 1993). According to Bronfenbrenner (1979) the child always develops in the context of family-type relationships and development is

the outcome of the interaction with the immediate family and the environment. The child interacts with four levels: a microsystem (direct influences on the individual), mesosystem (relationship between two or more microsystems), an exosystem (indirect external influences), and a macrosystem (culture). Children's nutritional knowledge is largely influenced by the microsystem, which includes parents and teachers, but is also influenced by the three other systems, through media and other outlets. Due to the multifaceted nature of the ecological framework, it is impossible to encompass every system into a study. Since nutrition education primarily takes place in a school setting, to understand children's nutritional knowledge we must study the microsystem (teacher) and the influence it has on the children in their classroom.

*Symbolic Interaction.* What ecological framework leaves out, however, is the way in which these interactions take place. Using symbolic interaction terminology, the microsystem is comprised of signs and symbols from which one interprets meaning. Children pay attention to the signs and symbols presented to them through their interactions with their teachers. Through both verbal and nonverbal communication and the behaviors that teachers and parents model, the child's perception of health is formed.

# CHAPTER 3

# METHOD

A quasi-experimental, non-equivalent groups design was used for this study since the location of the trainings prohibited random assignment of subjects. Two groups of children were used, an experimental group and control group. Both groups received pre and post tests, but the experimental group received an educational curriculum.

## *Research Questions*

This study sought to address the overarching question: Do three-to-five-year-old preschool children understand food group categorization and can an intervention increase the level of this understanding? Three hypotheses guided the analysis:

1. Pre-test categorization means will not differ between the groups
2. Post-test categorization means for the groups will differ, with the experimental group having the higher mean.
3. Children will correctly categorize food items if they can correctly name the foods

## *Participants*

Two hundred and seventy-one preschool children between the ages three and five years-old, 140 girls and 131 boys, participated in a food group categorization activity during the observers' first visit to the child's child care center. The overall race/ethnicity of the children can be seen in Figure 1. One hundred and seventy-six of those 271 children participated in the same food group categorization activity during the observers' final visit to their center. To account for attrition, ideal sample size was calculated and at a 95% confidence level with a 5%

margin of error and a population size of 271, the recommended sample size was 160. Using a random number generator, the researcher randomly selected 160 of the 176 children who completed both pre and post measures to be included in the analysis.

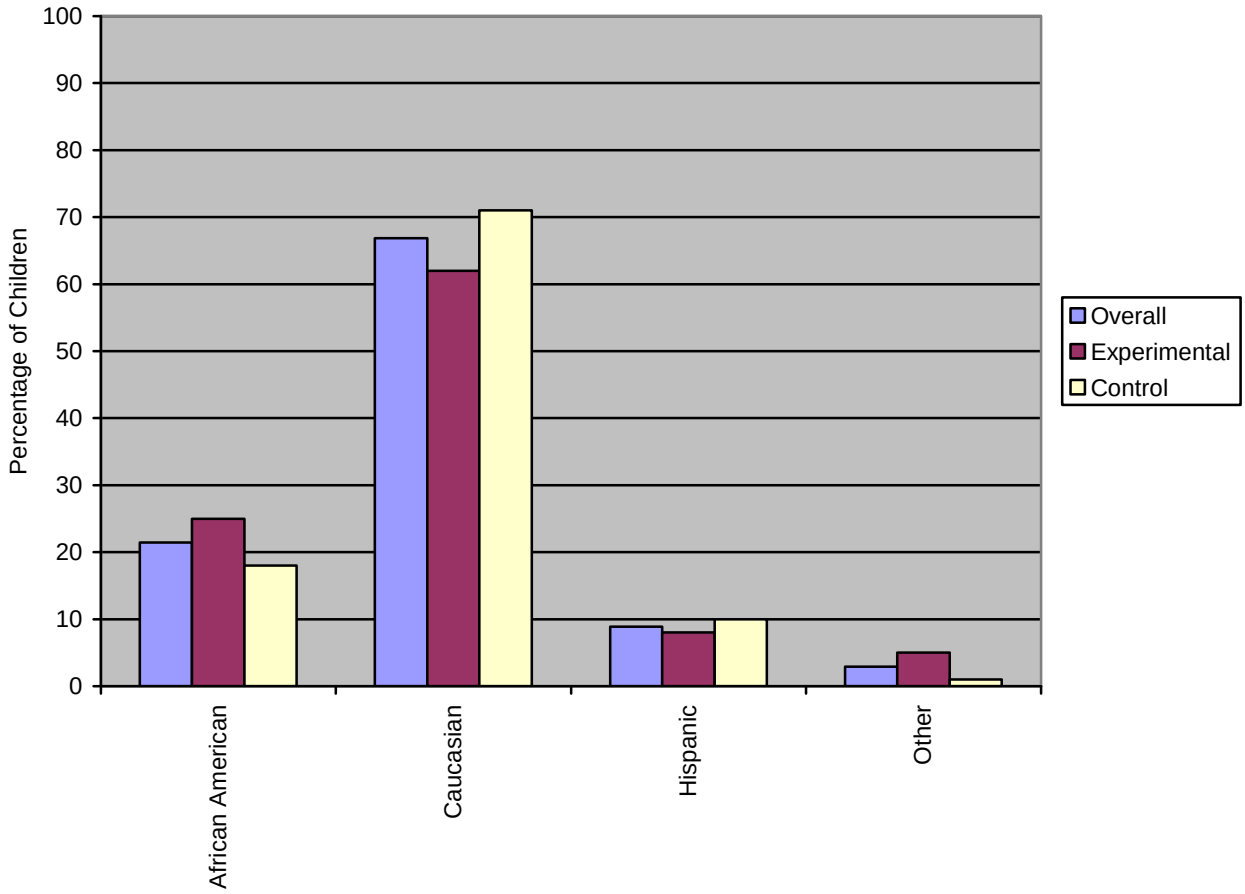


*Figure 1: Race/Ethnicity of Children*

*Design and Procedure*

This study was only a small portion of a larger study, which was funded by Bright from the Start: Georgia Department of Early Care and Learning, to evaluate the effectiveness of the *Eat Healthy, Be Active* curriculum. Eighty-five child care centers in Athens and the Atlanta area were recommended by local resource and referral agencies and were recruited to participate in the study. Based on the criteria for center participation set by the researchers (such as operating more than six hours per day, a licensing capacity of 40 or more, and teachers in the three-to-five-year-old classrooms could not be certified), 24 of these 85 child care centers were selected to participate. The range of teacher education can be seen in figure 2. (For a complete list of criteria for center eligibility, see Appendix A).

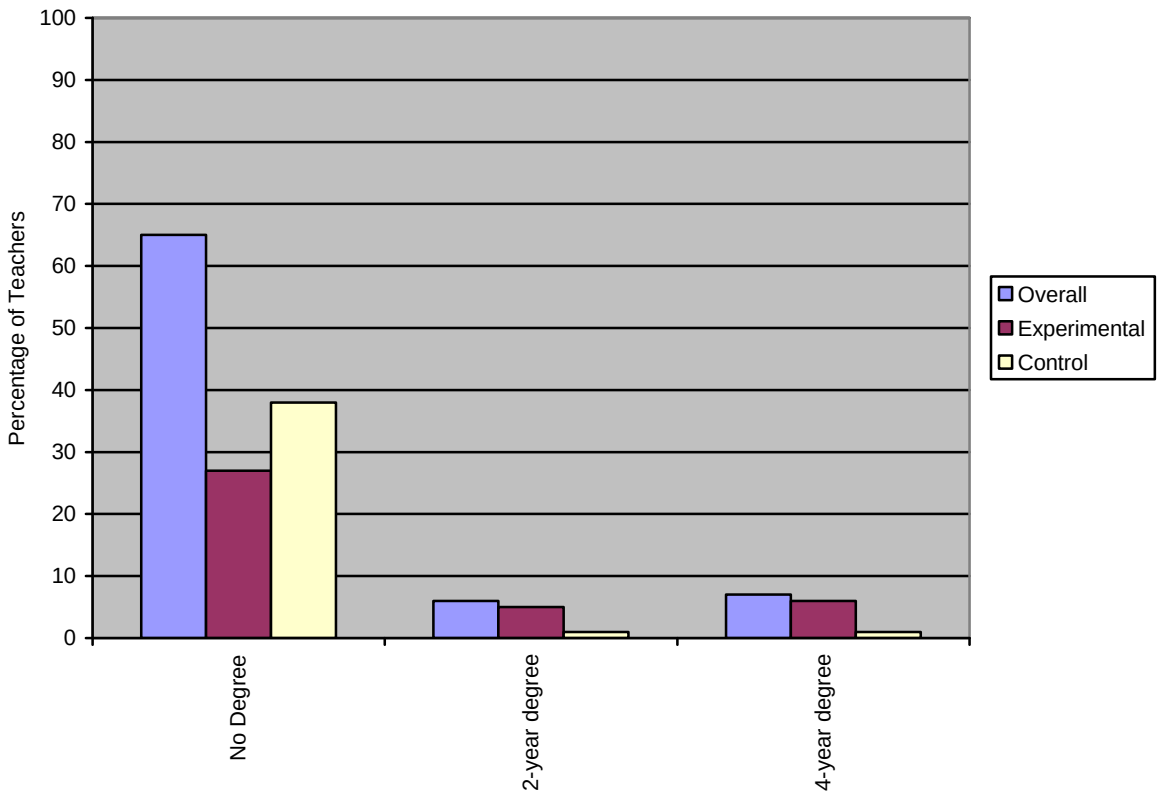


*Figure 2: Teacher Education*

Center directors were asked to sign consent forms and after completing the consent forms a maximum of two classrooms from each center were selected to participate in the study, for a total of 33 classrooms. All teachers in the selected classrooms were asked to sign consent forms and consent forms were sent home to parents for signatures allowing their children to participate in the study. As an incentive for parents to allow their children to participate in this study, parents of participating children were given the option to enter in a prize drawing for a chance to win $50. Two hundred and seventy-one consent forms were returned to researchers by parents.

The 24 participating centers were divided into experimental and control groups based on their proximity to the corresponding trainings. As part of the centers' and teachers' agreement to participate, the teachers at all centers were required to attend a three-hour training. Teachers in the control group, made up of 11 centers, attended a training on Family Involvement and teachers in the experimental group, made of up 13 centers, attended a training on the *Eat Healthy, Be Active* curriculum developed in 2006 by Drs. Diane Bales, Mick Coleman, and Charlotte Wallinga in the Department of Child and Family Development at The University of Georgia. The *Eat Healthy, Be Active* training highlighted hands on activities that could be found in the curriculum, as an example of how teachers could use the curriculum in their classrooms, along with background of childhood overweight as an international health problem. As a condition of the study, the teachers agreed to implement the curriculum activities in their classrooms for at least one week, and were encouraged to modify the curriculum as needed for use in their own classrooms. Of these 24 centers, five of these centers were dropped due to teachers' inability to participate in the training, leaving a total of 19 centers to participate in this study (ten control and nine experimental).

Over the course of three months, four trained graduate student observers visited the 19 centers in pairs, prepared with a protocol/script for their observations. The trained observers had to demonstrate the ability to follow the protocol correctly prior to conducting any observations. One observer was located in each classroom, unless the center had only one classroom. On the first visit to the center, the graduate student observers administered the child food sort individually in a quiet area of the classroom where the teacher could see both the child and the observer, to the children whose parents had returned consent.

After the first visit to the centers, teachers in all 19 centers then received their three hour training on their corresponding topic. Observers then returned to the control centers for a second and final visit to administer the child food sort a second time. Teachers in the experimental group were to implement the *Eat Healthy, Be Active* curriculum in their classrooms for at least one week and were observed by the researchers. A minimum of two weeks was required between the training and the final visit, in order to allow teachers time to implement the activities in the classroom prior to observers arriving.

Teachers in the experimental group received a copy of the curriculum that they could keep, which consists of hands-on, developmentally appropriate activities for 3 to 5 year-olds related to nutrition and physical activity. A resource kit with most of the materials necessary to complete all of the lessons in the curriculum (with the exception of food items, art supplies, and/or disposable items) was given to each classroom to utilize after the teachers had been trained. Teachers were expected to implement some of the activities in the classroom, although with the exception of having to implement a large group activity for the observers, it was not specified how many. After the teachers attended the training and received the resource kit

observers returned to the center for a third and final visit to administer the child food sort a second time.

*Measures*

The Child Food Sort was designed to assess children's ability to correctly identify several common foods and how they categorize these foods into the food groups. The observer presented the children with five blue bins, each with a picture of a food on the front to represent each food group (banana [fruit], hamburger [protein], carrots [vegetable], milk [milk], and a hamburger bun [grains]). The observer asked the children to identify the foods pictured on each bin. The observer then presented the children with a lunchbox that contained ten plastic food models (apple, orange, peas, corn, milk, cheese, chicken, hot dog, bread, cereal). The observer explained each box to the children; for example, "In my lunchbox, I have some pretend food. If I give you something you think is a fruit, like a banana (pointing to the picture of a banana), you put it in this box. If you think it's a vegetable, like carrots (pointing to the picture of carrots), you put it in this box, etc."

The researcher then handed the children one food item (apple, orange, corn, peas, cereal, slice of bread, glass of milk, cheese, hot dog, and chicken) from the lunchbox at a time and asked them to name the food. If the child did not know, or misidentified the food, he or she was told the correct name of the food.

The children were then asked to put the food item in a box. They were praised on their sorting, regardless of which bin they chose and the observers did not correct the children. The observer recorded each child's responses on the Child Food Sort Data Form (Appendix B).

Because the Child Food Sort was a new instrument, no formal assessment of validity and reliability had been undertaken. It was, however, pilot tested in the Head Start classrooms at the

Child Development Lab at the McPhaul Center at The University of Georgia, to determine children's understanding of the measure's protocol, as well as their ability to identify the pictures of food items and the actual food items themselves, and their ability to categorize the foods into food groups. After some refinement, the children seemed to be successful at the task of correctly naming and categorizing the food items, and the measure was deemed to have content and face validity, as it appeared to measure what it was intended.

*Data Analysis*

The data were analyzed using SPSS 16.0. Two t-tests and ten ANOVAs were conducted. Following the work of Nguyen (2007), correct answers on naming foods or correctly categorizing food items were assigned a score of "1" and incorrect answers were assigned a score of "0". The scores were then summed together.

*Hypothesis One.* An independent-samples t-test was conducted to evaluate the hypothesis that pre-test means of the control and experimental group's ability to correctly categorize foods would not differ. The variable used was the number of food items that each child categorized correctly (for a total of 10 if all food items were correctly categorized).

*Hypothesis Two.* An independent-samples t-test was conducted to evaluate the hypothesis that post-test means between the control and experimental group's ability to correctly categorize foods would differ with the experimental group being higher. The variable used was the number of food items that each child categorized correctly (for a total of 10 if all food items were correctly categorized).

*Hypothesis Three.* Ten ANOVAs were conducted to evaluate the hypothesis that the children would more accurately categorize food items if they correctly named the foods. The

foods were “apple,” “bread,” “corn,” “cereal,” “cheese,” “chicken,” “hot dog,” “milk,” “orange,” and “peas.”

# CHAPTER 4

# RESULTS

*Hypothesis One*

An independent-samples t-test was conducted to evaluate the hypothesis that pre-test means between the control and experimental group's ability to correctly categorize foods did not differ. Children in the experimental group ($M = 3.40$, $SD = 1.81$) on the average scored slightly higher on the food sort than those in the control group ($M = 3.38$, $SD = 1.79$) during the pre-test. However, children in general classified very few food items correctly, as can be seen by the means, which were based on a range of 0 to 10. As hypothesized, the difference between the means was not statistically significant, $t(166) = .046$, $p = .963$.

*Hypothesis Two*

An independent-samples t-test was conducted to evaluate the hypothesis that post-test means between the control and experimental groups' ability to correctly categorize foods did differ, with the experimental group being higher. Children in the experimental group ($M = 4.09$, $SD = 2.08$) on the average scored slightly higher on the food sort than those in the control group ($M = 3.99$, $SD = 1.93$) during the post-test. Although the average increased slightly for both groups, children in general classified very few food items correctly. Contrary to the research hypothesis, the test was not statistically significant, $t(166) = .336$, $p = .738$.

*Hypothesis Three*

Ten ANOVAs were conducted to evaluate the hypothesis that children will be more likely to correctly categorize food items if they correctly named the foods. The independent

variable, group, included two levels: experimental and control. The dependent variable was whether they correctly sorted the food items into the corresponding bins.

Nine of the ten ANOVAs were not significant, as can be seen with the high p-values and low $\eta^2$ in Table 1. Contrary to the rest of the food items, the ANOVA for cheese was significant, $F(1, 302) = 5.847$, $p = .016$.

In addition to these hypotheses, when children were asked to name the foods they were shown, interestingly, peas were commonly misnamed as green beans, but children were not less likely to correctly categorize them than foods they named correctly. The foods children were most likely to correctly name and categorize were milk, fruit, and bread.

Children who knew the food groups or understood food group categorization typically sorted food items correctly, with the exception of cheese and cereal. No children correctly named and categorized every food item, yet no children incorrectly named and categorized every food item.

Table 1

*Did the Children Correctly Categorize the Food Items? Pre and Post Tests Combined.*

| | Control | | Experimental | | | | |
|---|---|---|---|---|---|---|---|
| Item | *M* | *SD* | *M* | *SD* | *F* | $\eta^2$ | *Sig.** |
| Apple | 1.32 | .57 | 1.30 | .55 | .10 | .000 | .76 |
| Bread | 1.62 | .57 | 1.63 | .64 | .01 | .000 | .93 |
| Corn | 1.13 | .59 | 1.09 | .60 | .34 | .001 | .56 |
| Cereal | 1.03 | .43 | .99 | .49 | .75 | .002 | .39 |
| Cheese | 1.00 | .35 | 1.11 | .45 | 5.85 | .019 | .02* |
| Chicken | 1.22 | .61 | 1.21 | .64 | .01 | .000 | .93 |
| Hot Dog | 1.17 | .62 | 1.30 | 1.05 | 1.59 | .005 | .21 |
| Milk | 1.57 | .64 | 1.63 | .56 | .58 | .002 | .45 |
| Orange | 1.11 | .70 | 1.22 | .63 | 2.14 | .007 | .15 |
| Peas | .64 | .69 | .59 | .68 | .57 | .002 | .45 |

*$P < .05$

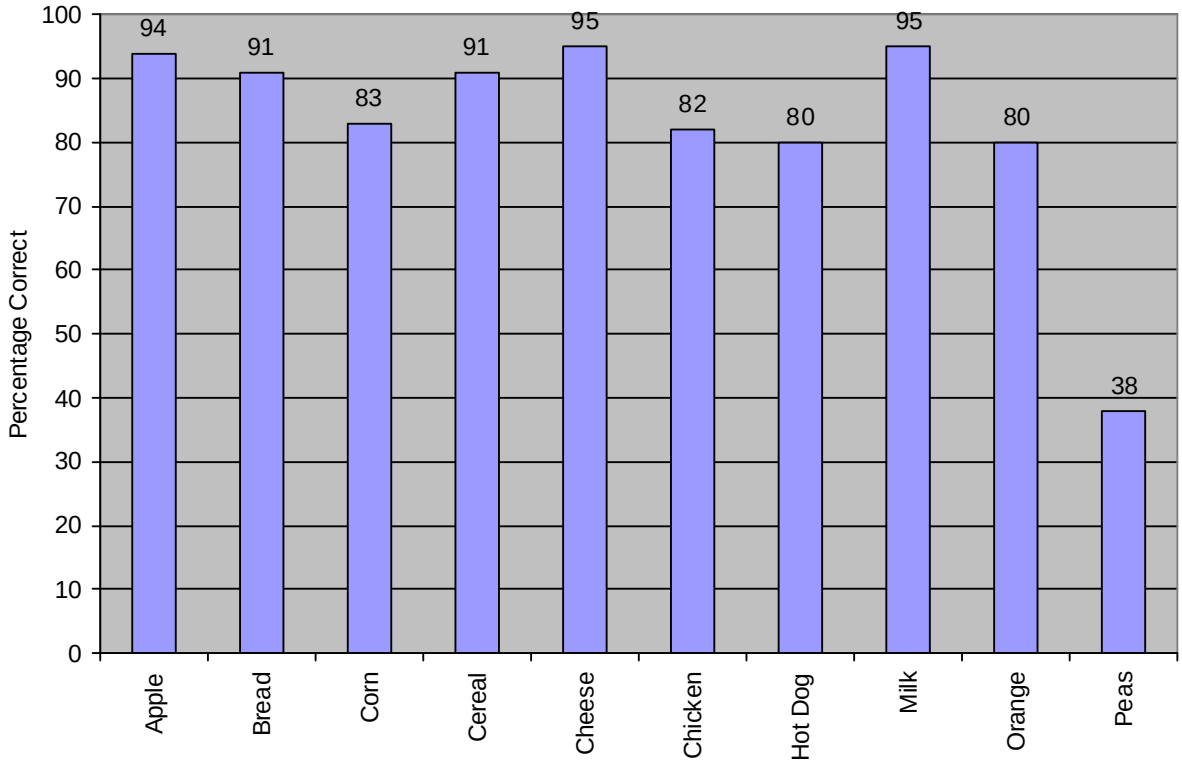


*Figure 3: Identification of Individual Food Items. Pre and Post Tests Combined.*

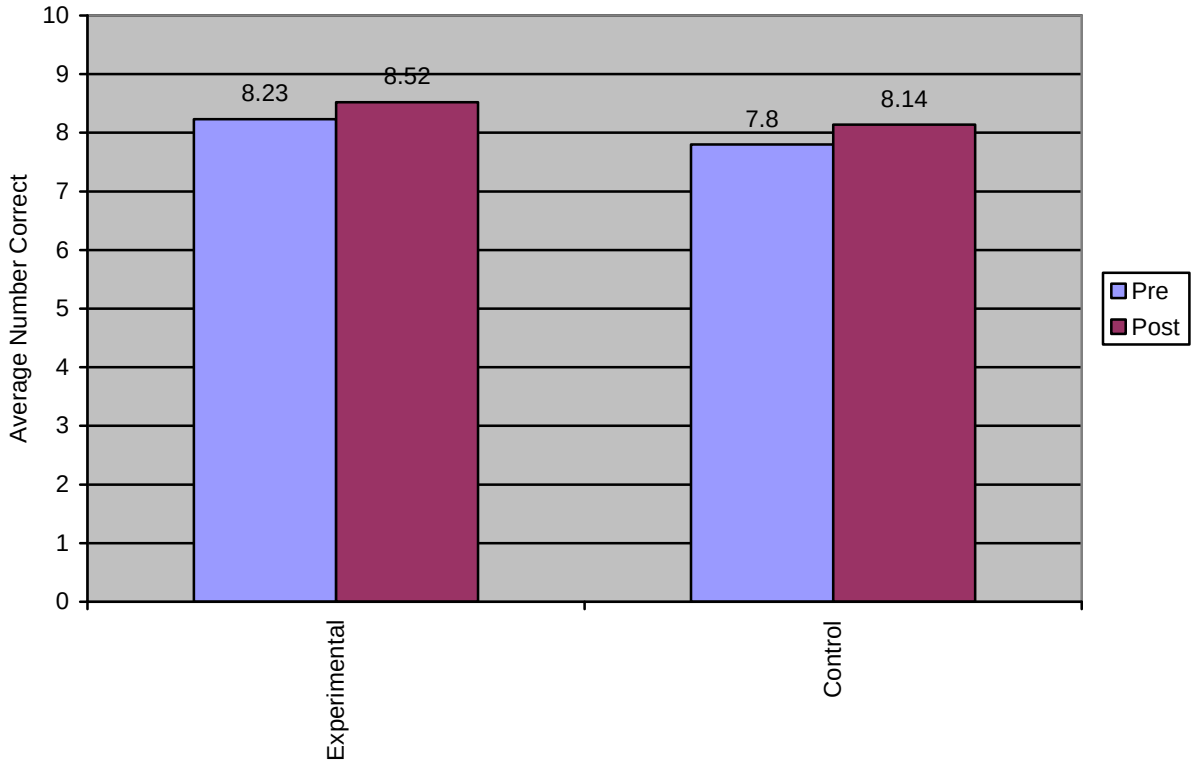


*Figure 4: Correct Naming of Food Items. Pre and Post Tests Combined.*

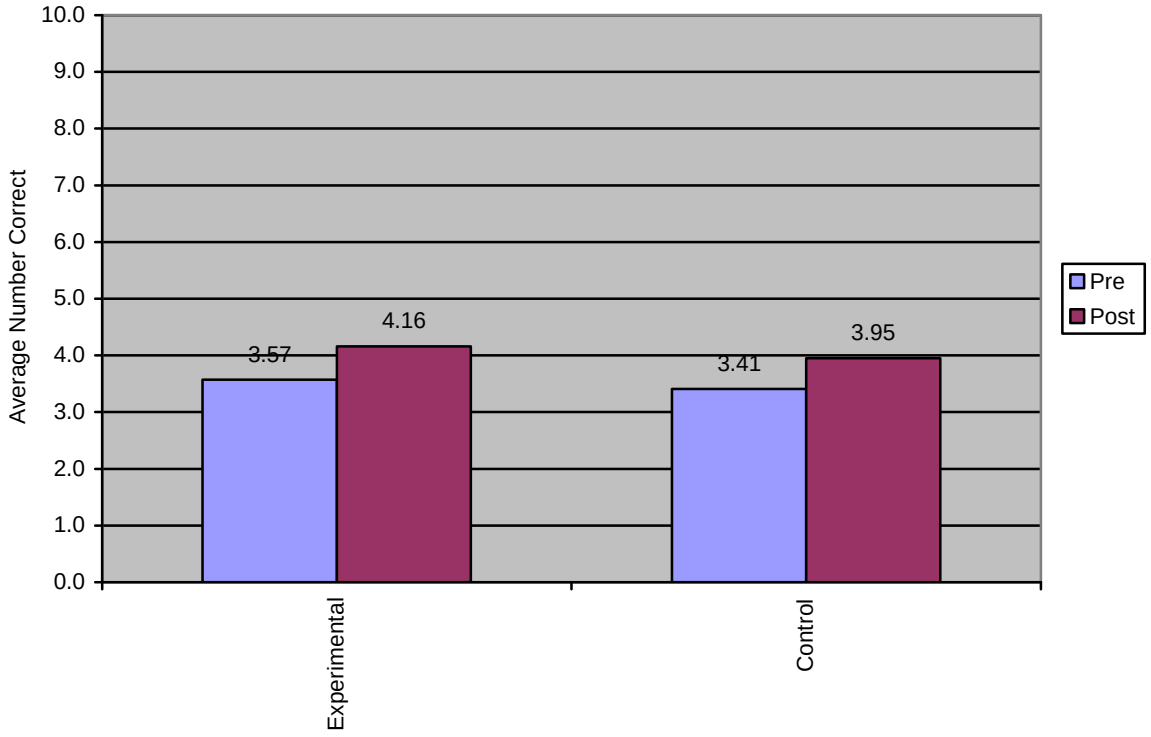


*Figure 5: Correct Categorization of Food Items*

# CHAPTER 5

# DISCUSSION

The purpose of this study was to determine whether three-to-five-year-old preschool children can understand food group categorization and to compare these preschool children's nutritional knowledge before and after exposure to the *Eat Healthy, Be Active* curriculum. Three hypotheses addressed this purpose. The first was that pre-test categorization means between the experimental and control groups would not differ. This hypothesis was supported since the group means only differed by .02, a difference that was not statistically significant. Children in both the experimental and control group had similar low levels of understanding of food group categorization when applied to the five food groups, as can be seen by the means of 3.4 and 3.38 respectively.

The second hypothesis was that post-test categorization means of the experimental and control groups would differ, with the experimental group mean being higher. In fact, the experimental and control groups did not differ statistically and contrary to expectations, both the experimental and control group means increased by .69 and .61 respectively.

The third hypothesis was that children would be more likely to correctly categorize food items if they could correctly name the foods. The results did not support this hypothesis. Children were no more likely to correctly categorize food items if they correctly named the foods.

*Discussion of Findings*

Both the experimental and control groups had similar levels of understanding prior to the educational intervention. This finding was expected and provided a clear baseline for comparison between the two groups. After the intervention, the two groups still did not differ, which was not anticipated. This result could be attributed to the short duration of the study or to the teachers not following the procedures for implementation. Due to the short duration of the study, the teachers may not have had time to optimally implement the activities between the time they received the training and the observers' final data collection visit. The larger study found that the number of activities implemented in the classroom varied widely, with some teachers only implementing a few, and others implementing many. Depending on their own individual time constraints, teachers may not have implemented the activities effectively, whether due to trying to implement too many activities, or due to other constraints.

Although the experimental and control groups did not differ after the experimental group received an educational intervention, the means in both groups increased. This increase in both groups could be a testing effect due to the child food sort being conducted in the classroom. Teachers in both groups may have observed the child food sort taking place during the initial visit and replicated signs or symbols from this activity or focused on the food groups in their classrooms in the weeks following our first visit. This increase in both groups could also represent a slight improvement in the children's understanding of categories.

When children were asked to name the foods they were shown, interestingly, peas were commonly misnamed as green beans. However, children were not less likely to correctly categorize them than foods they named correctly. This could be due to the fact that when children misnamed food items, they often misnamed them as another fruit, vegetable, meat, etc.

The foods children were most likely to correctly name and categorize were milk, fruit, and contrary to Nguyen and Murphy's (2003) findings, bread. Correctly categorizing milk and bread may have been due to the fact that we referred to these food groups as "milk" and had a picture of a carton of milk on the side and "grains" with a picture of a hamburger bun on the side.

Children who knew the food groups or understood food group categorization typically sorted food items correctly, with the exception of cheese and cereal. It is the researchers' assumption that this finding was due to the fact that these items, although familiar to the children, are often not included in discussion of the food groups as being "made from milk" or "made from grains". As suggested by Turner (1992), food models were used as opposed to pictures because Turner found that children as young as four were able to categorize foods when models were used.

When children incorrectly categorized food items, this study found results similar to those of Matheson, Spranger, and Saxe (2002). Due to the developmental ability of three to five year old children, the children were prone to categorize based on color (corn went in the fruit bin with a picture of a banana on it, and the orange went in the vegetable bin with a picture of carrots on it). This study also found that children would categorize based on their logic of what food items belong together. This logic was seen with both the food models and matching the food models to the pictures on the bins. For example, if children were handed the food item, cereal, some would place it in the milk bin because they put milk on their cereal. Another example was the food item bread. No matter where they sorted bread, some children would place cheese in the same bin as the bread because that is what they sometimes eat on bread.

*Strengths and Limitations*

Like any study, this one has both strengths and limitations. One strength of this study is that it is unique and fills a gap in the existing literature of understanding food group categorization. It makes a contribution to a sparse existing literature on preschool children's nutritional knowledge, specifically related to the food groups and categorization. A second strength is that it continues to fill the gap in the literature by introducing new measures. The majority of previous studies only have looked at how children freely categorize foods into groups, whereas this study looked at how children categorized food items specifically into food groups. A third strength is the ease with which the assessment was administered, as it took approximately ten minutes per child to complete. A final strength was the large sample size, consisting of children from several child care centers in North Georgia. These centers were located in both Athens and the Atlanta area, making it somewhat generalizable to these populations.

As with every study there are limitations. One was its duration and timing. This study took place over the summer months of May, June, and July, in which many child care centers merge their three, four, and five year old classrooms with a summer camp. Not only was this a short time frame to collect data, but many centers reported they do not have a curriculum over the summer as they "just play" or go on field trips, which limited the sample size. This more relaxed summer schedule may have affected the outcome of the study because teachers may not have followed the procedures for the activities, or only implemented them while observers were present. A second limitation is that because of the three month time frame, by the time the observers went on their first visit and the teachers received the corresponding training, teachers often had limited time to implement the curriculum in the classroom before the observers

returned for the final visits. Due to this time limitation, the teachers may not have implemented the activities in a developmentally appropriate way, if they even implemented them at all. A third limitation is that because data were only collected in North Georgia, the sample may not be representative of the United States as a whole. A fourth limitation is that the curriculum only had one hands-on activity that focused on food group categorization, which had children classify foods on a large food pyramid. If children were able to fully comprehend this categorization task, they still may not have been able to categorize foods into the proper bin because it is a higher order task without the symbols they may have been exposed to during the activity. Finally, being a quantitative measure, the child food sort did not allow the researcher to gather information as to why children sorted each food item into different foods groups. Thus, their thought process could not be recorded as in other studies reviewed in the literature.

*Recommendations for Future Research*

This study was a first step into looking at children's knowledge of nutrition when it comes to the food groups. A larger and more nationally representative sample would yield more accurate results. Also, more time should be given for teachers to implement the curriculum in the classrooms between visits. This study may be able to further contribute to existing literature by having researchers ask children to justify their categorizations, in order to compare what is currently known about nutritional knowledge in preschool children. Replicating the current study, using the Child Food Sort but asking the children to justify their categorizations may be beneficial. Adding open ended comments to the existing measure, in order to record children's verbal thought process, would assist in gaining insights on each child's own individual cognitive level. It would also be interesting to compare children's ability to categorize foods using the

bins versus the food pyramid, as the activity in the *Eat Healthy, Be Active* curriculum teaches children to sort using the food pyramid.

*Implications for Practice*

This study has implications for the practice in the child care field. Although no significant results were found there was a slight increase in children's nutritional understanding, as measured by the Child Food Sort. With a longer time frame to implement the curriculum and more teacher instruction, the *Eat Healthy, Be Active* curriculum has a promising educational benefit for three-to-five year-old children.

From this study, child care directors and teachers can take away the importance of including a hands-on nutrition education portion to their curriculum and making sure that their teachers implement curriculums in their classrooms, as it is a learning environment for the youngest children. While including this nutrition education in your classrooms, it is extremely important to not assume children know the terminology we use, such as "Eat your fruits and vegetables." Furthermore, child care teachers have a wonderful opportunity to provide parents with information concerning children's nutrition education/physical activity. This study suggests that children need time to participate in activities, repetition of concepts, and to receive feedback in order to learn. Because children are influenced by their microsystems it is important for parents to carry on nutrition education at home, including being aware of their child's activity level and diet.

When training child care providers on any subject, especially nutrition education, it is important to provide them with exactly what they will need to implement curriculums in their classroom. A majority of the teachers that participated in this study had not obtained a college degree. It may have been more helpful to have a strict curriculum that told you which activities

to do on which day. Since the *Eat Healthy, Be Active* curriculum was more flexible than that, modifications should be made prior to future trainings.

Nutrition education is a very important and timely topic for three-to-five year-old children, in order to prevent childhood overweight in the future. Although this study did not find significant results, children actively engaged in activities over a long period of time will make connections and retain nutritional knowledge and begin to incorporate what they learn in their everyday lives. The key is teacher and parent-friendly nutrition education programs.

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# APPENDICES

# Appendix A
## Center Eligibility

In order for centers to participate in this study, they may not:

- Be accredited
- Be run by a college, university, or public school
- Have teachers in the 3 – 5 year old classrooms can be certified
- Have teachers who have previously attended an *Eat Healthy, Be Active* training
- Have teachers who are familiar with the *Eat Healthy, Be Active* curriculum or have used parts of the curriculum in their classrooms
- Have an *Eat Healthy, Be Active* resource kit, or ever used materials from the kit in their classrooms

Appendix B
Child Food Sort Data Collection Form
(Form C-02-B)

Center # _____ Child # _____ Visit Date _____

Check one: _____ Pretest _____ Post-test

Protocol Reminders
Step 1: Label the foods on the bins
Step 2: Pull foods out of lunch box, one at a time

- Ask child for name
- If incorrect, supply correct name
- Ask child to place food in bin that matches food group

Step 3: Pull out cake and ice cream and follow same procedure
Step 4: Move bins out of child's reach and move on to breakfast interview
Step 5: When both tasks are done, record categories and mark whether choices were correct or not

| Food | Correct name? | If no, name used: | Category | | | | | Correct? |
|---|---|---|---|---|---|---|---|---|
| Apple | | | Grain | Fruit | Vegetable | Milk | Protein | |
| Bread | | | Grain | Fruit | Vegetable | Milk | Protein | |
| Corn* | | | Grain | Fruit | Vegetable | Milk | Protein | |
| Cereal** | | | Grain | Fruit | Vegetable | Milk | Protein | |
| Cheese | | | Grain | Fruit | Vegetable | Milk | Protein | |
| Chicken*** | | | Grain | Fruit | Vegetable | Milk | Protein | |
| Hot Dog | | | Grain | Fruit | Vegetable | Milk | Protein | |
| Milk | | | Grain | Fruit | Vegetable | Milk | Protein | |
| Orange | | | Grain | Fruit | Vegetable | Milk | Protein | |
| Peas | | | Grain | Fruit | Vegetable | Milk | Protein | |
| | | | | | | | | |
| Cake | | | Grain | Fruit | Vegetable | Milk | Protein | |
| Ice Cream | | | Grain | Fruit | Vegetable | Milk | Protein | |

**(or corn on the cob)*
***(or corn flakes)*
****(or chicken leg)*