THE EFFECT OF A COOKING CLASS PROGRAM ON THE KNOWLEDGE AND SKILLS OF 4\textsuperscript{TH}-6\textsuperscript{TH} GRADE CHILDREN IN A LOW-INCOME NEIGHBORHOOD

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ABSTRACT

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Limited research has been conducted on the effectiveness of cooking programs for children. The objectives of this study were to develop a curriculum, “Kids in the Kitchen”, and determine its effectiveness on participants’ nutrition knowledge and cooking skills. Participants were 4th through 6th grade children from a low-income, urban area. This study was a quasi-experimental design with an intervention (n = 13) and control group (n = 11). The intervention, consisting of seven lessons about the Food Guide Pyramid and preparation of recipes, was based on the social learning theory and taught by the researcher. The study was conducted at a YMCA during an after-school program. Written pre and post-tests were administered to all children at the beginning and end of the intervention. A skills checklist was completed for the intervention students based on observation by the researcher. A written survey was administered to parents during the final session. Repeated measures analysis of variance testing found the mean number of correct answers by the intervention group (6.5 ± 3.1) was significantly higher (p = .04) than the control group (4.5 ± 2.6) at post-test. The results of the Skills Checklist indicated 92.3% of children could independently choose the correct measuring device for different ingredients. More than half of the children could use a vegetable peeler (69.2%), cheese grater (53.9%), and meat thermometer (53.9%) independently. The parent evaluation revealed that the majority of parents agreed or strongly agreed that their child knew how to: properly wash their hands before cooking (92.3%); measure ingredients (93.4%); use a vegetable peeler (92.4%); brown ground beef (84.6%); and, use a cheese grater (84.7%). The parents’ assessment matched the skill level of the child for independently measuring ingredients and using a knife. This study demonstrated a successful intervention for increasing nutrition knowledge and developing cooking skills of
inner city children. In addition, both the children and their parents were positive about the program and enjoyed the social outlet it provided. A recommendation for practitioners is to collaborate with community agencies, such as the YMCA, to provide “Kids in the Kitchen” in a constructive and safe environment.
This thesis is dedicated to my grandfather. Thank you for your constant encouragement and devotion during my college years.
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TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER I. INTRODUCTION</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statement of the Problem</td>
<td>2</td>
</tr>
<tr>
<td>Significance of the Problem</td>
<td>4</td>
</tr>
<tr>
<td>Objective</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER II. REVIEW OF LITERATURE</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development During Middle Childhood</td>
<td>7</td>
</tr>
<tr>
<td>Development of Children’s Food Preferences</td>
<td>9</td>
</tr>
<tr>
<td>Taste Preferences</td>
<td>10</td>
</tr>
<tr>
<td>Parental Controls</td>
<td>11</td>
</tr>
<tr>
<td>Nutrition Intervention</td>
<td>12</td>
</tr>
<tr>
<td>Primary Food Provider</td>
<td>13</td>
</tr>
<tr>
<td>Other Parental Behaviors</td>
<td>13</td>
</tr>
<tr>
<td>Cultural Factors</td>
<td>14</td>
</tr>
<tr>
<td>Food Aversions</td>
<td>14</td>
</tr>
<tr>
<td>Neophobia</td>
<td>15</td>
</tr>
<tr>
<td>Fruit and Vegetable Preferences and Consumption</td>
<td>15</td>
</tr>
<tr>
<td>Other Factors Influencing Food Choice and Eating Behaviors</td>
<td>16</td>
</tr>
<tr>
<td>Children’s Dietary Intake Patterns in the United States</td>
<td>18</td>
</tr>
<tr>
<td>Association Between Low Intakes of Fruit and Vegetables and Corresponding Nutrients</td>
<td>23</td>
</tr>
</tbody>
</table>
Factors That Influence Fruit and Vegetable Consumption .......................................... 24
Barriers to Consumption of Fruits and Vegetables .................................................. 26
The Effect of Nutrition on School Performance ......................................................... 27
Lack of Nutrients and Their Impact on School Performance .................................... 28
Importance of Breakfast Consumption ..................................................................... 28
Child Nutrition Programs ....................................................................................... 31
Disparity Between Food Insecure and Food Secure Households ............................ 32
Importance of Nutrition Education Programs ......................................................... 36
Studies with Social Learning Theory ....................................................................... 38
Cooking Class Interventions ................................................................................... 40

CHAPTER III. METHODS .............................................................................................. 45
Research Design ......................................................................................................... 45
Recruitment ............................................................................................................... 46
Subjects/Setting ......................................................................................................... 46
Intervention ............................................................................................................... 47
Lesson Overview ....................................................................................................... 47
Evaluation .................................................................................................................. 51
Statistical Analysis .................................................................................................... 52

CHAPTER IV. RESULTS .............................................................................................. 54
Demographics Profile ............................................................................................... 54
Knowledge Evaluation ............................................................................................. 54
Skills Checklist Evaluation ....................................................................................... 55
Attendance Evaluation .............................................................................................. 56
# LIST OF TABLES AND FIGURES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>“Kids in the Kitchen” weekly lessons, nutrients identified, cooking concepts, and recipes</td>
</tr>
<tr>
<td>2</td>
<td>Demographics profile of the “Kids in the Kitchen” participants</td>
</tr>
<tr>
<td>3</td>
<td>Observation of children performing each cooking skill for “Kids in the Kitchen” participants</td>
</tr>
<tr>
<td>4</td>
<td>Average attendance for each lesson and overall average attendance for “Kids in the Kitchen” participants</td>
</tr>
<tr>
<td>5</td>
<td>Percent of classes attended by each “Kids in the Kitchen” participant</td>
</tr>
<tr>
<td>6</td>
<td>Parent frequency (%) evaluation of the “Kids in the Kitchen” program and opinion of their child’s cooking skills</td>
</tr>
<tr>
<td>7</td>
<td>Responses from parents on three opinion questions in the “Kids in the Kitchen” evaluation</td>
</tr>
<tr>
<td>8</td>
<td>Cross tabulation results for child’s cooking skill and parents’ belief of their child’s skill</td>
</tr>
</tbody>
</table>

## Figure

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Difference in pre and post nutrition scores between “Kids in the Kitchen” participants and controls</td>
</tr>
</tbody>
</table>
CHAPTER I
INTRODUCTION

Obesity is increasing in the United States and the world. According to National Health and Nutrition Examination Survey data, overweight among six- to eleven-year old children increased from 11.3% in 1994 to 15.3% in 2000 (Ogden, Flegal, Carroll & Johnson, 2002). According to the American Academy of Pediatrics, the prevalence of overweight and obesity among children and adolescents has doubled in the past two decades (American Academy of Pediatrics, 2003). In addition, there is a higher percentage of both African-American and Hispanic American children aged six to eleven years who are overweight compared to Caucasian children (Ogden et al., 2002; United States Department Of Agriculture, 1999). Most often diet plays a major role in the prevention of chronic diseases related to overweight and obesity.

Nutrition education has become increasingly important as a strategy to decrease childhood obesity, especially among low-income children. Educating children at a younger age about nutrition can help prevent future health disparities and diseases associated with obesity that are prevalent in the United States. Specific disease categories associated with obesity are cardiovascular, endocrine system, and mental health (American Academy of Pediatrics, 2003). Obese children may suffer from cardiovascular diseases including hypertension, hypercholesterolemia, and dyslipidemia. Endocrine system diseases such as hyperinsulinism, insulin resistance, impaired glucose tolerance, non-insulin dependent diabetes mellitus, and menstrual irregularity can occur. In addition, mental health in children can be affected, primarily, depression and low self esteem.

Obesity has been linked to higher health care costs, morbidity, and mortality from chronic diseases (Dietz, 1995). Approximately $68 billion dollars are spent each year on health
care conditions related to obesity (United States Department of Agriculture, 1999). According to the Surgeon General’s “Call To Action To Prevent and Decrease Overweight and Obesity”, the total cost of obesity was estimated at $117 billion dollars (United States Department of Health and Human Services, 2001). Diet is an important component of preventing obesity.

Statement of the Problem

The number of overweight children in the United States of America is continuing to increase. According to government statistics, obesity rates are higher than previously reported, with an estimated 61 percent of U.S. adults either overweight or obese, and 13 percent of children and adolescents overweight (Anand, Basiotis & Klein, 1999). Since 1980, there are approximately twice as many overweight children and three times as many overweight adolescents in America (United States Department of Health and Human Services, 2001). Research suggests that overweight adolescents have a 70% chance of becoming overweight or obese as an adult. Even more alarming, the chances of becoming overweight or obese increase to 80% if one or more parent is overweight or obese (United States Department of Health and Human Services).

In the United States, minority populations, excluding Asian Americans, have higher rates of obesity and overweight compared to Whites (Drewnowski & Specert, 2004). More specifically, obesity is increasing among African Americans and Hispanic children. Rates of overweight and obesity are highest for Mexican American males age 6-11 years (17%), African American females 6-19 years old (16%), and adolescents 12-19 years old from low-income households (16%) (United States Department of Agriculture, 1999). The Centers for Disease Control and Prevention growth charts for the United States define overweight in children and adolescents as a sex and age specific BMI at or above the 95th percentile (Ogden, et al., 2002;
Children are classified as at risk for overweight if they are at or above the 85th percentile. Results from a cross-sectional survey (n = 4,722), based on the 1999-2000 National Health and Nutrition Examination Survey (NHANES), indicated that the prevalence of being overweight among non-Hispanic Black and Mexican American adolescents increased more than 10 percentage points from 1988-1994 and 1999-2000 (Ogden, et al.).

Obesity is a multifaceted disease that encompasses many factors (Rippe, Crossley & Ringer, 1998). One explanation for the increasing incidence of obesity is that American children and adolescents are currently less physically active than previous generations, which fosters being overweight, and developing health problems, such as: higher blood pressure, insulin and cholesterol concentrations, and abnormal lipid profiles (American Academy of Pediatrics, 2003). In 1994, a cohort study, the Child and Adolescent Trial for Cardiovascular Health (CATCH), was conducted on 4,019 children with a mean age of 9 years old. Body mass index (BMI), triceps and subscapular skinfolds ratio, and estimated body fat distributions were calculated and the results were compared to the First National Health and Nutrition Examination Survey (NHANES I), the Bogalusa Heart Study, and the Third National Health and Nutrition Examination Survey (NHANES III). Children in the CATCH study were heavier and fatter than children in the NHANES I study. Obesity was found to be higher among African Americans and Hispanics than for whites (Dwyer et al., 2000).

Another factor of obesity is the current diet quality of American children. In 1998, the United States Department of Agriculture released a report card on diet quality using Healthy Eating Index (HEI) scores (Lino, GERRIOR, Basiotis & Anand, 1998). A score of 80 or better indicates a “good” diet. African American children ages 7-10 years old scored the lowest HEI
score (65) compared to Caucasians (67) and other racial groups (69). African American children 11-18 years old had lower HEI scores (57) when compared to male (62) and female (63) Caucasians in the same age group. More recent data have been published for the diet quality of children in the 1999-2000 Healthy Eating Index (Basiotis, Carlson, Gerrior, Juan & Lino, 2004). Children ages 7-10 had an overall HEI score of 66. Females ages 11-14 scored 61.4 and males scored 60.8. When comparing the eating patterns in general of Americans, the Healthy Eating Index indicates that in 1989 the overall HEI score was 61.5 (Basiotis, Carlson, Gerrior, Juan & Lino, 2002 b). In 1996, the overall HEI score for Americans was 63.8 and remains the same in 1999-2000 (Basiotis, Carlson, Juan & Lino, 2002 a). Based on this data, the diet quality of children appears to have not improved in recent years and still needs attention by parents and health professionals.

Lack of nutrition knowledge and ongoing nutrition education in youth may be contributing to poor food choices, and ultimately childhood obesity. Furthermore, many children have little experience with cooking and food preparation. This study will examine the effect of an introductory cooking class program at the local Young Men’s Christian Association (YMCA) on the knowledge and cooking skills of 4th through 6th grade study participants from a low-income neighborhood.

Significance of the Problem

The “Kids in the Kitchen” program was developed to increase participants’ knowledge of both the Food Guide Pyramid and cooking principles. Limited research is available on the effectiveness of cooking classes’ impact on enhancing individual’s cooking skills and personal knowledge of the Food Guide Pyramid.
Results of studies conducted with cooking classes have in general been shown to have positive outcomes (Liquori, Koch, Contento, & Castle, 1998; Quinn, Horacek, & Castle, 2003; Winter, Stanton, & Boushley, 1999; Brown & Hermann, 2005). Cooking class interventions have increased exposure to new foods (Quinn et al., 2003), increased willingness to try new foods (Quinn et al., 2003), increased knowledge of nutrition (Liquori et al., 1998; Winter et al., 1999), increased self-efficacy (Liquori et al., 1998; Auld & Fulton, 1995), increased attitudes towards eating fruits and vegetables (Quinn et al.), and increased food preferences (Liquori et al.). Researchers have suggested that people from a low-income population are less likely to be provided and consequently eat nutritious foods (Basiotis & Lino, 2003). Nutrition education and high-quality meals have been shown to improve individuals’ eating habits and health status (Brady, Lindquist, Herd, and Goran, 2000).

In addition to the growing number of overweight or obese children, and the impact that excess body weight can have on a child’s future health, there is also the issue of the benefits of good nutrition on academic performance. Good nutrition is linked to learning readiness and academic achievement, decreased discipline problems, and decreased emotional problems (Brady et al., 2000). The Toledo Public Schools 2001-2002 Annual Report suggested that the average percentage of fourth grade students passing the Ohio Proficiency Tests who attend the three Toledo Public Schools in the District was 11% (Toledo Public Schools, 2002). The district is working continually to increase proficiency tests scores, and, nutrition education via the “Kids in the Kitchen” cooking class can support the districts’ efforts by re-enforcing reading, math, and science skills through activities in the program. The results from this study of youth cooking and preparing food may enhance nutrition educators’ knowledge of the effectiveness of cooking classes on personal knowledge of the Food Guide Pyramid and children’s cooking skills. By
giving children the knowledge needed to make healthy food choices, they can be empowered to begin to take better control of their health.

The CATCH study is a prime example of empowering children to make healthier food and lifestyle choices. CATCH was a large randomized control trial that included individual, school, and family interventions (Nader et al., 1999). The study focused on improving healthy eating habits, increasing physical activity, improving school cafeteria and physical education programs, establishing non smoking curriculum in schools, and involving parents in improving cardiovascular risk factors for children. The CATCH cohort study included third grade children from 96 national schools (n = 3,714), which included 56 schools in the intervention group, and 40 schools in the control group. Children that participated until the three-year follow up had higher daily physical activity. Among 8th graders, the intervention group students averaged 30.2 minutes of physical activity compared to 22.1 minutes in the control group. Also, children in the intervention group consumed less total fat (30.6% vs. 31.6%) and saturated fat (11.3 vs. 11.8) than the control group. Interventions such as the CATCH cohort study support the idea that school based nutrition education can be highly effective in providing children with the knowledge to change behaviors.

Objective

The objectives of this study are to use the “Kids in the Kitchen” nutrition education program with low income 4th-6th graders to increase participants’ knowledge of the food guide pyramid, appropriate food serving sizes, recommended number of servings per day from each food group, and identification of key nutrients found in foods and food groups. An additional objective is to improve skills related to food safety and cleanliness in the kitchen, the use of kitchen equipment and utensils, and cleaning up after meal preparation.
CHAPTER II
REVIEW OF LITERATURE
Development During Middle Childhood Years

School-aged children obtain health information from many resources including parents, teachers, television, and the media (Berk, 2002). Having various health resources is important for children; however, they may receive conflicting information with differences in accuracy between the sources. Researchers developed eight-nutrition education messages about eight different foods, four of which were true and four of which were nutrition misconceptions (Main & Wise, 2002). The questionnaires were distributed to 200 customers sitting in a café during off peak times. The results indicated that out of 169 individuals who completed the questionnaires correctly, a significant difference was found for correlation coefficients between agreement and compliance (p< .001). Those that believed the message was true appeared to frequently comply with the message even though it was false, and those who knew the message was false did not comply with it. Researchers concluded that those who have correct nutrition knowledge act with correct behavior. On the other hand, those that agreed with the misconceptions appeared to engage in incorrect behavior. For this reason, having nutrition educators provide correct nutrition information is a necessity.

Most health education efforts have little impact on health habits. One of the reasons that children do not apply the information they receive into healthy habits is because children are not concerned with their health, when they feel good a majority of the time (Berk, 2002). Another reason is that children do not normally observe negative health consequences when they are young (Berk). Therefore, teaching healthy behaviors by using multiple methods of
reinforcement and modeling will enhance a child’s ability to translate their knowledge of nutrition into healthy eating habits.

The developmental skills that are particularly important to nutrition education for children 9-11 years old are cognitive, language, emotional, and social skills. During this time, children’s cognitive skills are improving, such as: logical thought, planning, the ability to rehearse and organize information to aid in memory, and self-regulation. In addition, a greater and better-organized long-term knowledge is established (Berk, 2002).

Language skills are also developing during middle childhood. For example, children are able to grasp double meanings of words, emphasize synonyms, understand complex grammatical constructions, refine conversational strategies, and narrate the past with longer and more complex meaning (Berk, 2002). Improved language skills enable children to understand and talk about nutrition concepts.

The emotional skills that develop during middle childhood, such as increased self-esteem, regulation of emotion, and the ability to grasp personal matters, are important for children to understanding their health (Berk, 2002). Increased self-esteem may enhance the child’s motivation to be concerned about eating habits and making healthy food choices. Because younger children may lack attention, and older adolescents may have other interests, the developmental skills of the middle childhood age group are such that they are a prime target audience for nutrition education interventions (Lytle, 2002).

Younger children are not able to learn the meaning of abstract terms, and their expectation of future health problems is limited to a few days (Westenhoefer, 2001). For example, research suggests that knowledge about health or the effects of foods high in fat does not influence food preference in 6-10 year old children (Westenhoefer). In contrast, a survey of
10-17 year old school children in Germany indicated a majority of children expected to have adverse health effects of poor nutrition within a half year (Westenhoefer). Another study, which included 594 middle school children from 6th (n = 178), 7th (n = 150), and 8th grade (n = 191), determined from a Comprehensive Assessment of Nutrition Knowledge, Attitudes, and Practices (CANKAP) questionnaire that the relationship between nutrition knowledge and eating behavior was insignificant for sixth graders, but significant for 7th (p < .008) and 8th graders (p < .01) (Pirouznia, 2001). Overall, knowledge of nutrition among middle school children was low. The children were not able to identify food sources of nutrients or functions of nutrients, they did not use the Food Guide Pyramid to choose foods but they were aware of the importance of milk and vegetable consumptions (Pirouznia).

There appears to be conflicting evidence of when it is most appropriate and most feasible to teach children about the relationship between nutrition and eating behavior in the middle childhood years. In general, eating habits are more likely to be shaped at a younger age, and nutrition education programs should be aimed at elementary schools (Pirouznia, 2001). Some researchers believe that behaviors are more resistant to change after the 6th grade (Kandiah & Jones, 2002), and that intervention strategies for nutrition are more successful before children begin junior high school and the optimal age is 8-12 years old (Winter, Stanton, & Boushley, 1999; Murphy et al. 1998; Splett & Story, 1991; Shannon, Graves & Hunt, 1982).

Development of Children’s Food Preferences

Children’s preference for one food over others can be affected by a variety of factors including genetic predispositions, parents’ child-feeding practices, food neophobia, and food aversions based on postingestive consequences. The developmental system’s perspective views development of food preferences as a result of interactions between genetic predispositions and
environmental factors (Birch, 1999; Schwartz and Puhl, 2003; Birch and Fisher, 1998; Bull, 1988). Examples of genetic predispositions that restrict food preferences include the predisposition to prefer foods that are sweet and salty compared to sour and bitter. Children’s food preferences can also be affected by the predisposition to reject novel edibles (neophobia) and to learn preferences for the more familiar foods. Parent child feeding practices such as using food as rewards can enhance preferences for certain foods (Birch, 1999). In addition, the predisposition to learn food preferences by associating foods with the contexts and consequences of eating them can affect children’s food preferences (Birch). For instance, the postingestive consequence of nausea or vomiting after consumption of a particular food can lead to a food aversion (Birch).

**Taste Preferences**

A person’s preference for sweet and salty taste has been linked to evolution (Schwartz & Puhl, 2003). For instance, sweetness has been viewed to determine the energy value of food. Bitter foods have been avoided due their link with toxic substances. Early experience or exposure and learning to accept or try new foods can modify these predispositions. Those children who have repeated exposure to either plain or flavored food tend to decrease their preference for the food that they were exposed to less (Schwartz & Puhl). The innate preferences for sweet tastes and avoidance of bitter tastes have been studied with human infants. Infant responses to salty and sour tastes are inconsistent. Human infants given sweet and bitter solutions have been found to respond with different facial expressions (Hursti, 1999). Although there are no data indicating that children have an innate preference for high fat or high energy dense foods, researchers have concluded that repeated experience with foods that are energy dense can enhance their preferences for these types of foods through associative conditioning.
Researchers believe that the flavors of foods can be associated with satiety cues that occur during the digestion of energy dense foods, which result in enhanced preferences for these foods.

**Parental Controls**

Every parent has different strategies for feeding their child/children. Parental control of food has been suggested to have a negative effect on the quality of children’s diets. Some child-feeding strategies may reduce a child’s preference for certain foods. For example, when children are given food as a reward for good behavior they develop more of a preference for those foods (Schwartz & Puhl, 2003; Birch, 1999). On the other hand, when children are offered rewards for eating, the foods eaten to obtain rewards tend to become less preferred (Birch; Schwartz and Puhl).

In one study of parental opinions on childrens’ food preferences, 40% of parents reported that they believed restricting or forbidding consumption of a food would decrease the child’s preference for the food (Birch & Fisher, 1998). Research indicates that restricting certain foods from children actually enhances their liking for that food rather than dislike, and may increase intake (Birch & Fisher). Other researchers (Sherry et al., 2004) have also reported data from 12 focus groups (n = 101), which included socioeconomically diverse mothers, that all 12 groups reported they use bribes or rewards as a practice in feeding their children. Also, 11 out of 12 groups indicated they did not believe their child was being truthful when they said they were full, and they would encourage their children to eat more (Sherry et al.). In addition, parental encouragement to eat was positively associated with time spent eating, and the degree of being overweight in children (Birch & Fisher).
The results of Masui et al. (2002) indicated a correlation existed between parents controlling the food environment and total energy intake (p = .079), total fat intake (p = .030), and percentage of energy from fat (p = .047). Strict parental control over a child’s food environment may increase preferences for high fat, energy dense foods, and disrupt internal cues that regulate satiety and energy intake. Allowing children to have freedom to make food choices may promote good nutrition (Masui et al.). Negative parent child feeding practices, such as using food as a reward, restricting certain foods, and controlling a child’s food environment may promote children to develop certain preferences for some foods.

Parental control of child feeding practices may not promote healthy weight either. For example, in a study of 75 White (25 boys, 49 girls) and 46 African American (22 boys, 24 girls) children with a mean age of 11 years old, researchers assessed the relationship between mothers’ child feeding practices and children’s adiposity (Spruijt-Metz et al., 2002). Results from this study indicated that the pressure to eat and concern for the child’s weight explained 15% of the variance in total fat mass in African American and Caucasian children (p < .001). Ethnicity, sex, and socioeconomic status did not significantly contribute to variance in total fat mass (Spruijt-Metz et al.). Another study reported that maternal attempts to control food intake corresponded with increased consumption of the restricted foods when free access to these foods was given (Schwartz & Puhl, 2003).

**Nutrition Intervention**

In a pilot study to examine the effectiveness of a nutrition intervention program on enhancing 5th and 6th grade children’s knowledge, preferences, and intakes of fruit, and decreasing parents use of controlling child feeding behaviors (Gribble, Falciglia, Davis & Couch, 2003), significant increases were found after the intervention within the experimental group for
knowledge (p < .001) and intake of daily whole fruit consumption (p < .02). A significant
difference for preferences of fruit was not detected between the two groups (P = NS, not
significant). A significant reduction in parental control was also found for restriction (p < .02)
and monitoring of food (p < .03) after the intervention. There was not a significant difference
with encouragement after the intervention (p = not significant). Parents in the intervention group
were found to have significant reduction in total control (p < .01) (Gribble et al., 2003). Parental
feeding practices such as these can have a negative impact on food preferences and body
composition of their children.

*Primary Food Provider*

Families usually have one person that takes responsibility for deciding which foods are
served in the household, a concept commonly called the ‘gatekeeper’. The ‘gatekeeper’ food
preferences are also influenced by the preferences of other family members, which will also have
an impact on a child’s food preference. In a study of low-income African American women in
public housing, women who lived with older adults and children in the household, and who
worked, were less likely to be the sole person to prepare meals (Shankar & Klassen, 2001). In
addition, parents that provide readily available access to healthy foods for the entire family that
are consistent with Food Guide Pyramid recommendations will make it easier for children to
consume and accept these foods (Schwartz & Puhl, 2003).

*Other Parental Behaviors*

Parents, peers, and the media can influence children’s food acceptance. Parental
modeling has been suggested to have a profound impact on children’s food preferences. In one
study of elementary school students, lack of parental modeling of eating fruits and vegetables
were the primary reason for children not eating those same foods (Schwartz & Puhl, 2003).
Birch & Fisher (1998) pointed out that children’s eating habits may be influenced by parents’ eating habits, including dietary restrictions of certain foods, and disinhibition in families where obesity, dieting, and weight control are prominent issues. These researchers also suggest that daughters of mothers who diet, and have issues in controlling their eating, often exhibit similar patterns as mothers (Birch & Fisher). However, peer influence has been suggested to be more influential in regards to food preferences than parental influence in preschool children (Westenhoefer, 2001).

**Cultural Factors**

Cultural factors can also impact a child’s food preference. Children from families of various ethnic groups can affect their food preferences (Hursti, 1999). For instance, Spruijt-Metz et al. (2002) conducted a study including 74 white and 46 African American children and mothers and the researchers determined that African American mothers reported higher levels of monitoring, feelings of responsibility, restrictive practices, pressure to eat, and concern for child’s weight than did white mothers. However, ethnicity was not found to be a significant predictor of children’s total fat mass. The African American culture has different food preferences in comparison to other ethnicities; i.e., frying, barbequing, and serving food with gravy and sauces are common. These methods of food preparation add excess fat and calories to meals, which when over consumed can lead to weight gain and possibly lead to chronic health problems (Ewing, J., 1995).

**Food Aversions**

Food aversions may develop when the consumption of a particular food leads to a negative postingestive consequence, such as nausea or vomiting. When food aversions are formed, the person will avoid consuming the specific food, and will have innately developed a
dislike for that particular food (Birch, 1999). Learned food aversions usually result from association of a single food with an illness. Food dislikes for bad tastes appear to develop more easily than likes for good tastes, and tend to develop towards foods that are less familiar and less preferred (Hursti, 1999). Consequently, children that suffer from multiple occurrences of nausea and vomiting after consumption of specific foods may be vulnerable to developing multiple food aversions, which can affect the quality of their diet (Birch). On the other hand, learned food preferences tend to form more slowly and are easier to dispose of than learned food aversions because they are a result of common consequences of normal eating such as the feeling of satiety (Birch).

Neophobia

Food neophobia (fear of new foods) in the past has been a survival mechanism to protect against consuming dangerous foods. Children have been reported to be more neophobic than adults. Repeated exposure to a specific food can reduce neophobia (Hursti, 1999; Westenhoefer, 2001). Research also suggests that neophobia may increase with age; therefore, exposure to certain foods at a younger age may be beneficial (Domel Baxter et al., 1993 a).

Fruit and Vegetable Preferences and Consumption

Studies with middle-aged children indicate a higher preference for fruit than vegetables (Domel Baxter et al., 1993 a; Domel Baxter & Thompson, 2002). Domel Baxter et al. (1993 b) conducted focus group discussions with 235 fourth and fifth grade students, parents, teachers, and food service employees in order to develop a valid and reliable questionnaire to measure fruit and vegetable preferences. Although preferences for fruit were higher than for vegetables, a significant correlation was not found between preferences and consumption of fruit snacks (p < .06). Continuing this line of research, Domel Baxter & Thompson (2002) used a retrospective
analysis design including data from observations and interviews to document 4th graders’ preferences and consumption of fruits in comparison to vegetables as part of school lunches [n = 237]. Results indicated that preferences were higher for fruits than vegetables. The research also suggested that as preferences increased for fruits and vegetables, consumption also increased (p<. 0001).

In another attempt to increase fruit and vegetable consumption, researchers developed a school-based curriculum, “Gimme 5”, aimed at 4th and 5th grade students (Domel Baxter et al., 1993 b). The purpose of the intervention was to enhance students’ ability to request, prepare, and include fruits and vegetables in their diet. Teachers incorporated the curriculum into their classrooms. Fruits and vegetables were also incorporated into the school lunch menu. Students set goals for eating fruits and vegetables, monitored the amount of fruits and vegetables they consumed by recording their intake for two days. Problem solving was also incorporated into the intervention in order to overcome barriers for eating more fruits and vegetables at meals. The results indicated that fruit and vegetable knowledge significantly increased among the experimental school students (n = 183), compared to the control school students (n = 105) (f = 55.10, p = .001). Preferences for fruits (f = 4.02, p = .046) and fruit and vegetable snacks (f = 16.57, p = .001) significantly increased, however, preferences for vegetables did not increase (f = 2.40, p = .123). Therefore, increasing availability of fruits and vegetables may be a good intervention strategy for children of this age, and enhance their preferences for these foods.

Other Factors Influencing Food Choice and Eating Behaviors

Other researchers investigated factors influencing food choices and eating behaviors of middle childhood and adolescent perceptions. In one study (Neumark-Sztainer, Story, Perry & Casey, 1999), 21 focus-group discussions were conducted with 141 adolescents in the 7th and
10th grade from two urban schools in Minnesota. The results suggested that the adolescents described multiple factors that influenced their food choices and eating behaviors. Among these factors were: hunger, food cravings, appeal of food, time considerations of adolescents and parents, convenience, availability, parental influence, benefits of food, mood, body image, cost, media, and vegetarian beliefs. The barriers to consuming healthier foods, such as fruits and vegetables and foods lower in fat, were taste preferences and lack of interest in personal health in relation to other concerns. Birch & Fisher (1998) have acknowledged that repeated exposure to food advertisements on television may foster childrens’ preferences for energy dense foods. Other researchers have observed that childrens’ requests for foods were related to the frequency that children saw the food on television. Also, children exposed to advertisements tended to select foods with more sugar that those children who did not view a food advertisement (Birch & Fisher). Nutrition educators must understand and consider these factors that affect food choices in children when developing and implementing nutrition education programs.

Cullen et al. (2003) also addressed availability of food, especially fruits and vegetables, in relation to food preference and consumption. The study included 225 children in 4th through 6th grade, and 88 parents from nine parochial schools. Researchers wanted to determine the relationship among home fruit, 100% fruit juice, and vegetable (FJV) consumption with availability and accessibility. Data were collected by using seven days of food records per child and a questionnaire administered to both children and parents to measure availability of fruits, vegetables, and 100% fruit juice. The results of the study indicated that children who had high fruit, vegetable, and 100% fruit juice preferences also had high availability of these foods. Availability and accessibility were significant predictors for consumption in children with low fruit, juice, and vegetable preferences (p < .05). Availability and accessibility were significantly
correlated with fruit ($r = .22, p < .001$), juice ($r = .17, p < .01$), and vegetable preferences ($r = .45, p < .001$). Children with high preference for FJV only needed these foods in the home in order to consume them, and children with low preferences for FJV suggested that these children needed to have the food available in the home, and have easy access in order to consume these foods. Also, consumption of fruit, 100% fruit juice, and vegetables were low, 1.37 servings for boys and 1.66 servings for girls, relative to the national recommendations of at least five servings per day (Cullen). In conclusion, availability and accessibility of fruits and vegetables may positively impact consumption of these foods.

Children’s food preferences are influenced by a variety of factors including genetic predispositions (Birch, 1999), parent child feeding practices such as controlling food intake and using food as rewards or bribes (Schwartz & Puhl, 2003; Birch, 1999; Sherry et al., 2004), food neophobia (Hursti, 1999; Westenhoefer, 2001), and food aversions (Birch, 1999; Hursti, 1999). Preferences are also affected by culture, modeling of parents and/or peers, television and the media (Neumark-Sztainer et al., 1999). Availability and accessibility of food such as fruits and vegetables affect food preference and thereby affect consumption of these foods (Domel Baxter & Thompson, 2002; Domel et al., 1993; Cullen et al., 2003). Understanding the various factors that influence food preferences of children is important, especially for nutrition educators, in order to create nutrition interventions that will promote healthier diets of children. Having knowledge of these factors also aids in teaching parents useful strategies to promote variety in their child’s diet.

Children’s Dietary Intake Patterns in the United States

Monitoring dietary intake patterns among children is important in order to explore and prevent the onset of adult health problems (Hogbin, Davis & Escobar, 1999). Diets of
adolescents are becoming more similar to the general population (Bull, 1988). Commonalities in dietary habits of 10-25 year olds 20 years ago can be still found today. For example, research suggests that young people habitually skip meals and lack balance in their diet, which results in the consumption of specific foods to satisfy appetite (Bull; Birch & Fisher, 1998; Birch, 1999; Hursti, 1999).

Data from the Continuing Survey of Food Intakes by Individuals (CSFII) 1994-1996, 1998, the CSFII 1989-91, and the Nationwide Food Consumption Survey 1977-78 were compared to determine whether children’s food intakes have changed over a 20-year period (Wilkinson, Mickle & Goldman, 2002). The trend for carbonated beverages significantly increased (p < .01) over time, while a significant decrease was found in the percentage of whole milk consumed for both girls (p < .01) and boys (p < .05). Mean intake of crackers, popcorn, pretzels, and corn chips increased for both girls (p < .01) and boys (p < .05). The percentage of candy also significantly increased for girls (p < .05) and boys (p < .01). Significantly higher carbohydrate intakes were found for boys than girls. Both boys and girls had lower intakes of protein and fat. The percentage of calories from protein significantly decreased for boys only. A decrease in vitamin B12 was found for girls and boys. Higher intakes of thiamin and iron were determined in 1994-96, 1998 compared to 1977-78 for girls. Boys also had increasing intakes of thiamin and iron, as well as had higher intakes of vitamin C, riboflavin, niacin, and vitamin B6. The Enrichment Act of 1942 required iron, niacin, thiamin, and riboflavin to be added to refined grain products to prevent deficiencies of these nutrients (Sizer & Whitney, 2003). Adequate intakes of these nutrients could be attributed to the Enrichment Act of 1942. These trends reveal changes in dietary habits over time, and not all are favorable.
More recent research published by the United States Department of Agriculture in 2005 compared nutrient intakes of Americans from food with the Dietary Reference Intakes (DRI) (Moshfegh, Goldman & Cleveland, 2005). These data revealed which nutrients are currently adequate as well as which nutrients are lacking in the diets of children in the study. Children were found to have adequate intakes of folate, copper, phosphorus, thiamin, iron, and protein. A majority of Americans, including children, have adequate intakes of carbohydrate, selenium, niacin, and riboflavin. Nutrients of particular dietary concern are vitamin K, calcium, and potassium. Dietary fiber was also noted to be a concern because of low intake relative to recommendations. Approximately one in four Americans met their Adequate Intake (AI) for vitamin K and calcium. In addition, less than 5% of Americans had intakes above their AI for dietary fiber and potassium. Large portions of the population may be at risk for deficiencies of vitamins A, E, and C, and magnesium. The development of dietary interventions in the future should take into consideration, which nutrients are currently of concern for children. Focusing on teaching children food choices that are high in these nutrients, to prevent future physiological deficiencies, as well as limiting consumption of foods high in saturated fat and refined sugars, in order to reduce disease risk is recommended.

Multiple studies comparing children’s dietary intakes to national recommendations suggest that children are not meeting these recommendations, especially for the different food groups in the food guide pyramid. Brady et al. (2000) conducted a study aimed at comparing children’s dietary intakes with national recommendations and measured whether sex or ethnic differences were evident by using the Food Guide Pyramid that was developed by the United States Department of Agriculture. The study included 110 subjects [African-American (n = 57) and Caucasian (n = 53); males (n = 47) and females (n = 62)] with a mean age of 9.9 years.
Dietary data were collected from three 24-hour food recalls and food group intakes were determined by using the nutrient analysis program, Food Intake Analysis System (FIAS). Weights of food items (g) obtained from FIAS were used as reference figures to determine how many servings each subject consumed from each of the food groups in the Food Guide Pyramid (Brady et al.).

A high percentage of subjects failed to meet the recommended number of servings from each of the food groups (Brady et al.). Approximately 5% of the subjects met the fruit group recommendations, and 9% met the dairy group recommendations. The largest proportion of children meeting the guidelines for any of the major food groups were for the grain group [46%] (Brady). Consumption of foods from the “tip” of the pyramid comprising discretionary fat, added sugar, and alcohol contributed almost 50% of the reported diets. Sex and ethnic differences were also noted in this study. When controlling for total energy intake and social class, a significant difference in discretionary fat became evident, with females consuming a higher daily amount of energy from fat. Also, a higher percentage of males (30%) met the guidelines for vegetables than females (13%). There was not one African-American child in the study that met the current guidelines of at least two servings of dairy per day. A significantly higher proportion of African-Americans than Caucasians met the requirements for the meat group. These results suggest that implementation of nutrition education programs may be important for promoting healthy nutrition among both ethnic groups of American children tested.

There are numerous studies that have focused specifically on comparing children’s intake of fruits and vegetables with national recommendations. Krebs-Smith et al. (1996) investigated fruit and vegetable intakes of children and adolescents, ages 2 to 18 years, in the United States and compared the data to dietary recommendations (n = 3,148). Researchers used three days of
diet recalls from the USDA 1989-1991 Continuing Survey of Food Intakes by Individuals (Krebs-Smith et al.). The results from this study showed that one quarter of the vegetables consumed by children and adolescents were French fries. Also, only one in five children consumed five or more servings of fruits and vegetables per day (Krebs-Smith). The Healthy Eating Index, a measurement of diet quality, developed by the United States Department of Agriculture, indicated that the diet of children decline as they grow older (Basiotis, Lino & Anand, 1998). More specifically, only 20% of children ages 7-10 years old met the dietary recommendations for vegetables from the Food Guide Pyramid. Females aged 11-14 meet 24%, and males met 23% of the vegetable recommendation. In addition, children and adolescents scored lower on the fruit recommendation of the Healthy Eating Index. Children ages 7-10 years met 18% of the recommendation, and males and females ages 11-14 years old met 9% and 14% of the fruit recommendation, respectively. Thus, increasing fruit and vegetable consumption is an important goal of nutrition education.

Another study of 4th-6th grade students (n = 262), from five metropolitan elementary schools, investigated the frequency that the student’s consume fruits and vegetables for meals and snacks (Sandeno, Wolf, Drake & Reicks, 2000). The sample included 69% white, 15% multiracial, and 9% African American. Approximately 7% of the students classified themselves as Native American, Hispanic, or Asian. According to the results, 1/3 of the participants reported most often starting the day with juice or fruit, eating fruit offered on the lunch line at school, eating a vegetable at the evening meal, and asking parents to buy fruits for snacks or meals at home. The strongest correlation was found for children beginning their day with juice or fruit (r = .24, p < .001) and asking their parents to buy vegetables (r = .22, p < .001). The ability to prepare a vegetable for a snack or meal (r = .15, p < .01), and determining if they were
eating the recommended number of servings of fruits and vegetables each day were weakly correlated, although statistically significant, \(r = .24, p < .01\) with intake. Knowledge of the number of servings of fruits and vegetables recommended each day was weakly correlated with intake \((r = .16, p < .01)\). The children preferred to consume fruit over vegetables for snacks, and often asked their parents to buy fruits rather than vegetables. Liking fruits \((r = .05)\) and vegetables \((r = .11)\) were not correlated with intake. Other researchers found similar results, where preferences for fruit were greater than for vegetables in a sample of 4\(^{th}\) and 5\(^{th}\) grade students (Domel et al., 1993a). Fruit snack preferences \((r = .11, p < .05 \text{ (pre)} vs. r = .15, p < .01 \text{ (post)})\) and vegetable snack preferences \((r = .08 \text{ (pre)} vs. r = .15, p < .01 \text{ (post)})\) were weakly correlated with consumption. A modest correlation was found for fruit \((r = .25, p < .001 \text{ (pre)} \text{ vs. } r = .27, p < .001 \text{ (post)})\) and vegetable \((r = .28, p < .001 \text{ (pre)} \text{ vs. } r = .39, p < .001 \text{ (post)})\) preferences with consumption. These studies suggest that knowledge and preferences of fruits and vegetables do not necessarily relate to consumption. In spite of this, availability and accessibility of fruits and vegetables were not included in these studies, and may impact consumption of these foods.

*Association Between Low Intakes of Fruit and Vegetables and Corresponding Nutrients*

Additional studies have revealed that children with low intakes of fruits and vegetables often have inadequate intakes of nutrients (Dennison, Rockwell & Baker, 1998). For example, Dennison et al. (1998) investigated the number of fruit and vegetable servings per day children age two \((n = 116)\) to five \((n = 107)\) years old consume in their diet. Data were collected by using seven days of dietary records, and data were analyzed using the USDA definitions of serving sizes and the Minnesota Nutrition Data System (Dennison et al.). According to the study, approximately 80% of preschool-aged children consumed the recommended servings of fruits
per day, and only 25% consumed the recommended servings of vegetables per day. Low intakes of fruits and vegetables were associated with inadequate intakes of vitamin A, vitamin C, and dietary fiber, as well as high intakes of total fat and saturated fat.

Other studies like have found similar results to Dennison et al. (1998) concerning the correlation between low intakes of vitamin C and fruits and vegetables. Hampl, Taylor & Johnston, (1999) conducted a study to determine the vitamin C intakes among American schoolchildren. The data for this study included a sample of 1,350 7-12 year old children and 908 13-18 year old children, which were obtained from the 1994-1996 Continuing Survey of Food Intakes by Individuals (CSFII). Children were divided into one of three vitamin C consumption groups, based on two 24 hour recalls. The results of this study implied that children who did not consume an adequate amount of vitamin C also had diets with significantly greater intakes of fat and saturated fat. Children with desirable vitamin C intakes appeared to have healthier diets, including more milk and vegetables (Hampl et al., 1999). Lack of consumption of fruits and vegetables is often associated with a lack of other beneficial nutrients that these foods provide.

Factors that Influence Fruit and Vegetable Consumption

There are many factors that influence fruit and vegetable consumption, such as individual, social, and environmental factors. Three studies indicated family influences played a vital role in fruit and vegetable intake. Granner et al (2004) administered a self-report questionnaire to a convenient sample of 736 black and white middle school students, ages 11 to 15 years. The questionnaire included measures of self-efficacy, family dinner frequency, normative beliefs, outcome expectations, modeling, availability, preferences, snack choice, and demographics (Granner et al.). The results indicated that black participants reported greater
social influences than white participants (Granner). White participants reported greater family environmental influences on fruit and vegetable intake. White participants, especially females, reported a higher preference for vegetables than did black participants and males. The oldest adolescents reported lower self-efficacy, peer modeling, family dinner frequency, and fruit and vegetable preferences, compared to younger adolescents. Preferences for vegetables and parental modeling were the strongest correlates of self-efficacy. Self-efficacy was the strongest correlate of snack choice.

Cullen et al. (2001) found similar family influences on fruit and vegetable consumption. In this study, eighteen 4th-6th grade school classrooms were recruited (n = 230). The sample was ethnically diverse, including 25% African-American, 29% Euro-American, 37% Mexican-American, and 9% Asian. Also, 31% of the participants were in the fourth grade, 32% were in the fifth grade and 76% were in the sixth grade. Food records and a questionnaire were used in the study to determine actual consumption of fruit, juice, and vegetable, as well as family and peer influences related to children’s food consumption. The results indicated that parental modeling, peer normative beliefs, and fruit and vegetable availability were significantly correlated with children’s fruit, juice, and vegetable consumption.

Comparable to the above studies, other researchers investigated student perceptions of parent behaviors on fruit and vegetable consumption, and whether self-efficacy mediates this relationship, and perceived home fruit and vegetable availability (Young, Fors, Fasha & Hayes, 2004). Data were collected by a cross sectional survey including 366 students from three middle schools in northeast Georgia. Approximately 81.7% of the sample was Caucasian, 6.4% were African American, 4.2% were multiracial, 2.8% were Asian, 2.5% were Hispanic or Latino, and 2.5% were American Indian (Young et al, 2004). Also, 38% of the students were in sixth grade,
33.6% were in seventh grade, and 28.4% were in 8th grade (Young et al.). The results of this study indicated a significant relationship between perceived parent modeling, perceived parent support, self-efficacy, perceived fruit and vegetable availability and consumption. In addition, the results suggested that perceived parent support and fruit and vegetable consumption were mediated by self-efficacy.

**Barriers to Consumption of Fruits and Vegetables**

Barriers to consuming fruits and vegetables have been examined as well. In a study conducted on low income African Americans, researchers wanted to assess the food-purchasing behaviors and barriers to consuming fruits and vegetables among African American women and their family who lived in public housing in an urban city (Shankar & Klassen, 2001). Data collection included interviews of two focus groups of 10 women each, and structured-questionnaire interviews of 230 women. The structured-questionnaire interviews were 22 questions and focused on food-purchasing and food-preparation behaviors. The barriers to increasing fruit and vegetable consumption were cost, poor cooking skills, lack of social support, and childhood eating patterns (Shankar & Klassen). The participants reported that childhood memories of being forced to eat vegetables deterred them from making their own children eat vegetables. This study emphasizes the importance of teaching children at a younger age about nutrition, in order to establish healthy eating patterns that can be carried into adulthood, and finally passed on to their own children. Behavior change is vital for creating an effective nutrition education program. A clear understanding of the desired outcome for the target audience is also the key to success in nutrition education (Shafer, Gillespie, Wilkins & Borra, 1996).
The current diet of children in the United States needs improvement. Children are not meeting national recommendations for most food groups. Diets low in fruits and vegetables lack vitamins and minerals that are important for the development of children, while excess intakes of nutrients such as fat and sugar can contribute to weight gain, and lead to chronic health problems. In addition, researchers have suggested that the diets of children decline from childhood to adolescence (Story, Neumark-Sztainer & French, 2002), and children become settled in learned eating behaviors during this time of development, which are retained through adulthood (Lytle, 2002). The multiple studies that have been conducted on fruit and vegetable intake provide insights for nutrition educators, and are the foundation for creating education and nutrition intervention strategies. However, given the poor quality of children’s diets today, it is clear that additional strategies for improvement are needed that focus on early intervention, create healthy eating habits, and educate children on nutrients of concern to reduce disease risk.

The Effect of Nutrition on School Performance

In general, American children need to improve the quality of their diet. Approximately 88% of children 6-18 years old have a “poor” diet, while only 12% have a “good” diet according to a Healthy Eating Index analysis of the 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII) (Lino et al., 1998). Poor nutrition has been associated with overweight, obesity, and lower academic achievement. Children from households with insufficient food can have profound effects on a child’s cognitive and academic performance in school. For instance, according to NHANES III, children in food insufficient households ages 6-11 years old had significantly lower arithmetic scores, and were more likely to repeat a grade (Olson & Holben, 2002; Alaimo, Olson & Frongillo, 2001 a). Poor nutrition can restrict brain development, result in short stature in infants, reduce immune function, affect learning potential, and ability to
succeed in school (Food Research and Action Center, 2003; Tufts University, 1999). Food insufficiency has been associated with behavioral problems in children ages 6-11 years old such as having difficulty getting along with their peers of the same age group (Olson & Holben; Alaimo et al., 2001 a).

*Lack of Nutrients and Their Impact on School Performance*

One of the most prevalent nutritional problems in the United States in children is iron deficiency. Iron deficiency reduces the body’s ability to fight infections, which can result in children becoming ill easily and missing school more often (Food Research and Action Center, 2003; Tufts University, 1999). Iron deficiency anemia leads to shortened attention span, irritability, fatigue, and difficulty with concentration (Parker, 1989). Children with iron deficiency anemia tend to do poorly on vocabulary, reading and other tests (Parker).

Other nutrients that impact school performance are protein and zinc. For example, in a study among fourth graders, those who had the lowest protein intake in their diet had the lowest achievement scores (American School Food Service Association, 1989). Low zinc intakes are associated with concentration and behavioral development (Food Research and Action Center, 2003; Tufts University, 1999).

*Importance of Breakfast Consumption*

Morning fasting has been found to have a negative effect on cognitive performance in 9-11 year old children. A sample of 22 girls and 12 boys with a mean age of approximately 10 years was included in the study (Pollitt, Leibel & Greenfield, 1981). Children were included in the study if their height and weight measures were above the 10th or below the 90th percentile of the HANES growth charts. A test of speed and accuracy of response on problem-solving tasks was given to children who did or did not eat breakfast. The results of the study found that
skipping breakfast had an adverse influence on the accuracy of problem solving (Pollitt et al., 1981). A beneficial effect of brief fasting was found on immediate recall in short term memory depending on the time of day (Pollitt et al.). These results are attributed to the heightened arousal level that is associated with brief experimental fasting (Pollitt). According to the literature, the brain is sensitive to short term fluctuations in glucose supply and maintaining glucose concentrations at adequate levels between meals may help maintain optimal cognition. Immediate ingestion of a carbohydrate rich food or some type of glucose load has positive effects on short-term memory, focused and sustained attention, maze learning, arithmetic ability and long-term free and cued recall tasks (Bellisle, 2004). Multiple researchers have determined that breakfast consumption has an impact on memory function such as recall, short-term memory, and long-term memory (Rampersaud et al., 2005). According to Rampersaud et al. (2005), results from research on the association between breakfast consumption with attention, problem solving, reading, listening, and comprehension are less supportive. Proper nutrition and physical activity increases composite math and reading scores, improves student behavior, reduces morning trips to the nurse, and increases student attendance and test scores (Minnesota Department of Children, Families & Learning, 1998).

In contrast to morning fasting, eating breakfast has been suggested to improve the quality of children’s diet. The United States Department of Agriculture compared breakfast consumption of children in low-income households to those in higher income households (Basiotis et al., 1999). Approximately 67% of low-income children ate breakfast somewhere other than school, compared to 82% of children in higher income households. Also, fewer children were found to not eat breakfast in lower income households, compared to higher income households (14% versus 16%). Only 2% of children from higher income households ate
breakfast at school compared to 19% of children from lower income households. Both children from low and high-income households had a higher Healthy Eating Index (HEI) score than those children that did not eat breakfast. These results support that eating breakfast in general is an important factor in the quality of children’s diet. A study collected information on participation of a school breakfast program in one public school in Philadelphia and two public schools in Baltimore (n = 133) determined that children who ate school breakfast decreased their absence rate from 9.2 days per year to 6.3 days (Murphy et al., 1998). Students increased their math scores but other subjects were not affected. Children who increased their participation in school breakfast increased their math grades by 0.3 of a grade compared to children who had the same or decreased their participation (z = 4.2, p < .001) (Murphy et al.). Absence rates also decreased 0.1 days when compared to children that had the same or decreased their school breakfast participation (z = 2.6, p = .009). Increased participation in school breakfast was also found to significantly decrease the days (-0.4) that children were late to school (z = 2.5, p = .01). This study provides evidence that nutrition can have an impact on the academic and psychosocial functioning of children.

Adequately nourished children who eat breakfast have been found to have better behaviors in class such as decreased anxiety, hyperactivity, depression, and psychosocial dysfunction (Murphy, Pagano & Bishop, 1999). Other researchers have also found that eating breakfast has beneficial effects on test scores, grades, attendance, tardiness, improved depression, improved hyperactivity, and improved mood and alertness (Rampersaud et al., 2005). Not only do school teachers and school food service employees have a critical role in helping students learn and practice healthy eating habits, but nutrition education programs in the community play a vital role as well, and can re-enforce the message of proper nutrition.
Child Nutrition Programs

Inadequately nourished children may do poorly on tests in school, experience difficulty concentrating, display undesirable behaviors, and have increased absences compared to children whom are properly nourished. Fortunately, the United States government provides multiple child nutrition programs to provide a safety net for school aged children who may not have access to an adequate food supply due to limited incomes. These programs include the National School Lunch Program, the School Breakfast Program, the Special Milk Program, the Summer Food Service Program, the Child and Adult Care Food Program (Stang & Taft Bayerl, 2003).

In short, the National School Lunch Program provides a reduced price or free lunch to qualifying students. The meals provide 1/3 of the RDA for protein, vitamin A and C, iron, calcium, and energy. The School Breakfast Program also provides free or reduced price breakfasts to students living in poor areas, and those that travel long distances to attend school. The Special Milk Program provides milk to children in childcare settings or schools that do not participate in other federally funded programs. The Summer Food Service Program provides meals to children during the summer, when the School Breakfast Program and National School Lunch Program are not available. Schools, public agencies, and nonprofit organizations are eligible to receive federal aid. The Child and Adult Care Food Program provide meals and snacks to adults and children that reside in homeless shelters and after school care programs. These government nutrition programs aid in providing children nourishment that may not otherwise be available, and inhibit the negative consequences that poor nutrition has on school performance.
Disparity Between Food Insecure and Food Secure Households

Low income is highly associated with food insecurity. In 2000, 44% percent of food insecure households had an income below the poverty line (Nord & Andrews, 2002). Overall, 71% of food insecure households had incomes 185% of the poverty line and below (Nord & Andrews; Nord, Andrews & Carlson, 2002). Of these households, approximately 26% of the households consisted of a family composition including married couples with children, and single women with children contributed another 25% of the households that were food insecure (Nord).

The definition of food security is all people at all times will have access to enough food for an active, healthy life including the ready availability of nutritionally-adequate, safe foods, as well as the assured ability to acquire them in socially acceptable ways (Olson & Holben, 2002). Conversely, food insecure individuals and families have limited access to or availability of nutritious food, or a limited/uncertain availability to acquire food in socially acceptable ways (Olson & Holben). Food insecurity and hunger are related terms, however, hunger is viewed as a severe level of food insecurity, where reduced food intake is involuntary (Gurthrie & Nord, 2002). Hunger is defined as an involuntary, recurrent, uneasy and/or painful sensation cause by lack of food, and may contribute to malnutrition over time (Olson).

In 2000, 10.5% of US households in were food insecure (Olson & Holben, 2002). Households below the poverty line, as well as households headed by single-women with children, were three times the national average to have food insecurity (Olson & Holben; Nord et al., 2002). Furthermore, 20% of all children under the age of 18 lived in food insecure homes where food may have been scarce, or diets were altered due to limited incomes (Anand et al., 1999). According to the Position Statement of the American Dietetic Association, approximately
18% of children in the United States in the year 2000 lived in food insecure households (Olson & Holben, 2002). Based on the 1995 Current Population Survey, approximately 65% of food insecure households showed no evidence of hunger, 28% had reported moderate hunger, and 6.9% reported severe hunger (Drewnowski & Specter, 2004). Low-income households with children are affected with food insecurity more than households without children (Nord et al., 2002).

Conflicting data exist on the relationship between food insecurity and obesity, particularly in children. For instance, an increased prevalence of overweight and food insufficiency was not determined in either non-Hispanic white children, non-Hispanic black children, or Mexican American children in a study reported by Alaimo, Olson & Frongillo (2001 b). Food sufficient girls were less likely to be overweight. Older, non-Hispanic white, food insufficient girls, were more likely to be overweight than food sufficient girls (p < .10). Casey et al. (2001) could not determine that food insufficiency was associated with measures of obesity in children. In contrast, an analysis of 7-16 year old children in 1999 from the USDA found an inverse relationship between income and overweight status (Anand, et al., 1999; Tufts University, 1998). Consistent data has not been found for a relationship between overweight girls from lower income to higher income families (United States Department of Health and Human Services, 2001). Family income has not reliably predicted prevalence of overweight in Mexican American and non-Hispanic black children and adolescents (United States Department of Health and Human Services, 2001). Non-Hispanic white adolescents from lower income families have been suggested to have a greater prevalence of overweight compared to higher income families (United States Department of Health and Human Services, 2001).
Children from families with food insecurity may lack resources to obtain food (Food Research and Action Center, 2003). Several explanations for food insufficiency and overweight exist. First, low-income families may consume lower cost foods that are energy dense, which can lead to weight gain. Another reason is that households may reduce the cost of food by changing the quality and/or variety of their diet before they reduce the quantity of food eaten. A child may consume enough food to feel full yet the food may not have been nutritious. Low-income families may also eat more when food is available, which results in overeating. Psychological changes also occur when diets are inadequate. The body can become more efficient at storing more calories as fat, when food is unavailable (Food and Research Action Center).

Food insecurity has been shown to affect various ethnic groups to different degrees. For instance, a cross-sectional survey conducted on six California counties, recruited 274 low-income Latino families that had preschool children enrolled in WIC, Head Start, and other community organizations. The results of this study imply that Latino households with greater food insecurity are associated with a lower variety of foods, especially fruits and vegetables (Kaiser et al., 2003). These families tend to rely on traditional Mexican staples, which do not include abundant sources of fruits and vegetables. Latino households are reported to have higher levels of food insecurity when compared to other ethnic groups (Kaiser et al.). One of limitations of this study was the prevalence of food insecurity within Latino households with incomes below 130% of the poverty line in this sample was higher than the national sample (Kaiser). This result may be due to the fact that food security data were collected during the winter months, when food security levels tended to be worse. Another limitation of this study was that a convenience sample does not allow the findings to be generalized to other Latino
populations. Food insecurity affects different ethnic groups in different ways. Among the factors that may differ among ethnicities is the level of food insecurity for each family, variety of foods, different cultures use different staple foods, and different seasons may affect food insecurity.

Limited resource individuals rely on a variety of strategies to maintain food sufficiency. Kempson, Keenan, Sadani, Ridlen & Rosato (2002) identified four categories of food acquisition practices. The four categories included relying on resources offered in the community (i.e. participate in federally funded food programs), interaction with informal support systems (i.e. budgeting, using credit, and cycling bill payments to conserve money for food), supplement financial resources (i.e. panhandling to increase income, or babysitting), and lowering food costs by using shopping strategies (i.e. purchasing food from low cost sources, using coupons).

Kempson, Keenan, Sadani & Adler (2003) focused their research on comparing strategies of limited resource individuals to maintain food security with what nutrition educators identify as coping strategies. A sample of 62 limited resource individuals, ages 19 to 67, were recruited from Food Stamp agencies, low-income outreach programs, soup kitchens, welfare offices, Head Start centers, shelters, and food pantries. The participants race in this study comprised approximately 37% White, 37% African American, 19% Hispanic, and 5% American Indian and the majority of the participants were female (69% versus 31%) (Kempson et al., 2003). The results from 11 focus groups identified 95 coping strategies, of which nutrition educators had previously identified 83% of these strategies. Researchers discovered 10 new practices, including selling food stamps for money, cooking with other people when sufficient food was not available, employees obtaining food from company employers, selling blood or participating in research studies, and committing crimes with the intent to be sent to jail in order to obtain meals.
This study identifies new and existing coping strategies of limited resource individuals, and is important for nutrition educators to consider, since children often use parents as role models and may possibly develop these same coping strategies.

Importance of Nutrition Education Programs

According to Healthy People 2010, implementing nutrition education programs in the community setting can be very beneficial for children (United States Department of Health and Human Services, 2000). Although schools have more influence on the lives of young people than any other social institution, public facilities in a community, such as the YMCA, can be a strong advocate for nutrition education. Valuable and effective health benefits of community-based approaches have been demonstrated by community interventions. These interventions have incorporated a variety of ethnic, racial, and socioeconomic population groups (United States Department of Health and Human Services).

The United States Department of Agriculture is the lead agency for the nation’s nutrition education efforts. The USDA funds and administers a variety of nutrition education efforts such as the National School Lunch Program (NSLP), the Supplemental Nutrition Program for Women, Infants, and Children (WIC), the Food Stamp Program (FSP), and the Child and Adult Care Food Program (CACFP) (United States General Accounting Office, 2004). The National School Lunch Program (NSLP), the School Breakfast Program (SBP), and the Child and Adult Care Food Program rely upon an initiative called Team Nutrition to support their USDA-sponsored nutrition education efforts (United States General Accounting Office). Team Nutrition develops and distributes nutrition education materials that support these child nutrition programs.
Officials conducted interviews with nutrition education research experts from five USDA programs and reviewed program reports and studies. According to the report, USDA’s nutrition education efforts did not fully incorporate the monitoring and evaluation actions that contribute to success, such as collecting data on the types of nutrition education provided and the outcomes of the efforts. As a result, little is known about what nutrition education was provided, and whether these programs have met their nutrition education goals (United States General Accounting Office, 2004). For example, WIC and Team Nutrition did not systematically collect data on changes in the nutrition knowledge or dietary behavior of nutrition education recipients’ (United States General Accounting Office). There are multiple nutrition education programs available; however, not all programs have information available on program monitoring and evaluation to assess the outcome measures of the programs. These steps are crucial for measuring the success of nutrition education programs in the future.

There are two types of nutrition education: knowledge based and behaviorally focused (Contento et al., 1995). Knowledge based education for school aged children is appropriate in the school setting. On the other hand, behaviorally focused nutrition education focuses on the association between behaviors, predispositions, and skills with risk factors and chronic diseases (Contento et al.). One of the problems with knowledge based nutrition education is that increased knowledge does not necessarily mean that behaviors will change (Contento). Nutrition education programs should be designed to provide both nutrition knowledge and enhance skills, in order to facilitate behavior change of participants. Six elements of successful nutrition education programming have been identified (Lytle & Achterberg, 1995). These elements include: “(1) programs are behaviorally based and theory driven; (2) family involvement is incorporated into programs for elementary-aged children; (3) programs for middle school to
senior high students include self-assessment of eating patterns; (4) behavior change programs include intervening in the school environment; (5) behavior change programs include intervening in the larger community; and (6) programs include intensive instruction time” (Lytle & Achterberg). Programs that include most or all of these elements are shown to be successful. Furthermore, nutrition education interventions are more successful at changing behaviors when they are long term rather than short term (Westenhoefer, 2001).

Studies with Social Learning Theory

The development and implementation of nutrition education is often established by the use of a theory or multiple theories. Theories of health behavior describe the relationship among variables influencing certain behaviors. They also specify targets for facilitating behavior change (Achterberg & Miller, 2004). A single dominant theory for nutrition education does not exist, therefore, “An effective approach for nutrition educators is to incorporate constructs from competing theories and then refine these into a tailored theory or set of theories by empirical testing” (Achterberg & Miller). Also, current theories do not predict all behavior or behavior change.

One example of theory often used in nutrition education is Social Learning Theory, also known as Social Cognitive Theory. Social Learning Theory is most often used in behaviorally based studies (Contento et al., 1995). School based interventions that have included social learning theory have had positive results (Reynolds, Hinton, Shewchuk & Hickey, 1999). In Social Learning Theory, personal influences, environmental influences, and behavior equally interact with each other to explain and/or predict changes in behavior (Liquori et al., 1998; Reynolds et al., 1999). These influences are referred to as “reciprocal determinism”, which means that a change in one of the three components will produce changes in the others (Reynolds
Social Learning Theory is based on the premise that people learn from external factors as well as from observing models (Glanz, Lewis & Rimer, 1993). In addition, people learn vicariously from watching negative models. Examples of environmental influences include family support, barriers, teaching skills, and reinforcement for behavior change. Personal factors such as self-efficacy and outcome expectations can directly influence behavior. Behaviors can also be reinforced through the environment such as meeting new friends that support the behavior (Reynolds). Practicing and demonstrating skills are an important part of Social Learning theory. The educator can use positive reinforcement, which in result will enhance motivation and self-efficacy. Social Learning Theory is learner centered, and is a valuable tool for discussion sessions, mentoring, and role-playing.

Researchers reported a study using social cognitive theory to study the impact of factors on children’s dietary practices (Corwin, Sargent, Rheaume & Saunders, 1999). A sample of 717 4th grade children from 15 elementary schools were surveyed using a 24-hour, weekday, dietary recall, and a 141-item self report survey containing demographic and nutrition related constructs. The survey included basic nutrition knowledge, self efficacy for fruit and vegetable selection, self efficacy belief for low fat food selection, long term value expectancy belief, food preparation involvement, fruit and vegetable availability, social support, and eating behavior modeling. The results from this study indicate that African American children were more likely to consume fewer dairy products, more fat, and more sugar than white children. Females were more likely than males to consume more fruits and vegetables and less protein (Corwin et al, 1999). Self-efficacy, social support, meal preparation involvement, and fruit/vegetable availability were associated with dietary behavior. This study is an example that theory, such as Social Learning Theory, may be useful in developing nutrition education programs especially for children.
Cooking Class Interventions

Few studies have been conducted involving cooking classes. Only four studies including children have been published in the past seven years. The studies focused on increasing knowledge of nutrition and cooking skills via hands on cooking experience, in the hopes of changing dietary behaviors.

During the 1995-1996 school year, an 11-lesson Cookshop™ program developed by the Community Food Resource Center in New York City was conducted (Liquori et al., 1998). The researchers implemented various components including school lunch, classroom, parent, and community involvement. In an attempt to evaluate the effectiveness and feasibility of the Cookshop™ Program, a quasi-experimental study was conducted to compare cooking as an educational strategy with other participatory methods of education that do not involve food preparation activities (Liquori et al.). The study included kindergarten through sixth grade children (n = 590). Students from 39 classes were included and matched to one of the following conditions: Cookshops plus food and environment lessons only, Cookshops only, food and environment lessons only, and comparison condition in which students did not receive Cookshops or lessons. The results of the study found positive effects for children that participated in the Cookshops only condition. Both younger (3.93, n = 12 compared to 3.04, n = 11) and older classes (3.34, n = 9 compared to 3.16, n = 7) had higher mean food preference scores. Also, both younger and older classes that participated in Cookshops only and or food and environmental lessons were found to have positive effects on knowledge (f = 7.69 versus f = 5.14). More specifically, older students who participated in Cookshops only had a larger positive impact on knowledge than those children that participated in food and environmental lessons only (f = 28.11 versus f = 7.27). Older children also had a positive impact on self-
efficacy in cooking. Younger classes that participated in Cookshops only had higher behavioral intentions scores than those children that did not receive the Cookshops. Lastly, those children that participated in Cookshops and food environmental lessons were found to leave the least food on their plate (79% for younger children and 74% for older children). Thus, as suggested by this study, cooking experiences in adjunction with cognitive learning experience and consuming food with peers may be a beneficial intervention for nutrition education (Liquori).

A modified version of the 11-lesson Cookshop™ Program was implemented (Quinn et al., 2003). The purpose of the study was to improve attitudes toward and increase fruit and vegetable consumption of 5th grade students. The classroom lessons were included in this study with limited parental involvement; however, the school intervention aspect of the original Cookshop™ Program was omitted. The classroom component included cooking lessons and children that were not exposed to certain foods in the classroom were usually unwilling to try them. The results of the study concluded that the participants did not change their dietary habits; however, there was a difference in willingness to try novel foods (Quinn et al.). Although the results of this study were not as favorable towards changing behaviors as the original Cookshop™ Program, this study suggests that exposure to unfamiliar foods may positively impact variety in children’s diets.

In contrast to the previous study, Kandiah and Jones (2002) implemented a three-week school based program with 5th graders (n = 187) that included 3-day food records and a pre/post test to assess nutrition knowledge. Significant increases were found for nutrition knowledge scores in the experimental group (p = .001). Also, a significant change was detected for compliance with the Dietary Guidelines and the Food Guide Pyramid recommendations (p =
Although this program did not include cooking classes as part of the intervention, it did demonstrate that nutrition knowledge can impact the food choices of fifth grade children.

Two reported studies involving cooking classes implemented food safety as part of their program, in addition to nutrition knowledge and cooking skills. The Oklahoma Cooperative Extension Service conducted a study involving cooking classes with children. Approximately 229 youth with an average age of twelve years old and 373 adults with an average age of 57 participated in the study. The classes provided education on preparation skills of fruits and vegetables, sanitation practices, and nutrition related to produce. The main objective was to increase fruit and vegetable intake and improve food safety behaviors among both youth and adults (Brown & Hermann, 2005). The results of the study indicated that both the average number of fruits and vegetables increased significantly (p < .001). In addition, improvements were also discovered in food safety. For example, 38% percent of youth and 11% of adults increased the behavior of washing their hands before preparing or eating fruits and vegetables (p< .0001). More importantly, youth appeared to benefit more from using the hands on approach during class instruction (Brown & Hermann).

In addition to the encouraging results found in the previous study, significant increases in food safety practices were also found in a study with the Youth Cooking School. Nutrition knowledge based on the Food Guide Pyramid also significantly increased. The University of Illinois Cooperative Extension Service Family Nutrition Program educators developed the Youth Cooking School to promote basic food preparation skills, safe food handling practices, and application of the Food Guide Pyramid (Winter et al., 1999). Participants were 8-12 year old children who were primarily low income (n = 227). Significant increases on the post-test were reported for safe food handling practices to prepare food and to select nutritious foods according
to the Food Guide Pyramid (p < .001). A three-month follow up test suggested that the average score was significantly higher than the pre-test (p< .05). Significant increases were found on knowledge of the recommended number of servings from the Food Guide Pyramid test questions from pre test to post test, and pre test compared to the follow up test (p < .001). The Food Guide Pyramid was a valuable tool for increasing nutrition knowledge (Winter et al.).

In a study with adults, cooking and the Food Guide Pyramid were used to increase nutrition knowledge. In 1995, Auld and Fulton increased the use of commodity foods among low-income women (Auld & Fulton, 1995), in order to increase nutrition knowledge about the Food Guide Pyramid, and thereby increase self-efficacy via cooking classes (n = 29, p < .05). No attitudinal differences were found between the groups before the classes, but the treatment group demonstrated improved attitudes toward both the use of staples and the cost of eating correctly. During interviews, participants reported increased use of specific commodity foods (canned pork, dried milk, and peanut butter), variety in their diets, and benefits to their families from their use of recipes and bulk foods. These results propose that cooking classes are effective intervention strategy for teaching children nutrition education, and changing participant’s behaviors toward food safety and food preparation (Auld & Fulton).

According to the literature, the diets of children in the United States need improvement. There are many factors that influence the way children eat. Among these factors are the presence of food insecurity and the development of children’s food preferences. Preventing chronic health problems of children in the future depends upon nutrition educators understanding how children develop in middle childhood. Although discrepancies exist among researchers on the appropriate age to intervene, clearly, interventions are more effective when nutrition education is taught to children during younger ages rather than older. Also, teaching nutrition
education to children in general is important in order to establish good nutrition habits that can be carried forward into adulthood. Nutrition education programs should be developed to include all of the important components; such as theory, which are found to effect behaviors. Limited research is available on studies that have included cooking classes. Based on the studies that have been reviewed, cooking classes are suggested to have a significant impact on nutrition knowledge. The purpose of the present study is to determine whether cooking classes have an impact on knowledge of nutrition, specifically, the Food Guide Pyramid and improved cooking skills of 4th through 6th grade children.
CHAPTER III

METHODS

Research Design

The “Kids in the Kitchen” cooking class was developed as a YMCA sponsored after school nutrition intervention program for 4th-6th grade children. A quasi-experimental design was used with a control group drawn from a nearby YMCA and Catholic Club and included a pre-test and post-test. Classes were held at the Summit Street YMCA in Toledo, Ohio.

The cooking program was offered one time each week for seven weeks free of charge to the participants. A family feast was given at the end of the program. Recipes were chosen based on the type of cooking skills needed and final meal cost. A conscious effort was made to include recipes that used canned fruits and vegetables, as the availability of fresh fruits and vegetables in this population may be limited. Children were given a written test of nutrition knowledge, and self-assessment questionnaire concerning cooking skills at the beginning and end of the intervention. At the end of the intervention, children were assessed for cooking skills and parents were asked to complete a short survey.

The “Kids in the Kitchen” program was initially implemented as a pilot study as part of the Bowling Green State University Dietetic Internship requirements. Data on the participants during the pilot study were not included into the analysis of the results in this study because certain aspects of the pilot study program were modified, such as the lesson that was taught each week. The program was conducted on two separate occasions in order to gather data and get an adequate sample size with the intervention group for the current study. Data were collected on three separate occasions (six different times) in order to acquire more participants for the control group. Data collection for the current study was conducted over a two-year period. Participants
from the nearby YMCA completed the pre and post-test. Undergraduate dietetic students helped the principal investigator conduct the classes each week. In addition, the BGSU Dietetic Internship Director participated in developing the lessons, conducting the classes, purchasing food, organizing the family feast, and seeking undergraduate volunteers to help with the classes.

Funding for the program was provided by a Bowling Green State University (BGSU) Partnership for Community Action grant. The Bowling Green State University Human Subjects Review Board approved the completion of this study (#H04P185SE7).

Recruitment

Participants for “Kids in the Kitchen” YMCA cooking class were recruited by displaying flyers at a YMCA. The program was developed to target low-income youth from the surrounding community. In order to recruit these youth, the Childcare Director developed an information flyer/registration form (Appendix A). Before participation in the project, both the children and their parents signed written informed consent forms (Appendix B). An additional form was provided for parents in the control group to fill out regarding their child’s age, grade, and school attended (Appendix C).

Subjects/Setting

Subjects were selected on a first-come, first-serve basis. The program was created to accommodate up to 15 children in grades four through six per session. A YMCA, in Toledo, Ohio, provided space and cooking facilities for the program including a demonstration kitchen that contained a microwave oven, conventional oven, four burner stove, and refrigerator. The classes were conducted after school on Wednesdays, from 3:30 to 5:30 pm.

The surrounding neighborhood, North River, is a residential area and a majority of the children live in low-income households, and receive subsidized care through County public
funds or YMCA Scholarships. The North River neighborhood is considered by local law enforcement officials to be a heavily populated gang area.Prostitutes, drug offenders, and the homeless occupy the vacant buildings in the area, and there are no safe outdoor spaces where youth can play. Therefore, many children are not exposed to physical activity and have poor nutritional habits.

The children attended a variety of local schools. In the intervention group (n = 13), seven children attended Riverside Elementary School, three children attended Paul Lawrence Dunbar Academy, two children attended Chase Elementary School, and one child attended St. Elizabeth-Seton School. Children in the control group attended a variety of different schools (n = 11). Two children attended Oakdale Elementary School. One child attended each of the following elementary schools: Cox, Raymer, Sacred Heart, Navarre, Englewood, Lake Erie, Stewart, and Eagle.

According to a report published by the school district, approximately 89% of children attending Riverside Elementary School, 97% attending Chase Elementary, 66% attending Oakdale Elementary, 84% attending Navarre Elementary, and 70% attending Raymer Elementary receive free or reduced price lunches in the 2002-2003 school year (Toledo Public Schools, 2003). Furthermore, approximately, 57.7% of the students in the Toledo Public School district are considered economically disadvantaged (Ohio Department of Education, 2004).

Intervention

Lesson Overview

The program was designed by Bowling Green Dietetic Internship students to improve basic Food Guide Pyramid knowledge and cooking skills. The theoretical basis of the cooking class was the Social Learning Theory, including social modeling and meal preparation. The
cooking classes provided a supportive learning environment where children could observe
instructors demonstrate cooking skills, practice these skills, and then demonstrate the skills
themselves. In addition, ingredients to make recipes at home and equipment were provided to
reinforce behaviors. To increase the likelihood that the students would use the recipes again, the
participants were provided with the ingredients to prepare one of the recipes at home at the end
of every lesson. Each participant was provided equipment that includes a cheese grater, paring
knife, cutting board, meat thermometer, measuring spoons, measuring cups, spatula, vegetable
peeler/brush, and serving spoon, which subjects were able to take home with them at the end of
the intervention. The food preparation ingredients were provided as an incentive for participants
to attend the next lesson. Also, at the end of the intervention, the participants prepared selected
dishes from the cooking sessions for their families to enjoy at the Family Feast, at the YMCA.
Participants were also provided with a recipe book of all recipes created during the seven-week
program to take home. Each of these aspects was designed to increase knowledge, and increase
behavior change.

The recipes incorporated in this study were chosen based on ease of cooking, cultural
acceptability and minimal cost. The recipe sources included: the “4 Your Heart”: Easy “heart
healthy” family recipe ideas with four food ingredients or less and fun activities to get your body
moving, developed by the Toledo Lucas-County Health Department “4 Your Heart” Coalition
and WGTE public broadcasting (Treuhaft, Moran & Selan, 2001); “Preparing Nutritious Meals
at Minimal Cost” by the United States Department of Agriculture Center for Policy and
Promotion (Hogbin et al., 1999); and, “Heart-Healthy Home Cooking African American Style”
by the National Heart, Lung and Blood Institute (National Heart, Lung and Blood Institute,
1997).
The project curriculum included: 1) a review of the food guide pyramid, portion sizes, recommended number of servings/day and review of key nutrients [i.e. vitamins and minerals], 2) safety and cleanliness in the kitchen, 3) the use of kitchen equipment and utensils, 4) hands-on cooking experiences, and 5) the importance of cleaning up after meal preparation. Each session focused on a different food group. Detailed descriptions of the lessons and recipes are located in Appendix D and Appendix E. The hand washing and cross contamination lesson were utilized from the “Fight Bac” campaign (Fight Bac, 2004 a; Fight Bac, 2004 b). Table 1 summarizes the lessons and recipes for each week.
<table>
<thead>
<tr>
<th>Week</th>
<th>Lesson Topic</th>
<th>Nutrients Identified</th>
<th>Cooking Concepts</th>
<th>Recipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hand washing Cross contamination</td>
<td>NA</td>
<td>Washing/cutting vegetables, Heating milk without scalding</td>
<td>Ants on a Log Mexican Hot Chocolate</td>
</tr>
<tr>
<td>2</td>
<td>Grains</td>
<td>Carbohydrates, niacin, riboflavin, iron, folate, and fiber.</td>
<td>Measuring and mixing liquid/dry ingredients, Testing muffins for doneness</td>
<td>Corn Muffins Arroz Con Leche Snack Mix</td>
</tr>
<tr>
<td>3</td>
<td>Fruits</td>
<td>Carbohydrates, vitamin A, vitamin C, and fiber.</td>
<td>Measuring liquid/dry ingredients, Making a crumb topping, Using microwave safely</td>
<td>Peach Crisp Baked Apples</td>
</tr>
<tr>
<td>4</td>
<td>Vegetables</td>
<td>Carbohydrates, vitamin A, vitamin C, and fiber.</td>
<td>Measuring liquid/dry ingredients, Washing, slicing, chopping vegetables</td>
<td>Three Bean Casserole Veggies N Dip</td>
</tr>
<tr>
<td>5</td>
<td>Dairy</td>
<td>Vitamin A, vitamin D, riboflavin, protein, and calcium.</td>
<td>Grating cheese, Chopping onions and potatoes, Cooking macaroni to package instructions</td>
<td>Mac and Cheese Cottage Cheese Potatoes Yogurt Parfait</td>
</tr>
<tr>
<td>6</td>
<td>Meats</td>
<td>Protein, iron, zinc, thiamin, niacin, vitamin B6, and B12.</td>
<td>Removing excess fat, Correctly use meat thermometer</td>
<td>Kickin’ Oven Fried Chicken Lean, Mean, Bean Burritos Peanut Butter Balls</td>
</tr>
<tr>
<td>7</td>
<td>Family Feast</td>
<td>Review and Synthesis of all Lessons</td>
<td>Review and Synthesis of all Lessons</td>
<td>Discussed importance of handwashing and cross contamination. Discussed nutrients associated with each food group of the Food Guide Pyramid.</td>
</tr>
</tbody>
</table>
Evaluation

A written test consisting of 13 questions was used to assess change in knowledge and self-assessment of skills at baseline and at the end of the intervention (Appendix F). Knowledge of the Food Guide Pyramid, and questions concerning reading a food label were utilized from Team Nutrition (Team Nutrition, 1995) for third through fifth graders. Team Nutrition was developed by the United States Department of Agriculture. Participants in the control group and intervention group were asked to voluntarily complete a pre and post-test.

The self-assessment of confidence in performing cooking skills section of the test was not a part of Team Nutrition, and was created to assess the participants’ personal opinion in regards to completing various skills, such as following a recipe. The self-assessment of confidence in performing cooking skills section was administered on the same day the nutrition section of the pre test and post test were provided. Participants were asked to read the statements and circle the sentence that best describes how they feel about that particular skill.

The first section of the test consisted of seven questions relating to nutrition knowledge. For example, three questions of the test assessed knowledge of the suggested number of servings from each of the food groups. Two questions assessed the fat content in various foods. Another two questions asked participants to read the food label provided. The second section of the test, questions 8-13, included questions about the participants’ self-assessment of confidence in performing cooking skills. The subjects were asked to circle one of three sentences that best described how they felt about following a recipe, measuring ingredients, peeling carrots, grating cheese, preparing chicken for baking, and cutting up vegetables or fruit. For example, participants were asked to circle from one of the three statements: I can follow a recipe by
myself, I can follow a recipe with the help from someone else, or I have never followed a recipe, and do not feel I could make it by myself.

The pre-test was given on the first day of the sanitation lesson and the post-test was given on the day of the meat lesson. The average (± SD) length of time between the pre-test and post-test for the intervention group was 24 ± 15.6 days and control group was 21 ± 10.4 days.

An evaluation survey was also given to the parents of participants the day of the family feast (Appendix G). This survey was given to determine how effective the “Kids in the Kitchen” class met the teaching objectives of the individual classes. The survey also provided feedback of what the parent of the participants believed their child liked most and least about the cooking classes.

On the day of the Family Feast, each participant was observed and evaluated by the Principal Investigator using a Behavioral Skills Checklist (Appendix H). The checklist options were: performs independently, needs assistance, or not observed. Skills included on the checklist are: demonstrates proper hand washing technique, chooses correct cup to measure dry ingredients, measures dry ingredients correctly, uses measuring spoons correctly, chooses correct cup to measure liquid ingredients, uses vegetable peeler to peel carrots, washes vegetables using vegetable brush, uses grater correctly to grate cheese, uses knife correctly to chop vegetables, and uses thermometer to check temperature of meat.

Statistical Analysis

Data were analyzed using SAS (version 8) and Minitab (version 14) software. Repeated measures tests were used to analyze differences between the pre-test and post-test, and between the intervention and control groups. Statistical significance was indicated at p < .05. A two sample T-test was used to determine if the average age of the control group was higher than the
intervention group. The Mann-Whitney test was used to determine if the median age of the control group was higher than the intervention group. A two-proportion test was used to determine if the percent of Caucasian children were higher in the control group versus intervention group. This same test was also used to determine if the percentage of females in the treatment group were higher than in the control group. Cross tabulations were conducted to determine the childrens’ cooking skills based on the skill checklist in relation to the parents’ assessment of their child’s skills, according to the parent evaluation.
CHAPTER IV
RESULTS

Demographics Profile

There was no significant difference between the intervention and control group based on age, grade in school, or sex (Table 2). A test of two proportions determined that the percent of Caucasian in the intervention group was not significantly different from the control group ($p = .182$). The percentage of females in the treatment group was not significantly higher than the control group ($p = .659$).

Table 2. Demographics profile of the “Kids in the Kitchen” participants.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intervention (n= 13)</th>
<th>Control (n= 11)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>8 - 12</td>
<td>10.25 ± 1.04</td>
<td>9.91 ± 1.04</td>
</tr>
<tr>
<td>Grade level</td>
<td>4 - 6</td>
<td>4.46 ± .66</td>
<td>4.36 ± .50</td>
</tr>
<tr>
<td>Sex</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>23%</td>
<td>36.4 %</td>
<td>.659</td>
</tr>
<tr>
<td>Female</td>
<td>77%</td>
<td>64%</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td>.182</td>
</tr>
<tr>
<td>African American</td>
<td>N/A</td>
<td>61.5%</td>
<td>54.6%</td>
</tr>
<tr>
<td>Bi-racial</td>
<td>N/A</td>
<td>15.4%</td>
<td>-</td>
</tr>
<tr>
<td>Hispanic</td>
<td>N/A</td>
<td>7.7%</td>
<td>-</td>
</tr>
<tr>
<td>Caucasian</td>
<td>N/A</td>
<td>15.4%</td>
<td>45.5%</td>
</tr>
</tbody>
</table>

Knowledge Evaluation

To evaluate knowledge gains, three repeated measures analysis of variance tests were conducted to determine if there was a significant difference between groups (intervention versus control), and time (pre to post test). The test was divided into two sections: nutrition questions, skills self-assessment, and the total scores were evaluated as well. A significant difference was detected on the nutrition questions ($f = 4.7$, $p = .04$) between the groups, but not the self-assessment of skills questions ($f = .11$, $p = .75$), or the overall test score ($f = .59$, $p = .45$).
Although a significant difference was not detected on the self-assessment of skills questions and overall test score between the groups, the intervention group scores were higher when on the pre and post test when compared to the control group (Appendix I). There was no significant difference (p = .35) on the nutrition scores between the groups at baseline (Fig. 1). The mean number correct was 5.6 ± 2.3 for the intervention group, and 5.8 ± 1.8 for the controls (Appendix I). However, there was a significant difference in nutrition knowledge scores between the groups at post-test. The experimental groups (dotted line) scored significantly higher (p = .04) on average than the control group (black line) on the post nutrition scores, 6.5 ± 3.1 vs. 4.5 ± 2.6, respectively.

Figure 1. Difference in pre and post nutrition scores between the “Kids in the Kitchen” participants and controls.

*Significant differences between pre/post and intervention/control p < .05.
Time = 7 weeks.

Skills Checklist Evaluation

According to observation of skills of the intervention group by the principal investigator at the end of the program, all of the participants (100%) were observed to independently
demonstrate proper: hand washing; measurement of dry ingredients; using a knife correctly; and, using a vegetable brush to wash vegetables. Approximately 92.3% of the children were observed to independently choose the correct measuring cup for liquid and dry ingredients. They also used measuring spoons correctly. The participants scored lower on independently using a vegetable peeler to peel carrots (69.2%), using a grater to correctly to grate cheese (53.9%), and using a thermometer to check the temperature of meat (53.9%). These findings are summarized in Table 3.

Table 3. Observation of children performing each cooking skill for “Kids in the Kitchen” participants.

<table>
<thead>
<tr>
<th>Skill</th>
<th>Not Observed</th>
<th>Needs Assistance</th>
<th>Performs Independently</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrates proper hand washing technique</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Chooses correct cup to measure dry ingredients</td>
<td>-</td>
<td>7.7</td>
<td>92.3</td>
</tr>
<tr>
<td>Measures dry ingredients correctly</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Uses measuring spoons correctly</td>
<td>-</td>
<td>7.7</td>
<td>92.3</td>
</tr>
<tr>
<td>Chooses correct cup to measure liquid ingredients</td>
<td>-</td>
<td>7.7</td>
<td>92.3</td>
</tr>
<tr>
<td>Uses vegetable peeler to peel carrots</td>
<td>30.8</td>
<td>-</td>
<td>69.2</td>
</tr>
<tr>
<td>Washes vegetables using vegetable brush</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Uses grater correctly to grate cheese</td>
<td>30.8</td>
<td>15.4</td>
<td>53.9</td>
</tr>
<tr>
<td>Uses knife correctly to chop vegetables</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Uses thermometer to check temperature of meat</td>
<td>-</td>
<td>46.2</td>
<td>53.9</td>
</tr>
</tbody>
</table>

n = 13

Attendance Evaluation

Attendance in the beginning of the program started high and gradually declined. The dairy (61.5%) and meat lesson (53.8%) had the lowest attendance. However, every subject (n = 13) attended the Family Feast event (Table 4). Weather and religion may have played a role in the decline in attendance on certain lessons; however, data were not collected on these variables.
Table 4. Average attendance for each lesson and overall average attendance for “Kids in the Kitchen” participants.

<table>
<thead>
<tr>
<th>Class</th>
<th>Lesson</th>
<th>Percent Attended</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Food Safety</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Grains</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>Fruit</td>
<td>92</td>
</tr>
<tr>
<td>4</td>
<td>Vegetables</td>
<td>92</td>
</tr>
<tr>
<td>5</td>
<td>Dairy</td>
<td>61.5</td>
</tr>
<tr>
<td>6</td>
<td>Meat</td>
<td>53.8</td>
</tr>
<tr>
<td>7</td>
<td>Family Feast</td>
<td>100</td>
</tr>
</tbody>
</table>

Overall Average 85.6

Attendance for each participant (Table 5) ranged from 43% to 100%. Only 4 of the 13 participants (38%) attended every class. Two participants attended class 71% of the time. Five participants attended class 85% of the time. In summary, eleven out of thirteen children attended seven classes over 70% of the time.

Table 5. Percent of classes attended by each “Kids in the Kitchen” participant.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Percent of Classes Attended</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>71</td>
</tr>
<tr>
<td>4</td>
<td>85</td>
</tr>
<tr>
<td>5</td>
<td>71</td>
</tr>
<tr>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>7</td>
<td>100</td>
</tr>
<tr>
<td>8</td>
<td>85</td>
</tr>
<tr>
<td>9</td>
<td>85</td>
</tr>
<tr>
<td>10</td>
<td>85</td>
</tr>
<tr>
<td>11</td>
<td>85</td>
</tr>
<tr>
<td>12</td>
<td>43</td>
</tr>
<tr>
<td>13</td>
<td>100</td>
</tr>
</tbody>
</table>

Parent Evaluation

The results of the parent evaluation (Table 6) indicated that the majority of parents agreed that the food used to make recipes in class was sent home after class (76.9%). The majority of
parents also either agreed or strongly agreed that their child knew how to properly wash their hands before cooking (76.9% agreed and 15.4% strongly agreed). They also believed their child knew how to measure dry and liquid ingredients (46.72% agreed and 46.72% strongly agreed), could use a vegetable peeler to peel carrots (46.2% agreed and 46.2% strongly agreed), could brown ground beef (15.4% agreed and 69.2% strongly agreed), and could grate cheese using a cheese grater (53.9% agreed and 30.8% strongly agreed). There were split results regarding correctly using a meat thermometer. Approximately 46.2% of the parents disagreed or were not sure if their child could use a meat thermometer (15.4% disagreed and 30.8% not sure) and 53.9% agreed or strongly agreed (30.8% agreed and 23.1% strongly agreed).
Table 6. Parent frequency (%) evaluation of the “Kids in the Kitchen” program and opinion of their child’s cooking skills.

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Not Sure</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often was the food sent home after class used to make the recipes from the cooking class?</td>
<td>-</td>
<td>15.4</td>
<td>7.7</td>
<td>76.9</td>
<td>-</td>
</tr>
<tr>
<td>My child knows the proper way to wash hands before cooking.</td>
<td>7.7</td>
<td>-</td>
<td>-</td>
<td>76.9</td>
<td>15.4</td>
</tr>
<tr>
<td>My child knows how to measure dry ingredients using measuring cups.</td>
<td>-</td>
<td>-</td>
<td>7.7</td>
<td>46.2</td>
<td>46.2</td>
</tr>
<tr>
<td>My child knows how to measure liquid ingredients using a measuring cup.</td>
<td>-</td>
<td>-</td>
<td>7.7</td>
<td>46.2</td>
<td>46.2</td>
</tr>
<tr>
<td>My child can use a vegetable peeler to peel carrots.</td>
<td>-</td>
<td>-</td>
<td>7.7</td>
<td>46.2</td>
<td>46.2</td>
</tr>
<tr>
<td>My child can chop vegetables using a knife.</td>
<td>-</td>
<td>-</td>
<td>15.4</td>
<td>38.5</td>
<td>46.2</td>
</tr>
<tr>
<td>My child can brown ground beef.</td>
<td>-</td>
<td>7.7</td>
<td>7.7</td>
<td>15.4</td>
<td>69.2</td>
</tr>
<tr>
<td>My child can use a thermometer to see whether or not meat is fully cooked.</td>
<td>-</td>
<td>15.4</td>
<td>30.8</td>
<td>30.8</td>
<td>23.1</td>
</tr>
<tr>
<td>My child is able to grate cheese using a cheese grater.</td>
<td>-</td>
<td>7.7</td>
<td>7.7</td>
<td>53.9</td>
<td>30.8</td>
</tr>
</tbody>
</table>

n = 13

Parents were also asked to write down their thoughts and opinions about the cooking classes in response to three short answer questions. The majority of parents believed their child liked learning to cook, making different recipes, and eating what they cooked (Table 7). One parent believed their child/children did not like some of the food. Two parents commented that their children disliked the short class time. In general, the parents were happy with their child’s cooking class experience. One parent suggested cooking typical foods that children enjoy.
<table>
<thead>
<tr>
<th>Parent</th>
<th>Question 10- What did your child like most about the cooking classes?</th>
<th>Question 11-What did your child like least about the cooking classes?</th>
<th>Question 12- Please make any additional comments about how you think the class went or suggestions for future classes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Making different foods.</td>
<td>The room was too small.</td>
<td>My child really enjoyed the class and learned a lot of things.</td>
</tr>
<tr>
<td>2</td>
<td>Mixing ingredients (especially eggs)</td>
<td>Some of the food (rice pudding)</td>
<td>Maybe teach them some things that they really like such as tacos, spaghetti, and deviled eggs, vegetable pizza.</td>
</tr>
<tr>
<td>3</td>
<td>Cooking</td>
<td>Cutting onions</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>My child had no complaints, she loved everything!</td>
<td>-</td>
<td>Wonderful program. I hope it continues.</td>
</tr>
<tr>
<td>5</td>
<td>Other children, food prep.</td>
<td>Short classes, limited time.</td>
<td>Great class. Gave her a great sense of independence. Teaches responsibility.</td>
</tr>
<tr>
<td>6</td>
<td>Cooking</td>
<td>She likes everything</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Food. Learn to cook. Letting them cook.</td>
<td>Only once a week.</td>
<td>Thank you. I think my children learned a lot.</td>
</tr>
<tr>
<td>8</td>
<td>Being able to cook.</td>
<td>Nothing, she enjoyed it.</td>
<td>I think this was a good program. My daughter has learned a lot and enjoyed doing it.</td>
</tr>
<tr>
<td>9</td>
<td>Learning more about being in the kitchen and cooking and being a part of making a meal.</td>
<td>The short time limit.</td>
<td>There are some kids that aren’t allowed to be in the kitchen at all. This gives the kids a chance to be responsible and feel a part of something being helpful.</td>
</tr>
<tr>
<td>10</td>
<td>Eating what he has made.</td>
<td>Nothing</td>
<td>Very enjoyable experience for my son. Taught him to understand the responsibilities/duties I face in the kitchen. Thank you all.</td>
</tr>
<tr>
<td>11</td>
<td>Learning different recipes.</td>
<td>Some of the kids were rude.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Than you can cook!</td>
<td>Nothing</td>
<td>I think it’s very important to teach children about cooking.</td>
</tr>
<tr>
<td>13</td>
<td>The cooking</td>
<td>Nothing</td>
<td>I think everything went great because they came home and was excited about what they learned. I don’t think anything should be changed.</td>
</tr>
</tbody>
</table>
Seven cross tabulations were conducted to compare the Behavioral Skills Checklist to the parent evaluation. The percentages were completed for the following variables: hand washing, measuring dry ingredients, measuring liquid ingredients, using a vegetable peeler, using knife correctly, using a meat thermometer, and using a cheese grater properly (Table 8). In most cases, there was good agreement between what the child was able to do based on observations recorded by the principal investigator on the Behavioral Skills Checklist and the parent’s assessment of the child’s ability according to the parent evaluation. All children received an independent score for washing their hands. One parent did not believe their child was independent in hand washing, but the child was able to do the task. The parents’ assessment matched the skill level of the child for measuring dry ingredients and using a knife. Only one child needed assistance measuring liquid ingredients, and his or her parent agreed. One parent was not sure if their child could use a vegetable peeler and the child was observed to independently use a vegetable peeler correctly. One child needed assistance using a cheese grater and his or her parent agreed.
Table 8. Cross tabulation results for child’s cooking skill and parents’ belief of their child’s skill.

<table>
<thead>
<tr>
<th>Skill</th>
<th>Children that could complete the skill independently, with assistance, or not observed</th>
<th>Parents that strongly disagreed that child could complete that skill</th>
<th>Parents not sure if child could complete skill</th>
<th>Parents that agreed child could complete skill</th>
<th>Parents that strongly agreed child could complete skill</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Hand washing</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independently</td>
<td>100</td>
<td>7.69</td>
<td>-</td>
<td>23.08</td>
<td>69.23</td>
</tr>
<tr>
<td>Measuring dry ingredients</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independently</td>
<td>100</td>
<td>-</td>
<td>7.69</td>
<td>53.85</td>
<td>38.46</td>
</tr>
<tr>
<td>Measuring liquid ingredients</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independently</td>
<td>92.31</td>
<td>-</td>
<td>7.69</td>
<td>46.15</td>
<td>38.46</td>
</tr>
<tr>
<td>Needs Assistance</td>
<td>7.69</td>
<td>-</td>
<td>-</td>
<td>7.69</td>
<td>-</td>
</tr>
<tr>
<td>Using a vegetable peeler</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independently</td>
<td>76.92</td>
<td>-</td>
<td>7.69</td>
<td>38.46</td>
<td>30.77</td>
</tr>
<tr>
<td>Not observed</td>
<td>23.08</td>
<td>-</td>
<td>-</td>
<td>15.38</td>
<td>7.69</td>
</tr>
<tr>
<td>Using a knife</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independently</td>
<td>100</td>
<td>-</td>
<td>15.38</td>
<td>46.15</td>
<td>38.46</td>
</tr>
<tr>
<td>Using a meat thermometer</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independently</td>
<td>53.85</td>
<td>-</td>
<td>15.38</td>
<td>15.38</td>
<td>23.08</td>
</tr>
<tr>
<td>Needs assistance</td>
<td>46.15</td>
<td>7.69</td>
<td>23.08</td>
<td>7.69</td>
<td>7.69</td>
</tr>
<tr>
<td>Using a cheese grater</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independently</td>
<td>61.54</td>
<td>-</td>
<td>7.69</td>
<td>30.77</td>
<td>23.08</td>
</tr>
<tr>
<td>Needs assistance</td>
<td>7.69</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>7.69</td>
</tr>
<tr>
<td>Not observed</td>
<td>30.77</td>
<td>-</td>
<td>-</td>
<td>7.69</td>
<td>23.08</td>
</tr>
</tbody>
</table>

n = 13
CHAPTER V
DISCUSSION

The purpose of the present study was to determine if the “Kids in the Kitchen” cooking class program, which was developed as an after school community nutrition intervention for low-income children, would increase knowledge of the Food Guide Pyramid and improve cooking skills among 4th through 6th grade children. The results of the program revealed significant improvements on nutrition knowledge on the post-test between the intervention and control groups. These findings illustrate that community interventions that integrate cooking classes with nutrition education can successfully impact middle childhood age children’s nutrition knowledge. The results of this study support the findings from other researchers, such as Winter et al. (1999) who reported that children who participated in the Youth Cooking School had significant improvements on knowing the recommended daily servings from the Food Guide Pyramid.

Few cooking class studies have been conducted with children; however, the results from each of the studies found beneficial effects on nutrition knowledge, as did the “Kids in the Kitchen” program. Liquori et al. (1998) determined that nutrition knowledge was positively affected via cooking classes. The results of the other cooking class studies showed positive effects on food safety behaviors. For example, Brown & Hermann (2005) concluded that children improved their safe food handling behaviors with fruits and vegetables via a cooking class. Quinn et al. (2003) wanted to improve attitudes towards and increase fruit and vegetable consumption of 5th grade children; however, consumption was not shown to be affected. The study did conclude that participants increased their food exposure and were more willing to try new foods (Quinn et al.). The results from these studies suggest that cooking class interventions
can impact knowledge (Liquori et al., 1998), behaviors (Brown & Hermann, 2005), food exposure (Quinn), and willingness to try new foods (Quinn).

Researchers suggest that children from low-income families are less likely to eat fruits and vegetables, which contain vitamins and minerals such as vitamins A, E, C, K, magnesium, and calcium that are currently lacking in the diets of children today. One quarter of vegetables consumed by children and adolescents are french fries (Krebs-Smith et al., 1996). Multiple studies that have focused on increasing fruits and vegetables concluded that availability and accessibility are important determinants of consumption (Bull, 1998; Cullen et al., 2003; Cullen et al., 2001; Sandeno et al., 2000; Reynolds et al., 1999). Educating children on nutrition empowers them to make healthier food choices. Although, some researchers have found that knowledge and preferences do not necessarily relate to consumption (Domel et al., 1993 a). Others have concluded that knowing the number of servings of fruits and vegetables that should be consumed each day were weakly correlated \( r = .16 \) with intake \( (p < .01) \) (Sandeno et al., 2000). Children who know the recommended number of fruits and vegetables to consume everyday were more likely to be high consumers of fruits and vegetables (Sandeno et al.). The “Kids in the Kitchen” program improved children’s knowledge of the Food Guide Pyramid; however, data on actual consumption of servings from each food group were not collected from the participants.

Kandiah & Jones (2002) reported positive results on nutrition knowledge and choosing healthier foods in their study with 5th graders. The researchers used three-day food records to evaluate the effectiveness of a nutrition education program for 5th graders, which included lessons with the food guide pyramid. The results indicated that nutrition knowledge significantly increased \( (p = .001) \) within the experimental group, as well as choosing healthier foods that met
the Dietary Guidelines [p = .0001] (Kandiah & Jones). The results of the “Kids in the Kitchen” study could have been more valuable if food records from the participants were collected to determine if participants were making healthier food choices, or if they changed their food preferences.

Winter et al. (1999) demonstrated using a cooking class (n = 227) with 7-15 year old children that the average score on the three month follow up test continued to be significantly higher than the pre-test on food preparation, food safety, and nutrition knowledge questions. More importantly, participants scored significantly higher on the post-test in regards to knowing the number of servings from the Food Guide Pyramid compared to the pre-test. These results indicate that hands on cooking experiences have an impact on long-term nutrition knowledge. A long-term assessment of knowledge and skills such as this would improve the strength of the Kid’s in the Kitchen research project.

Children in the 4th through 6th grade were included in the current study because they were considered as being a prime target audience for nutrition intervention. Understanding the cognitive development of the target audience is important to consider when implementing nutrition education programs (Contento et al., 1995). One of the reasons that children of this age group are a prime target audience is that they are developing cognitive skills, such as improved planning and memory (Berk, 2002). These skills aid in remembering the various food groups of the Food Guide Pyramid. Children of this age would also have an easier time planning meals. Middle school children can also understand abstract concepts and casual relationships, such as food choices and future health implications (Contento et al.). Furthermore, research suggests that behavioral patterns become more resistant to change after the sixth grade (Kandiah & Jones, 2002).
Nutrition education interventions aimed at younger children such as before the sixth grade, may affect food choice behaviors (Sandeno et al., 2000). Older children tend to have other interests, and may have already established their own eating patterns, which may be harder to change. Younger children may lack focus and attention that would create difficulty in teaching them. Based on the children that participated in the “Kids in the Kitchen” program, children of the 4th through 6th grade age groups were willing to learn, appeared interested in trying new foods, and were eager to volunteer when help was needed or when another participant was having trouble completing a skill.

The “Kids in the Kitchen” program included all of the relevant elements of a successful nutrition intervention such as being theory driven and providing instruction time. Researchers indicate that nutrition education programs with ample time and intensity of teaching are more effective than shorter programs (Contento et al., 1995). For example, the nutrition education programs reviewed by Contento et al. (1995) discovered from one study that fifteen contact hours could be expected to bring about changes in knowledge and fifty hours were required for changes in attitudes and behaviors (Contento et al., 1995; Connell, Turner & Manson, 1985). The four cooking class studies reviewed with children ranged from two months to one year of nutrition education. Quinn et al. (2003) implemented eleven lessons throughout the school year. Brown & Hermann (2005) implemented eight classes over a period of two months. Winter et al. (1999) conducted their cooking class during the summer months. Liquori et al. (1998) conducted their study for one year. Results from Quinn et al. (2003) did not change behaviors; however, Brown & Hermann (2005) were successful in changing food safety behaviors. Winter et al. (1999) were successful at improving both safe food handling practices in children and selecting nutritious foods in accordance with the Food Guide Pyramid. Future recommendations are to
increase the amount of contact hours in nutrition education programs in order to successfully change behaviors. The implementation of Social Learning Theory into this intervention provided a basis for developing lessons. For example, instructors demonstrated the cooking skill and then observed the child demonstrate the skills, which enhanced their learning. According to results from the Behavioral Skills Checklist, many children were able to perform the majority of the skills independently. One of the reasons providing food was important was to be sure that the children would have the resources at home. Providing food for participants to take home gave an opportunity for the children to build upon the skills they learned in class within their home environment. Gribble et al. (2003) also incorporated Social Learning Theory into their study that provided nutrition education lessons and exposure to food, and reported similar results for nutrition knowledge. For example, a significant increase in nutrition knowledge scores \( (p < .005) \) and fruit intake \( (p < .005) \) were seen in children in the experimental group. Using theory in nutrition education, especially incorporating various constructs from different theories as Achterberg & Miller (2004) describe improves behavioral outcomes.

The results of the Parent Evaluation compared to the Behavioral Skills Checklist revealed that the majority of parents either agreed or strongly agreed that their child could complete certain skills at the end of the intervention. Few parents strongly disagreed that their child could brown ground beef and use a meat thermometer. There were some parents that were not sure if their child could complete a skill, such as using a knife. All children were observed to use a knife correctly in class. One child was observed to wash their hands independently in class and their parents strongly disagreed that their child knew how to wash their hands. Further research is necessary to determine if parents underestimate their child’s cooking ability. In addition, there may be the possibility that the parent was not sure if their child knew how to use a knife.
correctly because the child had never cooked at home and/or the parent had not actually observed
the child cooking. The results of the Parent Evaluation may have been different if the parents
were involved in the program, and were able to observe their own children cooking. Future
recommendations for improving this study are to include more parental involvement. Including
parents in the study provides the opportunity for them to enforce the messages they learned in the
program at home, as well as to set an example of healthy eating behaviors for their children and
other members of the household (Lytle & Achterberg, 1995).

According to the cooking class studies with children that were reviewed, only two of the
studies incorporated parental involvement. Other researchers have suggested that family
involvement increases the effectiveness of nutrition education programs, especially with younger
children in elementary school (Contento et al., 1995). Quinn et al. (2003) incorporated parents
through volunteering, and sending recipes and letters to the parents in their modified version of
the Cookshop™ program. The actual Cookshop™ program also provided parent workshops and
sent home recipes and newsletters to the parents (Liquori et al., 1998). Neither of these
interventions included a measurement of parent perceptions of children’s cooking skills or an
evaluation of the child’s cooking ability. Further research on this topic is warranted.

Contento et al. (1995) noted problems with low attendance rates of parents involved in
after school programs with children (Contento et al., 1995; Nader et al., 1989; Baranowski,
Henske, Simmons-Morton & Palmer, 1990). Attendance of participants during the cooking
classes began with 100% attendance up until the fourth week of class; however, the week of the
dairy and meat lesson attendance began to fall. One of the reasons multiple kids were missing
from the lesson about meats was due to the local school having a dance the week of the class.
Perhaps one of the ways attendance could have improved in this study was if the principal
investigator collaborated with the local schools to determine other program dates that may have interfered with the “Kids in the Kitchen” program. Although Meloche (2003) increased participation rates in a cooking class located on a university campus, 100% participation was not observed at each session, however, 88% participation rate was the lowest identified. Providing participants a reason to attend the next session such as providing taste testing may increase the likelihood that children attend the classes (Brown & Herman, 2005). Providing knowledge and tangible objects such as food are important to consider, as they may impact participation rates in nutrition programs (Meloche, 2003).

Programs such as “Kids in the Kitchen” should be more widely available. Many children would benefit from attending programs such as this one to increase their knowledge of nutrition and cooking skills. Based on the feedback from the parent evaluation, the majority of parents believed their children improved their cooking skills, and that the class was valuable to them. Some future suggestions for change include making recipes that children really enjoy. Although one of the parents stated that their child/children did not like some of the food, the program did provide the opportunity to try foods that were unfamiliar to them. In addition, informal comments from children were documented. One child commented that they made the Macaroni and Cheese recipe for their family. One child commented that they disliked the Arroz con Leche recipe. Another child commented that they helped their parent cook in the kitchen more often. These informal comments display the valuable benefits of the cooking class program. They also provide recommendations for researchers and educators to consider with future programs, such as, omitting certain recipes that did not appear favorable to the children that participated in the present study.
This program was developed to be appropriate for children of all ethnicities. The “Kids in the Kitchen” program included a high proportion of African Americans in the study. The program was appropriate for this audience because of the increasing prevalence of health problems in minority populations such as overweight, hypertension, and non-insulin dependent diabetes mellitus (Ogden et al., 2002). Recipes used in the program were adapted to provide less fat and calories than the original version. For example, fried chicken is popular among the African American culture; however, frying foods provides excess fat and calories and could lead to weight gain (Ewing, J, 1995). The recipe used in the “Kids in the Kitchen” program altered recipes by using a healthier food preparation method, such as baking chicken. Children that participated in the program were exposed to healthy food choices, which may impact their willingness to try these foods or new foods again in the future (Quinn et al., 2003).

Another benefit of the “Kids in the Kitchen” program was that it provided a place for children to learn in a safe environment. Also, it provided an opportunity for working parents to get their child involved in something positive, rather than illegal and/or dangerous activities that may occur in their neighborhoods. Participants in the “Kids in the Kitchen” program attended various schools in the immediate area. According to the Behavioral Skills Checklist, the majority of the children were able to complete each of the skills either with help or independently. Information collected on the academic achievement scores of children from the various schools would have been interesting to compare to determine if high achievers were better able to complete more skills independently when compared to low achievers, who may or may not have difficulty completing skills. It would have been helpful to find out if any of the subjects had previously completed or were currently taking a nutrition class. For example,
children that may have already learned about the Food Guide Pyramid in school may have done better on the pre and post-test than children who had no knowledge of the Food Guide Pyramid.

The lessons used in this study were designed around the food groups of the 1992 Food Guide Pyramid (United States Department of Agriculture, 1992). A new Food Guide Pyramid was released in January 2005, and was not incorporated into this study because the data were already collected. Providing updated nutrition information is essential and always ideal for research purposes, however, use of the new Food Guide Pyramid was not feasible during the course of this study. The “Kids in the Kitchen” program should implement the new Food Guide Pyramid, if the program were to be conducted again in the future.

The limitations of the study should be noted. Improvement of the children’s cooking skills was not measurable due to the lack of a baseline behavioral skills assessment. Also, some of the children were not observed on the day the behavioral skills assessment was completed. This could have skewed the results because the child may have been able to complete the skill. In addition, an important limitation of this study was that there was no reliability testing completed on the self-assessment of cooking skills section of the pre and post-test. Future recommendations are to conduct this type of testing to determine the validity and reliability of the test instrument. In addition, future recommendations are to include a participant demographic sheet to be filled out by parents of the participants to determine characteristics of the intervention group such as family size and income. These variables were not collected on the participants in the current study. Information on the prevalence of children who are home alone after school would be beneficial. Cooking class programs such as the “Kids in the Kitchen” program would provide “latchkey children” the opportunity to learn how to cook a nutritious
meal and/or snack at home when parents are not present. The program also provides children with the opportunity to learn how to properly and safely use kitchen equipment.

Another limitation of this study was the small sample size of both the intervention and control groups. Small sample sizes make it more difficult to test data statistically to show significant change. For example, the results of the self-assessment of confidence in cooking skills did not reveal a significant change from pre test to post-test when tested. The results may have been different if the sample size was larger. Multiple attempts were made to increase the number of participants in the intervention and control group for data collection purposes; however, due to time constraints of the study, it was not feasible to continue finding more participants. In addition, the kitchen used in this study was fairly small and could only hold a small number of children. Research suggests that getting people interested in attending programs related to their health is difficult (Meloche, 2003). Providing good incentives to attend programs such as learning new skills may enhance participation rates (Meloche; James & Wiley, 1993). For example, Meloche (2003) increased participation with her campus based nutrition program by involving hands on cooking and taste testing. Winter et al. (1999) obtained a larger sample of 227 children by recruiting through newspapers, radio, and letters. Limited funding of this study prohibited the principal investigator from using these more costly resources. In addition, it was difficult to obtain data from the control group because consent forms were not being completed, and children were absent on the days that the researcher attempted to administer the pre/post test. Winter et al. (1999) also provided call collect phone numbers to participants’ parents in order to decline participation in their study. This method may not have been useful for the “Kids in the Kitchen” program, however, due to the fact that a convenience sample was used in this study, and children participated in this after-school program on a voluntary basis only.
Although many community nutrition projects are conducted using convenience samples and a quasi-experimental design (Liquori et al., 1998; Auld & Fulton, 1995), this method makes it harder to generalize the results to other children of the same age. The “Kids in the Kitchen” program did not randomize participants into groups, due to the practical difficulty of telling certain children that they could attend the class and others, such as their friends, couldn’t. Liquori et al. (1998) were also unable to randomize the participants from various classes to the specific conditions in their study.

The “Kids in the Kitchen” program rendered many benefits for participating children and it supported national recommendations of ongoing nutrition education (Contento et al., 1995). The program provided nutritious foods that included few ingredients, limited cost, and were popular among children. Consideration of these environmental factors enhanced the effectiveness of the “Kids in the Kitchen” program. Researchers have previously identified factors that influence food choice and among these are: cost, time considerations, and influences of parents and/or peers (Neumark-Sztainer et al., 1999). Recipes with few ingredients usually require little time to prepare. The “Kids in the Kitchen” program positively impacted nutrition knowledge of its’ participants, which is one of the necessary components of a gradual multifaceted process for changing dietary habits of children (Contento et al.).
CHAPTER VI
CONCLUSIONS

The results of the “Kids in the Kitchen” program can be applied to both the research and practitioner settings. Researchers should consider examining the impact of cooking classes and hands on experience on nutrition knowledge with children, since few studies are currently available on this topic. More research should be conducted to consider various aspects of the relationship between nutrition knowledge, food consumption, preferences, and parental influence with hands on cooking experiences, such as the “Kids in the Kitchen” program.

Nutrition educators should consider using cooking classes as an educational approach as the results of this study demonstrated the program was effective in increasing nutrition knowledge of the 4th through 6th grade children who participated. Both researchers and nutrition educators should implement cooking classes with children that include not only classroom instruction and food experience, but parental involvement as well. Community interventions have been suggested to enhance school nutrition education (Contento et al., 1995). Both community programs, such as the “Kids in the Kitchen” program, and school based interventions should collaborate to teach children about nutrition, in an attempt to create healthy eating habits at an earlier age, to aid in preventing chronic diseases from developing that are prevalent in children today, such as obesity (United States Department of Agriculture, 1999), and non insulin dependent diabetes mellitus (American Academy of Pediatrics, 2003).

In addition, community outreach programs, such as the local YMCA, already have interests in serving the community. Both nutrition students and the YMCA benefit from collaborating together to develop and administer beneficial programs, such as the “Kids in the Kitchen” program. Nutrition students have the opportunity to gain experience in their field while
providing sound nutrition education. Also, the YMCA can benefit from the expertise of nutrition students, and provide programs to the community for minimal costs. Extra-curricular activities held at the YMCA may also bring in new customers from the community, and result in financial gain in the future, that could be used for continuing these and other types of programs.

Other community outreach programs such as local Cooperative Extension Agencies may help provide resources such as employees that could be trained to help teach the classes. Cooperative Extension agencies may also provide other resources such as funding or a place to hold classes. Local communities may also have grants specifically for nutrition education with children and will provide monetary resources to implement these types of programs.

Community nutrition interventions that include cooking classes are valuable to children in many ways. The immediate value of this type of intervention is that children actually do get to participate in hands on cooking experiences, and learn basic cooking techniques (Winter et al., 1999). Children become aware that they can cook and follow a recipe. They also get to experience new foods that enhance their ability to identify these foods, and they may be more likely to try them again in the future. The long-term value of cooking class interventions are that they are behaviorally based, and children are exposed to various foods, which is more effective in changing eating habits (Quinn et al., 2003). In addition, children are able to interact with their peers and meet new friends. They also have the opportunity to develop and improve their social skills. These types of interventions may illustrate to children the significance of health problems in the future and nutrition education may encourage children to make changes in their current eating habits (Kandiah & Jones, 2002).
REFERENCES


Cullen, K.W., Baranowski, T., Rittenberry, L., Cosart, C., Hebert, D., de Moor, C. (2001). Child-reported family and peer influences on fruit, juice and vegetable consumption:


Treuhaft, J., Moran, M., Selan, M (2001). “4 Your Heart”: Easy “heart healthy” family recipe ideas with four food ingredients or less & fun activities to get your body moving. *WGTE & The “4 Your Heart” Coalition: Toledo-Lucas County Health Department.*


APPENDIX A

Information Flyer and Registration Form
KIDS IN THE KITCHEN

AT

THE SUMMIT YMCA

FORMERLY

THE RIVERSIDE YMCA

306 Bush Street

419-729-6035

Mondays 4:00 pm - 6:00 pm

October 18 - November 29, 2004

Kids In The Kitchen is for 4th, 5th and 6th graders. Bring your child for fun and learning at this free class at the Summit YMCA. Children who have taken this class before will not be eligible.

Shop for food   *   Cook nutritious meals
Bring home recipes and food to make at home
Make a cookbook

Presented by the Summit YMCA Child Care, BGSU Dietetic Internship Program.
Made possible by a grant from 2004 Partnerships for Community Action and the Center for Innovative and Transformative Education
Please complete and return the registration form below.
Parent or guardian must bring child to first meeting.

Guardians name………………………….….        Telephone……………………………
Address………………………………... City…………….     State……    Zip…………
Child’s name……………………………. ……………   Age/Grade……………………...
School Attending………………………………... Guardian’s Signature……………………….

Parent or guardian must bring child to first meeting.
APPENDIX B

Consent Forms
Consent Form for Parents in the Intervention Group

Bowling Green State University

Kids in the Kitchen

Informed Consent

As part of the Summit Street YMCA cooking classes, your child will be asked to take a pretest and post-test. The purpose of the pretest and posttest is to find out if the cooking class helped your child learn cooking skills and some basic nutrition information. The pretest and posttest will be a written test, which will involve underlining or circling answer and answering a question about a food label. All of the questions will be related to food and cooking. The tests will be completed at the first and last class, and will take about 15 minutes to complete. The anticipated risks to your child are not greater than those normally encountered at school. The results will be included in a database with other participants and will be used for research purposes. Your child's name will not be used when entered into the database. This will help us make the cooking classes better in the future.

All of the information will be confidential. Your child's participation in the pretest and posttest is completely voluntary, and he/she does not have to answer any or all questions without penalty or explanation. Your decision to allow or not allow your child to take the test will not affect whether your child can attend the cooking class - we are happy to have them participate.

If you have any questions or comments about these tests, you can contact Cheyenne Parris at (419) 372-8528, Chris Haar at (419) 372-8941, Carole Jambard-Sweet at (419) 729-8544. Please contact the Chair of the Human Subjects Review Board at 419.372.7716 if you have any questions or concerns about participant rights.

I give my consent __________ I do not give my consent __________

Child’s Name (Printed) ____________________________________________

Signature of Parent/Legal Guardian ________________________________ Date: __________

APPROVED - BGSU HSRB
EFFECTIVE 5/30/21
EXPIRES 7/31/23
Consent Form for Participants in the Intervention Group

Bowling Green State University

School of Family and Consumer Sciences
Bowling Green, Ohio 43403-0224
(419) 372-2626
Fax: (419) 372-7854

Consent Form for Participants in the Intervention Group

Kids in the Kitchen

- You are asked to take a quiz at the beginning of the cooking classes and again at the end. This will help us see what you know already and what you have learned. You will not receive a grade for these tests. It will also help us to find out how good we were at teaching you.

- The quiz should take you 15 minutes or less to finish and will probably remind you of taking a test at school. The test will not cause you any more harm than those risks normally encountered in daily life.

- The information is confidential. This means only the teachers will know your answers.

- You don’t have to finish the quiz. You can agree to finish the quiz now and change your mind later.

- You can take the cooking classes even if you don’t want to take this quiz. Your teachers’ feelings about you will not change. We are still happy to have you in the class.

- If you have any questions, you can contact Cheyenne Parris at (419) 372-8528, Chris Haar at (419) 372-8941 or Carole Jambard Sweet at (419) 729-8544.

Name: ___________________________ Date: ___________________________
Consent Form for Participants in the Control Group

Bowling Green State University

School of Family and Consumer Sciences
Bowling Green, OH 43403-0254
Phone: (419) 372-2026
FAX: (419) 372-7854

“Kids in the Kitchen”

- You are asked to take a quiz. This will help us see what you know about cooking and basic nutrition. You will not receive a grade for these tests.

- The quiz should take you 15 minutes or less to finish and will probably remind you of taking a test at school. The test will not cause you any more harm than those risks normally encountered in daily life.

- The information is confidential. This means only the teachers will know your answers.

- You don’t have to finish the quiz. You can agree to finish the quiz now and change your mind later.

- You are welcome to have a healthy snack and drink for filling out this quiz.

- If you have any questions, you can contact Cheyenne Parris at (419) 372-8528, Chris Haar at (419) 372-8941 or Carole Jambard Sweet at (419) 729-8544.

Name: _______________________________ Date: __________________________
Consent Form for Parents in the Control Group

“Kids in the Kitchen”

Informed Consent

We are interested in collecting information on what children know about cooking and basic nutrition information. Your child will be asked to take a pre-test and post-test. The purpose of the pre-test and post-test is to find out what your child knows about cooking skills and some basic nutrition information. The pre-test and post-test will be a written test, which will involve underlining or circling answer and answering a question about a food label. All of the questions will be related to food and cooking. The pre-test will be completed around the week of July 4th and the post-test will be completed around the week of July 25th. The tests will take about 15 minutes to complete. The anticipated risks to your child are not greater than those normally encountered at school. The results will be included in a database with other participants and will be used for research purposes. Your child’s name will not be used when entered into the database. Your child will be offered a healthy snack and beverage for participating in the pre-test and post-test.

All of the information will be confidential. Your child's participation in the pre-test and post-test is completely voluntary, and he/she does not have to answer any or all questions without penalty or explanation.

If you have any questions or comments about these tests, you can contact Cheyenne Parris at (419) 372-8528, Chris Haar at (419) 372-8941, Carole Jambard-Sweet at (419) 729-8544. Please contact the Chair of the Human Subjects Review Board at 419.372.7716 if you have any questions or concerns about participant rights.

I give my consent __________________ I do not give my consent __________________

Child’s Name (Printed) _________________________________________________________

Signature of Parent/Legal Guardian _____________________________________________ Date:________________
APPENDIX C

Additional Information Provided to Parents in Control Group
Additional Information Provided to Parents in Control Group

If you have decided to allow your child to participate in our research, we would like to know the following about her/him:

Age

Grade

School Attending

This information is completely voluntary and will remain confidential.

Thank you for allowing your child to participate.
APPENDIX D

“Kids in the Kitchen” Lessons
“Kids in the Kitchen” Class 1-Fight Bac Campaign Food Safety Lessons

Learning Objectives:

1. Encourage children to wash hands properly.
2. Introduce children to the importance of food safety, specifically the importance of washing hands, cooking surfaces, and foods.

Procedures:

1. Discuss the concept of germs.
2. Using a potato show kids how washing vegetables makes them clean. Show kids a glass bowl with clean water. Then, pour water over the dirty vegetable and into a glass bowl. Show kids the dirty water.
3. Discuss proper hand washing. Conduct Soapy Solutions (Fight Bac, 2004 a) exercise.
   a. Ask three students to volunteer for the experiment.
   b. Rub 1 tablespoon of cooking oil all over your hands until completely coated. Sprinkle 1 teaspoon on hands and rub it around until it’s evenly distributed. The cinnamon will illustrate bacteria.
   c. Wash hands as follows, rubbing briskly for 20 seconds.
      i. Student #1, wash hands with cold water and no soap.
      ii. Student #2, wash hands with warm water and no soap.
      iii. Student #3, wash hands with warm water and soap.
4. Demonstrate proper hand washing. Encourage kids to sing a song, while washing their hands.
5. Discuss importance of washing cooking surfaces. Conduct Safely Separate (Fight Bac, 2004 b) exercise.

   a. Dampen two sponges. Set one sponge aside to represent the “cooked chicken.”
   b. Paint both sides of the other sponge to represent raw chicken. Pretend that the paint is the juice of the chicken that may have been contaminated with Salmonella!
   c. Place the painted sponge on the cutting board and use a knife to cut the sponge in half. Move the painted sponge onto the plate, and don’t wash the cutting board.
   d. Next, cut a slice of raw cucumber on the same cutting board you used in procedure #c.
   e. Now, place the clean sponge (“cooked chicken”) that was cooked and well done on the plate with the “raw chicken” sponge.
“Kids in the Kitchen” Class 2 – Grains

Cooking skills:
At the end of the class the participants will be able to:
1. Demonstrate the proper technique for measuring dry ingredients.
2. Demonstrate the proper technique for measuring liquid ingredients.
3. Demonstrate the method for testing muffins for doneness.
4. Describe the proper method for mixing wet and dry ingredients for muffins.
5. Describe the role of various ingredients (baking powder for leavening).

Lesson plan:
The above concepts will be reinforced through demonstration.

Nutrition knowledge:
- At the end of the class the participants will be able to:
- Identify foods that belong in the grain group,
- Identify the number of recommended servings per day for the grain group.
- Identify the portion size for various foods in the grain group.
- Identify the major nutrients found in the grain group,
- Identify better snack choices in the grain group based on fat content.
- Read labels and identify the fat content of a particular food.

Lesson plan:
Begin discussion by asking participants which foods belong in the grain group and what types of foods they have consumed from the grain group so far today.

Ask what is in the grain groups that are good for our bodies or why do we need to eat foods from the grain group.

Identify:

Carbohydrates for energy

Niacin, thiamin, riboflavin release energy from food (i.e. the match that gets the fire going)

Iron for healthy blood

Fiber lowers risk of cancer, heart disease and diabetes

Show bar graphs that show the relative nutrient content of various foods in the group.
Use bar graphs to show why foods like donuts or cookies are not in the grain group due to the fat content

Ask how many servings of grains should we have in a day?
Show food models to reinforce portion sizes. Have a participant pour out the amount of cereal he or she thinks is a serving and use the measuring cup to see how close it comes to the serving size on the box.

Distribute labels of foods that can be eaten as snacks. Have participants point out the fat content per serving on the label.

Look at the cereal labels for sugar content if there is enough time.
“Kids in the Kitchen” Class 3 – Fruit

Cooking skills:
At the end of the class the participants will be able to:
6. Demonstrate the proper technique for measuring dry ingredients.
7. Demonstrate the proper technique for measuring liquid ingredients.
8. Demonstrate the proper technique for washing and slicing apples.
9. Describe the proper method for making a crumb topping.

Lesson plan:
The above concepts will be reinforced through demonstration.

Nutrition knowledge:
- At the end of the class the participants will be able to:
- Identify foods that belong in the fruit group,
- Identify the number of recommended servings per day for the fruit group.
- Identify the portion size for various foods in the fruit group.
- Identify the major nutrients found in the fruit group,

Lesson plan:
Begin discussion by asking participants which foods belong in the fruit group and what types of foods they have consumed from the fruit group so far today.

Ask what is in the fruit group that is good for our bodies or why do we need to eat foods from the grain group.

Identify:
**Carbohydrates** for energy
**Vitamin A** healthy bones, skin, hair
**Vitamin C** healthy bones, wound healing, healthy immune system
**Fiber** lowers risk of cancer, heart disease and diabetes

Show bar graphs that show the relative nutrient content of various foods in the group.

Ask how many servings of fruit should we have in a day?
Show food models to reinforce portion sizes.
“Kids in the Kitchen” Class 4 – Vegetables

Cooking skills:
At the end of the class the participants will be able to:
10. Demonstrate the proper technique for measuring liquid ingredients.
11. Demonstrate the proper technique for washing and slicing carrots and broccoli.
12. Describe the proper method for chopping onions and celery.
13. Describe the proper method for browning ground beef.

Lesson plan:
The above concepts will be reinforced through demonstration.

Nutrition knowledge:
• At the end of the class the participants will be able to:
• Identify foods that belong in the vegetable group,
• Identify the number of recommended servings per day for the vegetable group.
• Identify the portion size for various foods in the vegetable group.
• Identify the major nutrients found in the vegetable group,

Lesson plan:
Begin discussion by asking participants which foods belong in the vegetable group and what types of foods they have consumed from the vegetable group so far today.

Ask what is in the vegetable group that is good for our bodies or why do we need to eat foods from the grain group.

Identify:
Carbohydrates for energy
Vitamin A healthy bones, skin, hair
Vitamin C healthy bones, wound healing, healthy immune system
Fiber lowers risk of cancer, heart disease and diabetes

Show bar graphs that show the relative nutrient content of various foods in the group.

Ask how many servings of vegetables should we have in a day?
Show food models to reinforce portion sizes.
“Kids in the Kitchen” Class 5 – Milk

**Cooking skills:**
At the end of the class the participants will be able to:
14. Demonstrate the proper technique for measuring liquid ingredients.
15. Demonstrate the proper technique for measuring dry ingredients.
16. Demonstrate the proper technique for grating cheese.
17. Demonstrate the proper method for chopping onions.
18. Demonstrate the proper method for dicing potatoes.
19. Demonstrate the proper method for cooking macaroni according to package instructions.
20. Describe the difference between measuring by weight rather than measuring by volume.

**Lesson plan:**
The above concepts will be reinforced through demonstration. Discuss how to estimate the amount of cheese if you don’t have a scale.

**Nutrition knowledge:**
- At the end of the class the participants will be able to:
- Identify foods that belong in the milk group,
- Identify the number of recommended servings per day for the milk group.
- Identify the portion size for various foods in the milk group.
- Identify the major nutrients found in the milk group.
- Identify the amount of fat in milk products using a food label.

**Lesson plan:**
Begin discussion by asking participants which foods belong in the milk group and what types of foods they have consumed from the milk group so far today.

Ask what is in the milk group that is good for our bodies or why do we need to eat foods from the grain group.

**Identify:**
- **Vitamin A**
  - healthy bones, skin, hair
- **Vitamin D**
  - healthy bones
- **Calcium**

Show bar graphs that show the relative nutrient content of various foods in the group.

Ask how many servings of milk should we have in a day? Pass out 3 a day handout.

Pass out food models to reinforce portion sizes and have participants compare the amount of fat in the different types of foods.
“Kids in Kitchen” Class 6 – Meat

Meat and Bean Group Objectives

**Educational Objective 1:**
Kids in Kitchen participants will be able to correctly identify food items from the meat and beans group.
- Food items may include: beef, chicken, turkey, fish, beans, peanut butter, veal, pork, eggs, dry beans (legumes, lentils, and peas), soybean products (tofu, tempeh, soyburgers), nuts, seeds

**Educational Objective 2:**
Kids in Kitchen participants will be able to verbally identify basic nutrients and vitamins found in large quantities in the meat and beans group
- Nutrients or vitamins found in the meat and beans group include:
  - Protein
  - Iron
  - Zinc
  - B vitamins: Thiamin, Niacin, B6 and B12

**Educational Objective 3:**
Kids in Kitchen participants will be able to identify how many servings of meat and beans individuals should strive to consume on a daily basis.
- Individuals should strive to consume 2-3 servings of meat and beans on a daily basis.
- Kids in Kitchen participants are not expected to identify serving portion sizes, but amounts and demonstrations were discussed in class.
- How many servings of meat should you have each day?
  - 2-3 oz. Meat, poultry, or fish
  - 2 Tbsp peanut butter
  - 1/2 cup beans
  - 1 egg
  - 1/3 cup nuts
  - 1/2 cup tuna or ground beef
  - 1 small chicken leg or thigh
  - 2 slices of sandwich-size meat
- What does a serving of meat look like?
  - 2-3 oz. Meat, poultry, or fish = deck of cards or a cassette tape
  - 2 Tbsp peanut butter = roll of film or Ping-pong ball
  - 1/2 cup beans = small computer mouse
Educational Objective 4:
Kids in Kitchen participants should be able to identify where raw meat should be placed in the refrigerator upon purchase.
- On the bottom of the refrigerator, covered, and on a plate in order to thaw.

Cooking Objective 1:
Kids in Kitchen participants will be able to identify excess fat and unwanted skin on chicken. Additionally, participants will be able to discard visible fat and skin in the preparation stages of cooking.

Cooking Objective 2:
Kids in Kitchen participants will be able to correctly use a meat thermometer demonstrated in the Kickin’ Oven Fried Chicken recipe.
- Place in the thickest part of the meat, not touching the bone and fatty portion.
- If you’re making a casserole, place thermometer in the center or the thickest part of the dish.

Cooking Objective 3:
Kids in Kitchen participants will be able to read thermometers and understand that different types of meat will require various temperatures in order to kill harmful bacteria and ensure doneness of the meat.
- Identification of types of meat and proper cooking temperatures is not necessary. However, these temperatures were discussed.
  - Beef, Pork, Ham or Egg Dishes: 160
  - Poultry: Thighs, wings, and drumsticks: 180; Breast and roasts: 170; Ground chicken and turkey: 165
  - When the thermometer is pulled out, the meat should no longer be pink in the inside and the juices should run clear.

Cooking Objective 4:
Kids in Kitchen participants should demonstrate methods in preventing illnesses when cooking, such as:
- Washing the thermometer after each use, especially when inserted and it was not cooked to the proper temperature.
- Continuous washing of the hands
- Washing of all utensils after use, especially when handling raw meats

Cooking Objective 5:
Kids in Kitchen participants will demonstrate previously learned knife skills in preparation stages of the Lean, Mean, Bean Burritos recipe.
APPENDIX E

Recipes Used in the “Kids in the Kitchen” Program
Recipes Used in the “Kids in the Kitchen” Program

**Ants on A Log**

*Ingredients:*
- Peanut Butter
- Celery Stalks
- Raisins

*Procedure:*

1. Rinse celery stalks in water.
2. Cut celery stalks into 1 or 3 inch pieces.
3. Spread peanut butter in the center of the celery stalk.
4. Sprinkle raisins on top of peanut butter.
5. Serve.

**Mexican Hot Chocolate**

*Ingredients:*
- 3 cups 1% milk
- ½ tsp. cinnamon

*Procedure:*

1. Warm chocolate milk in a saucepan. Stir constantly, and be sure not to let milk boil.
2. Pour ½ cup portions in mugs or cups.
3. Add a dash of cinnamon to each cup.
4. Serve.
Southern Style Cornbread/Muffins

Ingredients:
2 eggs, beaten with a fork
1 c. cornmeal
1 c. flour
1 c. milk
2 tsp. baking powder
¼ c. vegetable oil
1 tsp. salt
3 tbsp. sugar
½ c. corn

Procedure:

1. Preheat oven to 400 degrees Fahrenheit.
2. Put all of the dry ingredients into a medium bowl and mix well.
3. Put all of the wet ingredients (including the corn) into another bowl and mix well.
4. Add the wet ingredients to the dry ingredients and mix just enough so the dry ingredients are moist.
5. Let the mixture sit for a few minutes while you prepare the pan.
6. If using a baking pan, spray with nonstick cooking spray or great with shortening. If using a muffin pan, put paper liner into each of the spaces or spray with cooking spray or grease with shortening.
7. If using a muffin pan, bake in oven for 15 minutes. If using a square pan, bake for 25-35 minutes or until the cornbread is light brown on top.
8. Remove bread from oven and let cool before eating.
**Arroz Con Leche (Rice Pudding)**

*Ingredients:*
- ½ gallon 2% or whole milk
- 2/4 or 1 cup sugar
- 1 cup white rice
- Cinnamon and nutmeg, to sprinkle on top
- 7 cinnamon sticks

*Procedure:*

1. In a large non-stick pot, heat the whole milk, white rice, and cinnamon sticks.
2. Bring to a boil over medium heat, stirring frequently.
3. Turn down heat to low setting and cook for approximately 25 minutes, stirring occasionally.
4. Test a grain of rice to see if it is almost soft; if not, continue to cook until soft.
5. Stir in sugar and bring to a boil over medium heat, stirring frequently.
6. Place over a low setting and cook very slowly for approximately 30 more minutes, stirring often. Cook until thick—not too soupy and not too dry.
7. Transfer to a 2-quart serving bowl. Sprinkle with cinnamon and nutmeg. Allow to cool—will set like a pudding.
8. Tastes delicious chilled or warm from the stove. Enjoy!

**Snack Mix**

*Ingredients:*
- 1 ½ tbsp. margarine
- ½ tbsp Worcestershire sauce
- ¼ tsp garlic powder
- 1/8 tsp onion powder
- ¾ c. corn chex cereal
- ¾ c. rice chex cereal
- ¼ c. pretzels
- ¼ c. peanuts

*Procedure:*

1. In a large bowl, melt margarine in microwave.
2. Add Worcestershire sauce, garlic powder and onion powder. Stir well.
3. Add cereal, peanuts and pretzels. Stir well.
4. Microwave on high 2 minutes. Stir.
5. Microwave on high 2 minutes. Stir.
6. Place paper towel on cutting board.
7. Spread snack mix on paper towel to cool.
8. Place in a sandwich bag.
Peach Crisp

Ingredients
2 15 ounce cans of peaches, packed in light syrup, drained
1/2 teaspoon vanilla (optional)
1/4 teaspoon cinnamon
1 cup flour
1/4 cup brown sugar
3 tablespoons margarine, chilled

Procedure:
1. Preheat oven to 350 F.
2. Combine peaches, vanilla, and cinnamon in the baking dish and toss well. Spread evenly in the dish.
3. Combine flour and sugar in small bowl. Cut in margarine with fork until the mixture looks like coarse meal.
4. Sprinkle four mixture evenly over the fruit.
5. Bake until lightly browned and bubbly, about 20 minutes.

Baked Apples

Ingredients
1 apple
1 tablespoons brown sugar
1/2 teaspoon ground cinnamon
1 teaspoon margarine

Procedure:
1. Wash the apples with scrubbing brush.
2. Cut the apple in half and carefully remove the seeds with the tip of the knife.
3. Mix the margarine, brown sugar and cinnamon in a small bowl
4. Put half the mixture on each of the halves of the apples
5. Put the apple back together and place in microwave safe dish.
6. Cover the dish with a lid or plastic wrap
7. Microwave on high for 3 1/2 or 4 minutes or until tender.
8. Let sit for a few minutes before eating.
Three Bean Casserole

Ingredients
1 lb. Lean ground beef or ground round
1 medium onion, chopped
1-½ cups chopped celery, optional
1 (15 oz) can cut green beans, drained
1 (15 oz) can lima beans, drained
1 (15 oz) can chili style beans in chili gravy
½ cup brown sugar
¾ cup ketchup (or barbeque sauce or chili sauce)
1 Tbsp. Cider or white vinegar
1 tsp. Dry or cream mustard

Procedure:

1. Chop onion.
2. Put ground beef in skillet. Over medium high heat, brown ground beef and onion.
3. Drain fat.
4. Drain the liquid from the green beans and lima beans, add to skillet.
5. Stir in remaining ingredients.
6. Spoon into 2-quart casserole.
7. Cover and bake in preheated 325 degree oven 55-60 minutes.
8. Makes 6-10 servings
9. Variation- use any kinds of beans that you like- kidney beans, great northern beans, pinto beans.

Veggies N Dip

Ingredients:
2 carrots
3 cups broccoli
2 red bell peppers

Procedure:

1. Wash vegetables with a vegetable brush.
2. Peel carrots with a vegetable peeler. Then, cut off the ends of the carrots.
3. Cut broccoli into florets.
5. Place on a plate. Eat with ranch dressing as desired.
Macaroni and Cheese

Ingredients:
1 ¼ cups dry macaroni
1 cup evaporated skim milk
2 medium eggs
¼ tsp. pepper
8 oz cheddar cheese
nonstick cooking spray

Procedure:

1. In a large pot, cook macaroni according to the directions on the box. (Do not add salt to cooking water). Drain and set aside. Note: This will make about 4 cups of cooked macaroni.
2. Spray a casserole dish with nonstick cooking spray.
3. Preheat oven to 350 degrees F.
4. In a large bowl, mix together the milk, cheese, pepper, and eggs. After the macaroni has cooled a bit, add it to the bowl and mix thoroughly. (If the macaroni is too hot, the eggs will start to cook and you’ll have scrambled eggs).
5. Pour into casserole dish and bake for 25 minutes, or until bubbly. Let stand for 10 minutes before servings.

Cottage Cheese Potatoes

Ingredients:
5 potatoes
1 small onion
1 cup fat free cottage cheese
1 cup fat free sour cream
2 Tbsp. dried chives (optional)
2 cups shredded cheddar cheese

Procedure:

1. Wash and dice potatoes. Put in a large pot of water and boil until tender when pierced with a fork—about 10 minutes. Drain.
2. Preheat oven to 350 degrees F. Butter the casserole dish or spray with non-stick cooking spray.
3. Chop the onion.
4. In a large mixing bowl, combine potatoes, onion, cottage cheese, sour cream and chives if desired.
5. Pour into prepared casserole dish. Top with shredded cheddar cheese.
6. Bake for 30 to 40 minutes.
7. Serves 5-6.
Yogurt Parfait

Ingredients:
Your favorite fruit-frozen, fresh, or canned
8 ounces vanilla yogurt
grape nuts or other cereal

Procedure:
1. If using fresh fruit, wash and cut into small pieces if needed. If using canned fruit, drain and cut into small pieces of needed. If using frozen fruit, thaw and cut into small pieces if needed.
2. Put 2 to 3 spoonfuls of yogurt into the bottom of a cup.
3. Add 2 spoonfuls of fruit.
4. Add 2 spoonfuls of cereal.
5. Repeat the layers until the cup is full.
6. The parfait is ready to eat.

Kickin’ Oven Fried Chicken

Ingredients:
1 cup Rice Krispie Cereal
1 teaspoon garlic powder
1 teaspoon pepper
2 eggs
2 Tablespoons milk
1-2 pounds of chicken drumsticks

Procedure:
1. Preheat oven to 375 degrees.
2. Spray cookie sheet with cooking spray.
3. Place Rice Krispie cereal, garlic powder, and pepper in a large zip-lock bag and crush with spoon until cereal is well crushed.
5. Remove skin from chicken.
6. Dip the chicken in the egg and milk mixture.
7. Drop the chicken, one piece at a time, into the cereal mixture bag. Seal bag closed and shake until chicken is well coated with mixture.
8. Put chicken on the cookie after shaking.
9. Bake for 35 minutes. Turn chicken pieces over, using the tongs. Bake for another 10-15 minutes or until juice of chicken is no longer pink when centers of chicken are cut or until meat thermometer reads 180 degrees.
Lean, Mean, Bean Burritos

Ingredients:
¼ head of lettuce
1 can refried beans (8 ounces)
6 flour tortillas
1-2 tomatoes
¾ cup cheese of choice (Cheddar, Monterey Jack, or Colby)
Taco sauce and/or salsa to taste

Procedure:
1. Rinse and pat dry the lettuce leaves. Cut lettuce into tiny pieces.
2. Rinse tomatoes and dice into small pieces.
3. Open can of refried beans and place in saucepan. Heat over medium heat for about 5 minutes, stirring several each minute until beans are warm.
4. Spread beans over each tortilla until beans are almost to the edges of the tortillas.
5. Sprinkle cheese evenly over each tortilla.
6. Sprinkle chopped lettuce over cheese.
7. Fold 1 end of each tortilla up about 1 inch over filling. Fold the right and left sides over the folded end so the sides overlap. Fold the remaining end over.
8. Cut each burrito in half, using the sharp knife.
9. Serve with taco sauce or salsa, if you like.

Peanut Butter Balls

Ingredients:
1 cup peanut butter
1 cup powdered milk
1 cup oatmeal
1/2 cup honey

Procedure:
1. Mix all ingredients thoroughly in a large bowl. Roll 1 tablespoon of the mixture into balls or any desired shape. Ready to eat.
APPENDIX F

“Kids in the Kitchen” Pre/Post Test Instrument
Nutrition section of test from the United States Department of Agriculture Team

Nutrition

What Do You Know About Food?

1. How many total servings of fruits and vegetables should you eat each day?
   - at least 2
   - at least 5
   - at least 7
   - at least 10

2. Which group below should you eat the most servings of each day? Circle one group.

   - Bread, Cereal, Rice, and Pasta Group
   - Vegetable Group
   - Milk, Yogurt, and Cheese Group
   - Fats, Oils, and Sweets
   - Meat, Poultry, Fish, Dry Beans, Eggs, and Nuts Group

3. Which group below should you eat the fewest servings of each day? Underline one group.

   - Fruit Group

4. Check all the foods that are high in fats.
   - candy bar
   - bread
   - fruit cocktail
   - cheese
   - corn
   - corn chips
   - bologna
   - pretzels

5. In the food label pictured here, how much total fat is in a serving of food?

6. If you eat 2 cups of the food in the label pictured, how many grams of fat will you eat?

7. You have decided you want to eat foods lower in fat. Circle the food that you will eat.
   - ice cream or cherry popsicle
   - fried chicken or baked chicken
   - baked potato or French fries
   - granola or corn flakes
“Kids in the Kitchen” Pre/Post self-assessment of skills section of test instrument

Please circle the sentence that best describes how you feel. There is no wrong answer.

1. I can follow a recipe by myself.
   I can follow a recipe with help from someone else.
   I have never followed a recipe, and I do not feel I could make it by myself.

2. I can measure out ingredients by myself.
   I can measure out ingredients with help from someone else.
   I have never measured out ingredients and I do not feel I could measure them by myself.

3. I can peel carrots by myself.
   I can peel carrots with help from someone else.
   I have never peeled carrots, and I do not feel I could peel them by myself.

4. I can grate cheese by myself.
   I can grate cheese with help from someone else.
   I have never grated cheese, and I do not feel I could grate it by myself.

5. I can get chicken ready for baking by myself.
   I can get chicken ready for baking with help from someone else.
   I have never gotten chicken ready for baking and I do not feel I could get it ready by myself.

6. I can cut up vegetables or fruit by myself.
   I can cut up vegetables or fruit with help from someone else.
   I have never cut up vegetables or fruit and I do not feel I could cut them up by myself.
APPENDIX G

Parent Evaluation of “Kids in the Kitchen” program
Parent Evaluation of “Kids in the Kitchen” program

We would like to determine how well the “Kids in the Kitchen” class met the teaching objectives of the individual classes. By completing this survey, you agree to participate in this study to help determine whether or not we taught your child what we hoped to teach them. Thank you.

1. How often was the food sent home after class used to make the recipes from the cooking class?
   never  some of the time  most of the time  all of the time

2. My child knows the proper way to wash hands before cooking.
   strongly disagree  disagree  agree  strongly agree  not sure

3. My child knows how to measure dry ingredients using measuring cups.
   strongly disagree  disagree  agree  strongly agree  not sure

4. My child knows how to measure liquid ingredients using a measuring cup.
   strongly disagree  disagree  agree  strongly agree  not sure

5. My child can use a vegetable peeler to peel carrots.
   strongly disagree  disagree  agree  strongly agree  not sure

6. My child can chop vegetables using a knife.
   strongly disagree  disagree  agree  strongly agree  not sure

7. My child can brown ground beef.
   strongly disagree  disagree  agree  strongly agree  not sure

8. My child can use a thermometer to see whether or not meat is fully cooked.
   strongly disagree  disagree  agree  strongly agree  not sure

9. My child is able to grate cheese using a cheese grater.
   strongly disagree  disagree  agree  strongly agree  not sure

10. What did your child like most about the cooking class?

11. What did your child like least about the cooking class?

12. Please make any additional comments about how you think the class went or suggestions for future classes.
APPENDIX H

Behavioral Skills Checklist
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<th>Task</th>
<th>Independent</th>
<th>Assistance</th>
<th>Observed</th>
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<tr>
<td>Demonstrates proper handwashing technique</td>
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<tr>
<td>Chooses correct cup to measure dry ingredients</td>
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<tr>
<td>Measures dry ingredients correctly</td>
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<td></td>
<td>not observed</td>
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<tr>
<td>Uses measuring spoons correctly</td>
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<tr>
<td>Chooses correct cup to measure liquid ingredients</td>
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<td>Uses vegetable peeler to peel carrots</td>
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<tr>
<td>Washes vegetables using vegetable brush</td>
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<tr>
<td>Uses grater correctly to grate cheese</td>
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</tr>
<tr>
<td>Uses knife correctly to chop vegetables</td>
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<td>not observed</td>
</tr>
<tr>
<td>Uses thermometer to check temperature of meat</td>
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<td>not observed</td>
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Appendix I

Repeated measures analysis of variance for the intervention and control group on the nutrition questions, skills questions, and total test score
Repeated measures analysis of variance for the intervention and control group on the nutrition questions, skills questions, and total test score

<table>
<thead>
<tr>
<th>Test Section</th>
<th>Pre Test</th>
<th>Pre Test</th>
<th>Post Test</th>
<th>Post Test</th>
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<th>P-value</th>
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<td>Control (n =11)</td>
<td>Intervention (n = 13)</td>
<td>Control (n = 11)</td>
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<tr>
<td></td>
<td>X ± SD</td>
<td>X ± SD</td>
<td>X ± SD</td>
<td>X ± SD</td>
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<td>4.5 ± 2.6</td>
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<td>Skills Questions</td>
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<td>(n = 6)</td>
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<td>Total Score</td>
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SD = Standard Deviation.