AN EVALUATION OF THE FRESH FRUIT AND VEGETABLE PROGRAM IN SHAWNEE, OKLAHOMA

By

SYDNEY JACKSON

Bachelor of Science in Nutritional Sciences

Oklahoma State University

Stillwater, Oklahoma

2012

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
May, 2012

AN EVALUATION OF THE FRESH FRUIT

AND VEGETABLE PROGRAM IN

SHAWNEE, OKLAHOMA

Thesis Approved:

Dr. Gail Gates

Thesis Adviser

Dr. Janice R. Hermann

Dr. Deana A. Hildebrand

Dr. Sheryl A. Tucker

Dean of the Graduate College

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure Page

CHAPTER I

INTRODUCTION

It is known that fruits and vegetables contain a great amount of nutrients vital to the appropriate growth and function of our bodies. Fruit and vegetable consumption is most important for children, as they are experiencing growth at an exponential rate, but unfortunately, US children are consuming fruits and vegetables at a very low rate. In 2008, the percentage of US children ages 6 to 11 consuming the recommended intakes of fruits and vegetables was 74% for fruits and 44% for vegetables (Childstats.gov, 2008). These rates for US children ages 12 to 17 are 59% and 52%, respectively (Childstats.gov, 2008). These low rates are indicative of the poor state of our nation's children's health and call for changes to be made. One of these changes can be found with the Fresh Fruit and Vegetable Program (FFVP).

The FFVP was established by the U. S. Department of Agriculture (USDA). The FFVP is a nutrition assistance program for students in low-income elementary schools. The goal of the program is to create healthier school environments by providing students with healthy and nutritious fruits and vegetables (U.S. Department of Agriculture 2010).

The pilot project for FFVP was established with the Farm Security and Rural Investment Act of 2002 and was known as the Fruit and Vegetable Pilot Program (FVPP). This pilot project was carried out in four states and one Indian Tribal Organization. The FVPP was popular not only

among students but also parents, teachers, principals, foodservice staff, pilot managers, and state representatives. Pilot schools reported that children consumed over 90 percent of servings offered to them in the program. Due to the success of the pilot, it continued to grow and develop into the nationwide program it is today, the Fresh Fruit and Vegetable Program (Buzby, et al. 2003).

The purpose of this study was to test the effectiveness of the FFVP on fruit and vegetable selection in school age children in Shawnee, Oklahoma. This was done by examining school lunch fruit and vegetable choices of students in the school year following participation in the FFVP. This study is important because preliminary reports have shown that while a child participates in the FFVP, their fruit and vegetable consumption is significantly increased by one quarter of a cup daily (Olsho et al., 2011, p. 19), but the concern is, to what extent do the children retain this behavior? As the literature review below shows, children are capable of increasing their preferences for fruits and vegetables shortly after an intervention, but after a longer period of time post-intervention, children's preferences decrease back to baseline. Through the programmatic evaluation of the FFVP, the present study will allow us to better understand the long-term impact of the FFVP on students' continued selection of fruits and vegetables.

CHAPTER II

REVIEW OF LITERATURE

Why are Fresh Fruits and Vegetables Important for Children?

According to ChildStats.gov (2008), individuals in the U.S. ages 2 to 17 consumed only about three fourths of their recommended daily fruit intake, and only about half of their recommended daily intake of vegetables. As indicated by the USDA (2009), only 21% of individuals ages 2 and older in the U.S. consumed their recommended daily servings of fruits, and only about 14% met their daily recommended servings of vegetables while in Oklahoma these rates were both 12%. The Centers for Disease Control (CDC) (2009) data showed that the percentage of high school students consuming 5 or more fruits and vegetables a day was 22.3% for the U.S. and only 14.8% for Oklahoma.

According to the U.S. Department of Agriculture and U.S. Department of Health and Human Services (2010), children in the U.S. need to increase their fruit and vegetable consumption. In the Dietary Guidelines for Americans 2010, three main reasons are provided for increasing fruit and vegetable intake: (1) fruits and vegetables are major contributors of nutrients that are widely under consumed such as fiber and vitamin A, (2) consumption of fruits and vegetables is associated with reduced risk of several chronic diseases such as cardiovascular disease and cancer, and (3) fruits and vegetables consumed in their natural state or prepared without added fat

and sugar can be low in calories. Fruits and vegetables are excellent sources of nutrient dense foods, and increasing consumption of them can lead to a decrease in consumption of foods that are less nutrient dense. Often times, these less nutrient dense foods come from fast food establishments, and the following study explores this relationship.

Poti & Popkin (2011) looked at analyses of energy intake for foods prepared away from the home to establish relationships between eating location and energy intake in 29217 children ages 2 to 18 years old by using national survey data from the 1977 to 1978 Nationwide Food Consumption Survey, the 1989 to 1991 Continuing Survey of Food Intakes by Individuals, the 1994 to 1996 Continuing Survey of Food Intakes by Individuals, and the 2003-2004 and 2005-2006 National Health and Nutrition Examination Surveys. The study included the first 2 days of each child's intake, but only if the child had data for both days. The study found that while the amount of energy children consumed at home decreased minimally from 1977 to 2006, there was an observed overall increase in daily energy intake. The study correlated this directly with the increase in energy consumed away from home. Additionally, the study found that in 1977 schools were the largest source of food away from the home and fast food establishments were not much of a factor, but by 1998 consumption of energy from fast food sources equally contributed to that of schools. This study concludes that from 1977 until 1998, school was the largest source of food consumed away from the home for preschoolers and young children, but in the time from 1998 to 2006, fast food restaurants have more than surpassed schools as the number one energy source not only for preschoolers and young children but for individuals of all ages (Poti & Popkin 2011).

What are the Influences on Fresh Fruit and Vegetable Consumption by Children?

Modeling

Story, Kaphingst, Robinson-O'Brien, & Glanz (2008) conducted a comprehensive review of 107 articles to examine the idea that food choices are affected by variables such as the food environments and their conditions. The review noted that some of the strongest factors within the home environment associated with healthful dietary behaviors are availability and accessibility, frequency of meals consumed as a family, and parental modeling and practices. Ways to use these factors to promote healthy eating in children are to increase availability and accessibility, increase not only parental modeling but sibling modeling, increase parental use of an authoritative feeding style, and increase frequency of family meals. Finally, the review mentioned that to make the most of the environmental changes taking place at home, schools need to implement nutrition education in the classroom so children have increased their skill base to adhere to a healthy lifestyle (Story, et al. 2008).

Vereecken, Rovner, & Maes (2010) used data from the Familial Influences on Food Intake study (FIFI) to measure the correlation among parental fruit and vegetable consumption, parenting styles, feeding practices, and child fruit and vegetable consumption. Data were collected from 755 parents of Belgian-Flemish children via parent and child food frequency questionnaires, parenting practices questionnaires, parental feeding practices questionnaires, and child's characteristics questionnaires. The children in the study were half and half male and female, and they were an average of 3.5 years of age. The results of the study showed that the most important predictor of children's fruit consumption was parental consumption of fruit, and that children also had a strong positive "like" reaction to fruit. On the other hand, the results showed that children's strong dislike for vegetables was the most important predictor of children's fruit consumption, while parental consumption was not a significant indicator. The study also found that specific

nutrition related feeding practices such as positive interactions, laxness, and overreactivity were much better indicators of children's fruit and vegetable consumption than parenting styles in general. The study concludes that there is a need to encourage parents to realize that their own eating behaviors have the potential to increase or decrease their child's fruit and vegetable consumption, and parents can implement positive strategies such as modeling and increased taste exposure to further promote increased fruit and vegetable consumption among children (Vereecken, et al. 2010).

O'Connell, Henderson, Luedicke, & Schwartz (2012) conducted a randomized control trial of 96 preschoolers to assess whether consumption of unfamiliar and/or disliked vegetables could be increased with repeated exposure during lunch. The intervention consisted of serving one of three vegetables (cauliflower, snow peas, green peppers) determined through preliminary testing as being "disliked" by the preschoolers each school day for six weeks in a cycle so each child was exposed to each vegetable a total of ten times. These vegetables were given to the children in addition to their school lunch meal, and observers were present to assess consumption and ensure no pressure was put upon the students by faculty or staff to consume the study vegetables. Results from the study showed that a child's willingness to consume one of the study vegetables (described as consuming at least 3g of the vegetable) was associated with the willingness to try the other study vegetables. A major finding from the study was that about half of the children in the study willingly tried the study vegetable of the day at least one third of the time. The researchers concluded that children did not refuse to eat the study vegetable even if they tried it once and didn't like it. The children were willing to try it again at a later point in time. Lastly, the study found that there was a significant peer effect on these children's consumption of the study vegetables in that a child's consumption of the study vegetable was associated with the average intake of the study vegetable by the other children at his or her table. The researchers noted that

positive peer effects of a "good eater" should be further tested as a way to increase consumption of vegetables (O'Connell, et al. 2012).

School Food Environment and Policy

Hartstein, Cullen, Reynolds, Harrell, Resnicow, Kennel, & STOPP T2D Prevention Study Group (2008) used the data from a pilot middle school intervention to assess its impact on food and beverage purchases, kilocalories, fat, carbohydrate, and protein sold per student, and nutrient density of the foods sold. This data was specifically from the a la carte and snack bar cafeteria sales. This study focused mainly on reducing the serving size of all regular chips bags, increasing the amount of lower-fat chips offered, increasing the size of bottles for bottled water, and limiting sweetened beverages. By the sixth and final week of the intervention, only one of the six schools did not achieve all of the goals, however the study did not measure student dietary intake to discern whether student dietary change was reflective of the change in the school food environment (Hartstein, et al. 2008).

Wordell, Daratha, Mandal, Bindler, & Nicholson Butkus (2012) conducted a study with 7th and 8th grade students in a midsized western city to assess the effects of changes in the school food environment on food choices of adolescents. There were six schools in the study, and three years prior to the intervention, all six schools implement wellness policies that only allowed 100% juice and nonenergy-providing water to be sold in vending machines, and limited a la carte items to 250 calories and 9 grams of fat. The intervention further restricted beverages by eliminating juice in the vending machines and only allowing milk and fruit on the a la carte line while still making a seasonal fruit and vegetable bar available to all students. The intervention was implemented in 4 of the 6 schools. Data collected via food frequency questionnaires showed that there were no differences in fruit and vegetable consumption between the control and intervention schools. In addition, there were no differences in consumption of fruits and vegetables during school by

males and females, but females consumed significantly more fruits and vegetables outside of school than did males. Students in intervention schools were 56% less likely to consume pastries and 27% less likely to consume juice. The study concludes that when food environments are changed, positive food behaviors are observed, but these were mostly in regards to pastry and juice consumption (Wordell, et al. 2012).

Another study by Perry, Bishop, Taylor, Davis, Story, Gray, Bishop, Warren Mays, Lytle, & Harnack (2004) looked at the effects of the 5-A-Day Cafeteria Power Plus Project to determine if the intervention increased fruit and vegetable consumption in elementary school age children. The Cafeteria Power Plus Intervention was based on the social cognitive theory and sought to increase availability of a variety of fruits and vegetables during school lunch, provide healthful role models who consumed fruits and vegetables, and provide the social support beneficial to children's consumption of fruits and vegetables. This was a two year intervention that "included daily activities and special events for all first- and third-grade students during the 1st year of intervention and all second- and fourth-grade students during the 2nd year of intervention. The daily activities involved increasing the availability, appeal, and encouragement of fruits and vegetables in the school lunch program; emphasizing changes in the lunch line; and, secondarily, the school snack cart" (Perry, et al. p. 68. 2004) with the main objective being to increase the offered daily fruit and vegetable servings by at least one. An example of a change made to the lunch line was that food service staff encouraged students to consume fruits and vegetables through positive verbal interactions such as asking the student which fruit they would like to have for lunch. Special events of the intervention included a kickoff campaign lasting two weeks, "challenge weeks" engaging the students in competition to consume 3 servings of fruits and vegetables per day at lunch, a theater production, and a final event demonstrating how grapes can be used to make a variety of foods. The intervention also included monthly samplings of fruits and vegetables that were both new to several of the children and easily adapted into the school

lunch. Data were collected from 1,168 students, and fruit and vegetable consumption was measured by trained observers in the lunch room who calculated servings of fruits (with and without juice) and vegetables (with and without potatoes). Additional points of observation were items offered during lunch, presentation of fruits and vegetables and variety offered, and verbal encouragement from food service staff. The results from this study showed that when potatoes were excluded, environmental changes in the school lunch room could significantly increase children's fruit and vegetable consumption. It is to be noted in this study, though, that the significant increase came from fruit consumption and no significant difference was seen in juice or vegetable consumption. The study reported that the differences observed between control and intervention were from 0.14 to 0.17 servings, and they explained the small difference in magnitude by saying that environmental interventions alone may only have limited impact without classroom and parental involvement. In addition, results also showed that verbal encouragement from food service staff had a direct and significant effect on fruit and vegetable consumption of students. The final recommendation of the study was that "repeated exposure to well-prepared, fresh, and tasty fruits and vegetables, with strong verbal encouragement – at school, at home, and in the community – should be a stronger part of our 5-A-Day national agenda" (Perry, et al. p. 75. 2004).

Cullen, Watson, Zakeri, & Ralston (2006) investigated the impact of changes in school food policy on student lunch consumption in middle schools. Policy changes included removing snack chips, candy, sweet desserts, and sweetened beverages from snack bars and removing vending machines from cafeterias. The study observed approximately 2790 6^{th}-8^{th} grade students from three middle schools in one school district in Harris County, Texas. Of these 2790 students, 48% received free/reduced price lunches. Trained data collectors observed and instructed students on proper methods of completing the anonymous food records used to maximize accuracy of the study. At the end of collection, the self-reported food records were compared against point-of-

sale (POS) data and analyzed "by food source to investigate policy differences in consumption by meal source after the policy change" (Cullen, et. al, p. 816, 2006). The study highlighted two noteworthy datasets: self-reported lunch food records and POS data. Servings were derived from self-reported records by averaging each nutrient (energy, protein, fat, SFA, fiber, vitamin A, vitamin C, iron, calcium, and sodium) and food group per student for one week, and POS sales were derived as the percentage of total purchases in each category per week. The study showed a significant difference in the distribution of self-reported intake of food sources after the policy change in that significantly greater proportions of energy, protein, fat, fiber, iron, calcium, sodium and cakes and cookies were consumed from National School Lunch Program meals in the second year of the study (Cullen, et. al, 2006).

Additional Psychosocial Factors

Neumark-Sztainer, Wall, Perry, & Story (2003) conducted a study in which the primary objective was to identify any existing correlations between fruit and vegetable consumption and personal factors, behavioral factors, and socio-environmental factors. The secondary objective of the study was to "identify factors associated with home availability and taste preferences for fruits/vegetables, and to explore patterns of interaction between home availability of fruits/vegetables and taste preferences for fruits/vegetables" (Neumark-Sztainer, et al. p. 199. 2003). The study consisted of collecting survey data (using the Project EAT survey and the Youth and Adolescent Food Frequency Questionnaire) and anthropometric data from 4746 adolescents from 31 middle schools and high schools in Minnesota. Of the thirteen variables looked at in the Project EAT survey (taste preferences, health/nutrition attitudes, weight/body concerns, self-efficacy, BMI, meal frequency, fast food intake, weight control behaviors, social support for healthy eating, family meal patterns, food security, socio-economic status, home availability of fruits and vegetables), only taste preference and home availability were found to be meaningful and statistically significant as direct effects on fruit and vegetable intake. In regards to the

secondary objective, the study showed that regardless of preference, if fruits and vegetables are not available in the home, intake patterns were not affected, but when fruits and vegetables were available in the home, intake increased. Finally, the study concludes "interventions aimed at increasing fruits and vegetables must work at increasing the availability of fruits and vegetables that youth like to eat" (Neumark-Sztainer, et al. p. 207. 2003).

Velazquez, Pasch, Ranjit, Mirchandani, & Hoelscher (2011), conducted a study with 8th and 11th grade students to define the relationship between self-perception of dietary practices and actual dietary intake. Data used in this study were statewide surveillance data from the School Physical and Nutrition survey conducted by the University of Texas School of Public Health. Questionnaires were used for this data collection, and in addition to dietary practices and behaviors, "composite scores of healthy and unhealthy eating were also created to measure overall healthy and unhealthy eating behaviors" (Velazquez, et al. p. 1736. 2011). Results from this study showed that self-perception of dietary practices were significantly associated with dietary behaviors in adolescents. Also, students who reported a healthier self-perception of eating habits were more likely to report increased consumption of healthy foods overall (such as grains, fruits, and vegetables) and a decreased consumption of unhealthy foods overall (such as meats, snack foods, and sugar-sweetened beverages). These results led the researchers to the conclusion that "adolescents in this study understand the relative nutrient content of the foods they eat" (Velazquez, et al. p. 1737. 2011).

Domel, Thompson, Davis, Baranowski, Leonard, & Baranowski (1996) developed a self-efficacy questionnaire for fruit and vegetable consumption among fourth and fifth grade students, and looked at psychosocial factors affecting their fruit and vegetable consumption. The study found that these children's preferences for fruits and vegetables were consistent predictors of consumption, especially concerning vegetables. Because of this, the study concludes that nutrition education programs that target fruit and vegetable preferences are potentially much more

effective at increasing fruit and vegetable consumption in elementary school children than programs focusing more on self-efficacy and outcome expectations (Domel, et al. 1996).

A study by Cullen, Baranowski, Owens, Marsh, Rittenberry, & de Moor (2003) looked at consumption of fruits, 100% fruit juice, and vegetables (FJV) by children and its relationship to accessibility and availability. The students in this study were fourth, fifth, and sixth grade students in the greater Houston, Texas area, and data were collected through child food records, child questionnaires, and parent questionnaires. The study found that FJV accessibility reported by parents and FJV availability reported by children were both significant indicators of FJV consumption by children. A gender difference was observed in that FJV availability and accessibility were significant direct indicators for consumption for females but not males, and only FJV availability was an indirect indicator of FJV consumption by males. The study also indicates that FJV preferences were moderators of these relationships. The study also showed that for children with high FJV preferences, they only needed to have FJV available in the home for increased consumption, but for children with low FJV preferences, they needed FJV to be both available and easily accessible for increased consumption. The study concludes that "interventions targeting child dietary behaviors should include the home environment and may need to tailor to gender and to children's FJV preferences. Increasing children's asking skills and parent behavioral capability to make FJV available and accessible in the home appear to be important intervention targets" (Cullen, et al. p. 624. 2003).

Jansen, Mulkens, & Jansen (2010) conducted a study with 94 four to seven year old children in primary schools in The Netherlands and Belgium to test the effects of restriction and visual appeal on fruit consumption. The children participated in one of three experiments: (1) regular fruit was restricted while the visually appealing fruit was unrestricted, (2) regular fruit was unrestricted while the visually appealing fruit was restricted, (3) neither the regular fruit nor the visually appealing fruit were restricted. The second phase of each of these experiments was

identical: the children were offered both regular fruit and visually appealing fruit that were both unrestricted. Results from the study showed that restriction was not an effective method of increasing fruit consumption among 4 to 7 year olds, but making fruit visually appealing significantly increased fruit consumption among these children. The study concluded that parents should not use restriction as a promotional method of fruit consumption, but they should "present fruit in a more appealing manner in order to stimulate their consumption in their children" (Jansen, et al. 2010).

Robinson-O'Brien, Neumark-Sztainer, Hannan, Burgess-Champoux, and Haines (2008) did a study to see the relationship between child and parent perceptions of the home food environment in regards to fruits, vegetables, and their consumption. Subjects in this study were from four low-income, ethnically diverse, urban elementary schools in St. Paul, MN, and about 90% of the 73 participating students (average age of 10 years and 75% were female) qualified for free or reduced-price school lunches. Researchers used a variety of scales to assess fruit and vegetable availability within the home, accessibility of fruits and vegetables within the home, parental encouragement to eat fruits and vegetables, family meal frequency, fruit and vegetable intake, and actual parent/caregiver relationship to the child. The study found that while both the parents and children agreed on many aspects tested, parents consistently had higher perceptions for each item assessed. Also, the results from this study showed that while parents and children were asked the same questions, "child perceptions of the home food environment were more strongly associated with child [fruit and vegetable] intake" (Robinson-O'Brien, et al. p. 362. 2008) than parent perceptions. The study concluded that parents should be aware of potential differences in perceptions in regards to the home food environment and should take action to implement strategies to increase availability and accessibility of fruits and vegetables within the home (Robinson-O'Brien, et al. 2008).

Reinaerts, de Nooijer, Candel, & de Vries (2006) conducted a study in the south Netherlands with 1739 parents of students ages 4 to 12 years to see the relationship between availability, accessibility, exposure, parental consumption, habit, and psychosocial factors with child fruit and vegetable consumption. The study used a questionnaire to assess background characteristics, fruit and vegetable intake, psychosocial factors, preferences, social influence, self-efficacy, fruit and vegetable availability, fruit and vegetable accessibility, fruit and vegetable exposure, habit, and parental fruit and vegetable consumption. Results showed that all concepts assessed correlated significantly with children's fruit and vegetable intake with the exception of fruit intake and the concept of intention. A major point of discussion for the study was the fact that habit had the strongest correlation with consumption for both fruits and vegetables, even more so for males than females. The results also showed that simply by exposing children to a variety of fruits and vegetables, both preferences and consumption for fruits and vegetables were increased. In addition, the results indicated that fruit and vegetable consumption were separate behaviors with different influencing factors, and factors influencing fruit and vegetable consumption differed by gender and ethnicity, but "the majority of the most influential correlates, such as habit and availability for fruit and habit and taste preferences for vegetable consumption are the same among all subgroups" (Reinaerts, et al. p. 257. 2007). And finally, the study concluded that the results from environment-related factors such as parental modeling and exposure to and availability of fruits and vegetables showed that not only is a child's food environment critical to their fruit and vegetable consumption, but they also showed that parents must be included in interventions dealing with children (Reinaerts, et al. 2007).

Mathias, Rolls, Birch, Kral, Hanna, Davey, & Fisher (2012) conducted a study with 30 four to six year old children to assess the effects of preferences and portion sizes of served fruits and vegetables on actual consumption. During the study, parents brought their children to an observational facility on Temple University's Health Sciences Campus in Philadelphia once a

week for five weeks. Children were placed at a table together and given 20 minutes to eat the study meal with the only instruction being to eat as little or as much as they liked. The study meal consisted of a pasta entrée and equal portions of broccoli and peaches. After consumption data was collected, results showed that children consumed 70% more fruit and 37% more vegetables when portion size was increased to greater than that of the reference values. Additionally, researchers found that increasing the portion size of fruit did not affect the intake of vegetables and increasing the portion size of vegetables did not increase the intake of fruit. Researchers also found that children who already exhibited a preference for the vegetable served ate more when the portion size was increased. Lastly, researchers concluded that increasing portion size of fruits and vegetables in the meal did not increase total caloric consumption from the meal, even though the fruits and vegetables were consumed (Mathias, et al. 2012).

What are the Results of Other Programs That Have Attempted to Change Fresh Fruit and Vegetable Consumption in Children?

Food Choices in the School Lunch Program

Baxter & Thompson (2002) used data from observations and interviews to document fourth-graders' preferences for, and consumption of, fruits compared to vegetables as part of school lunches. Participants were 237 children from up to 4 schools in one district during three school years. Trained data collectors observed students for the entire school lunch period for 97 days. Randomized student interviews were then conducted by trained research assistants following a written protocol. These interviews collected data on consumption and preference. The results of the study showed a strong relationship between preference for and consumption of available fruits and vegetables in school lunches, and "observed consumption increased significantly from only a taste of items liked *not at all* to almost half a serving of items liked *a little* to more than four-

fifths serving of items liked *a lot* regardless of whether the items were fruits or vegetables" (Baxter & Thompson. p.168, 2002). The study also found that fruits were like *a lot* while vegetables were liked *not at all* by the majority of children in the study. It is also worth noting that 78% of the students in the study were provided with at least one serving each of fruits and vegetables by the school lunch program (Baxter & Thompson. 2002).

Briefel, Wilson, & Gleason (2008b) looked at data from the 2004-2005 third School Nutrition Dietary Assessment Study (SNDA-III) to see whether students participating in the National School Lunch Program (NSLP) who were consuming few low-nutrient energy-dense foods during school were counteracting this by consuming more of these items away from school. The researchers also looked at consumption patterns of children in different environments to help them understand better the association with risk of obesity. After analysis, the study showed that there were no significant differences in the amount of energy consumed at all locations combined over the course of the day, but NSLP nonparticipants consumed 119 kcal more at home than did participants. It is important to note that NSLP participants consumed significantly more energy from potato products and less energy from sugar-sweetened beverages, candy, and chips or salty snacks compared with nonparticipants. For elementary children participating in the NSLP, 40% of their daily energy was consumed at school, whereas only 35% of nonparticipants' daily energy was consumed at school. The study "found no significant differences between NSLP participants' and nonparticipants' consumption patterns of low-nutrient, energy-dense foods and beverages at home, with one small exception: elementary school participants consumed more energy from salty snacks at home than nonparticipants" (Briefel, et al. p. S88. 2008b).

Condon, Crepinsek, & Fox (2008) looked at data from the 2004-2005 third School Nutrition Dietary Assessment Study (SNDA-III) to provide a baseline of foods offered and included in the NSLP and School Breakfast Program (SBP) for comparison to future data after program changes are made. Data shows that more than 90% of school lunch menus offered fruit or 100% fruit juice

with most of this fruit coming from canned sources rather than fresh sources. Almost all lunch menus offered one or more vegetable options as discrete items, but the most frequently offered vegetables were starchy vegetables such as potatoes. There were no significant differences between elementary NSLP participants and nonparticipants in consumption of fruits or 100% fruit juice, but participant consumption of vegetables was twice that of nonparticipants. However, for middle school children, a difference was observed not in vegetable consumption but fresh fruit consumption with NSLP nonparticipants eating significantly more than participants. Overall, the study suggests "that school meals offer children a selection of healthful food items, but availability of these items within school meals may not be enough to influence children's consumption of healthful foods. Efforts are needed not only to increase the availability and accessibility of healthful foods, but also to educate children on appropriate food choices within and among food groups" (Condon, et al. p. S75. 2008).

Fox, Gordon, Nogales, & Wilson (2008) looked at data from the School Nutrition Dietary Assessment Study (SNDA-III) for the school year 2004-2005 to assess the effect competitive foods had on children's energy intakes. They did this by looking at the prevalence and sources of competitive foods in U.S. schools, types and amounts of competitive foods consumed, calories consumed from competitive foods, and the difference between children's caloric consumption of competitive foods between children who ate a school lunch and children who did not eat a school lunch. The study found that nearly three fourths of elementary schools and almost 100% of middle schools offered one or more sources of competitive foods, but only 29% of students in elementary school and 44% of students in middle school were consuming these competitive foods. It is also important to note that about 67% of elementary schools and 90% of middle schools offered a la carte options at lunch, and consumption of these options was higher in middle school students (12%) than in elementary school students (6%). Among children in the study who consumed one or more competitive foods, the most common foods consumed were dessert and

snack items and beverages other than milk or 100% fruit juice. Of the elementary school students consuming competitive foods, an average of 216 calories were consumed from competitive foods with 135 of those calories coming from low-nutrient energy dense options. Of the middle school students consuming competitive foods, an average of 273 calories were consumed from competitive foods with 171 of those calories coming from low-nutrient energy dense options. The article concludes that if children do not decrease discretionary caloric intake, they will be unable to meet their recommended intake needs from nutrient-dense foods without first exceeding their total caloric needs (Fox, et al. 2008).

A study done by Briefel, Crepinsek, Cabili, Wilson, & Gleason (2008a) looked at data from the third School Nutrition Dietary Assessment Study (SNDA-III) to assess the relationship between school food environments and practices with children's dietary behaviors in relation to healthy weight maintenance. It is important to note that nearly 75% of elementary and middle school children attended schools that provided nutrition education in every grade. The study found that 62% of children (all ages) consumed low-nutrient energy-dense foods at school, and that most of these foods were obtained from the school. The study noted that the low-nutrient energy-dense foods most often obtained from school were baked goods/desserts, dairy based desserts, and french fries whereas chips/salty snacks and candy were most often obtained from non-school sources. The study also found that elementary school students consumed an average of 0.5 MyPyramid cup equivalents of fruits and vegetables at school each day, and that this number declined with age to 0.3 MyPyramid cup equivalents in middle school. The research showed that children who attended elementary schools with healthful school lunch characteristics (e.g. not offering french fries at least once weekly) had lower consumption of low-nutrient energy-dense foods obtained from school and an overall average of 43 kcal less from these foods. Also, children in elementary schools that specifically offered daily fresh fruit or raw vegetables had an overall consumption of 36 kcal less from low-nutrient energy-dense foods than those children

going to elementary schools not offering them. In regards to middle school students, those attending middle schools not offering low-nutrient energy-dense a la carte foods were shown to consume a small but significantly greater amount of vegetables. The study concludes that "participation in school lunch contributes to fruit and vegetable intake; however, about half of all children did not consume any fruit, 100% fruit juice, or vegetable during the school day. Our results suggest that not offering low-nutrient energy-dense foods a la carte or in vending machines in secondary schools has the potential to increase fruit consumption" (Briefel, et al. p. S105. 2008a).

Cullen & Zakeri (2004) conducted a two year cohort study on children in southeast Texas to assess the difference in fruit, vegetable, milk, and sweetened beverage consumption with and without access to a snack bar or a la carte line in school. The study followed two groups simultaneously: 4th and 5th grade students from the 1998-1999 school year and the same students in 5th and 6th grade during the 1999-2000 school year. Reasoning for these groups was that the school attended by 4th grade students had no access to a snack bar or a la carte line, while the school attended by 5th and 6th grade students had access to both of these. Data were collected from these students via self-reported food records. The study found that in middle school, 35-40% of meals consumed were purchased from the snack bar/a la carte line, and there was a significant decrease in NSLP and home meals consumed from elementary school to middle school. It was also found that from elementary school to middle school, consumption of fruits, regular vegetables, and milk significantly decreased (33%, 42%, and 35%) while consumption of high fat vegetables and sweetened beverages significantly increased (68% and 62%). The study concluded that the NSLP was very important to children's consumption of fruits, regular vegetables, and milk (Cullen, et al. 2004).

Additional Interventions to Change Children's Fruit and Vegetable Consumption

Cullen, Watson, & Konarik (2009) conducted a quasi-experimental study that utilized a post-test only survey to assess fruit and vegetable exposure and preferences among students. These students were from two high schools in one school district in the Houston area. One school participated in the USDA Free Fruit and Vegetable Program, which served as the intervention, and the other school served as the comparison school. These schools had approximately 4800 (57% were listed as economically disadvantaged) and 3500 (38% were listed as economically disadvantaged) students, respectively. All students were given anonymous surveys to assess demographic information and fruit and vegetable exposure and preference. Fruit exposure and vegetable exposure were rated significantly higher in the comparison school than in the intervention school. There was no difference in fruit preference scores between schools, but there was a significantly higher score for vegetable preference in the comparison school than the intervention school. Based upon the study and other research, it was concluded that the main factors affecting fruit and vegetable consumption in children are preference and availability (Cullen, et al. 2009).

Hendy, Williams, & Camise (2005) developed the Kids Choice school lunch program and evaluated its effectiveness in increasing both consumption and preference of fruits and vegetables among children. The participants in this study were 346 elementary school students (95% Caucasian) in first (n=131), second (n=95), and fourth (n=120) grades of a rural county in eastern Pennsylvania. Before the intervention, parent questionnaires provided demographic information and information regarding their child's fruit and vegetable preferences, and children were observed during lunch under baseline conditions. For the intervention the children were again observed during lunch, but this time the children were randomly assigned to receive token reinforcement for either consumption of fruits or consumption of vegetables. Children were interviewed 2 weeks post-intervention and 7 months post-intervention to assess for lasting effects.

The results of this study indicate that across all grades studied, using token reinforcement, food choice, and peer participation were effective at increasing children's fruit and vegetable consumption, and these increases were observed to have lasted through the duration of the school lunch program. The results also show that at two weeks post-intervention, children in all grades had increased fruit and vegetable preferences from baseline. While there was no difficultly in significantly increasing fruit preferences, there was an observed difficultly in significantly increasing vegetable preferences. The results further indicate that at seven months post-intervention, preferences for fruits and vegetables returned to baseline, and researchers concluded that a more ongoing program is needed to keep preferences high. The researchers also noted that the Kids Choice intervention had avoided "overjustification effects" by using small and delayed reinforcement, food choice and only being required to eat a small amount of the fruit or vegetable, and conditions that encourage peer participation and modeling (Hendy, et al. 2005).

A study done by Tuuri, Zanovec, Silverman, Geaghan, Solmon, Holston, Guarino, Roy, & Murphy (2009) looked at how Louisiana fourth and fifth grade participation in a school-based wellness program, "Smart Bodies" impacted their "knowledge of the importance of eating fruit and vegetables, improving psychosocial variables associated with consuming fruit and vegetables, and increasing preferences for these foods" (Tuuri, et al. p. 446. 2009). "Smart Bodies" was comprised of three primary components: The Louisiana Body Walk™, The OrganWise Guys™, and teacher modeling. Teachers acted as models by encouraging students to taste and consume fruits and vegetables available in the school lunch. Teachers also helped students engage in physical activity within the classroom while incorporating academic lessons and activities promoting the health and benefits of eating fruits and vegetables. The only gender difference noted in the study was that girls had a lower preference for garlic, onions, and bell peppers than did boys. "Smart Bodies" was effective in increasing both nutrition knowledge and self-confidence to consume fruits and vegetables, but it had mixed effects on the students' preferences

for fruits and vegetables. The fifth graders preferences remained the same for commonly served vegetables, but the fourth graders preferences decreased. The researchers concluded that a short-term school-based intervention is successful in improving nutritional knowledge and self efficacy to consume fruits and vegetables in children, and "with guidance from program leaders, cooperation from teachers, classroom activities, and school lunch foods, children can increase their preferences for FV and begin making behavioral changes to improve their diets" (Tuuri, et al. p. 450. 2009).

Another study done by Baranowski, Davis, Resnicow, Baranowski, Doyle, Lin, Smith, & Wang (2000) conducted an outcome evaluation on the revised Gimme 5 curriculum by analyzing results from a randomized school trial. The revised Gimme 5 curriculum was designed to increase fruit, juice, and vegetable intake among fourth and fifth grade students by (a) increasing FJV availability-accessibility at home and at fast food restaurants through role plays and other activities to develop student asking skills; (b) enhancing students' preferences for FJV by strongly encouraging students to taste the fast, simple, safe, and tasty (FaSST) FJV recipes prepared in class; (c) training students in FaSST FJV preparation to increase their FJV snack and meal preparation skills; (d) training students in goal setting to mobilize skills to increase intake; and (e) training students in problem-solving skills for cases in which initial goals were not attained. Students were reinforced with points and prizes for achieving dietary goals. The fourth grade curriculum focused solely on vegetable consumption while the fifth grade curriculum gave emphasis to fruit and juice consumption while still including vegetables to help students meet the recommend goal of five fruit, juice, and vegetable servings a day. The teacher conducted the 12 Gimme 5 lessons required each year. Gimme 5 also utilized food diaries, newsletters, home assignments, videotapes for home-viewing, and point-of-purchase education. The results showed that there was no significant difference between the different groups at baseline, but after time, the treatment group showed an increase in consumption of total fruits, juices, and vegetables and

vegetables alone with no differences in fruit consumption alone. Also, asking behaviors and knowledge increased in the treatment group, but not other psychosocial factors. The overall effect size was 0.2 servings of fruits, juices, and vegetables (Baranowski, et al. 2000).

A study by Perry, Bishop, Taylor, Murray, Warren Mays, Dudovitz, Smyth, & Story (1998) collected data from the 5-a-Day Power Plus program to assess whether or not the school-based intervention was able to increase fourth and fifth grade children's fruit and vegetable consumption. This was a randomized community trial with 20 schools in St. Paul, MN. The 5-a-Day Power Plus program was composed of (a) behavioral curricula in the fourth and fifth grades, (b) parental involvement/education, (c) school food service changes, and (d) industry involvement and support. The curricula prepared for the fourth- and fifth- grade students included sixteen 40- to 45- minute classroom sessions that consisted of skill-building and problem solving activities along with snack preparation and taste testing. During these curricula, the students formed teams to compete for eating the most fruits and vegetables during lunch. At the end of each competition, students were reinforced with small prizes both at the individual and team levels. As for the parental portion, the fourth grade students brought home five information/activity packets to be completed with their parents, and the fifth grade students brought home four snack packs put together by the school food service for the student to prepare as a snack for their families at home. If these activities and snacks were completed and prepared, parents were to sign cards verifying participation, and these cards were entered into a classroom drawing for a prize. The food service changes included: point-of-purchase promotion, enhancing the attractiveness of fruits and vegetables served, increasing the variety and choice of fruits and vegetables available, and providing an additional fruit item on days when a baked dessert was served. To complete the industry component, the intervention obtained support from the 72-member Minnesota 5-a-Day Coalition, and a produce supplier, Beckman Produce, Inc, supplied fruits and vegetables for school lunches, in-class taste testing, and the snack packs the children

took home to prepare. Additionally, a Beckman Produce executive visited each of the 30 participating classes to deliver a 30 minute presentation on fruits and vegetables. Measures used to collect data were 24-hour recalls and lunchroom observations from a random sample of 34 students in each school, phone interviews with the parents of the children who completed the recalls, a group administered health behavior questionnaire at baseline and follow-up of all students, and demographics of students taken from school records. Results from this study showed that for all students, fruit consumption during school lunch and daily fruit consumption increased as well as total daily calories attributable to fruits and vegetables. However, the increase in vegetable consumption during school lunch was seen only in girls. The results also show 4 significant results from the health behavior questionnaires: more perceived teachers' support for eating fruits and vegetables, greater perceived need to eat fruits and vegetables, more reports of asking for fruits and vegetables, and more usual daily servings of fruits and vegetables. The study concluded that methods for increasing preference for and availability of fruits in vegetables as well as increasing parental involvement is critical to increasing fruit and vegetable consumption in children, particularly boys. Additionally, the study suggests that environmental changes like those made in the intervention school cafeterias need to be implemented in the home (Perry, et al. 1998).

Bante, Elliott, Harrod, & Haire-Joshu (2007) looked at data from a community based program for parents of rural southeastern Mississippi preschool children, the High 5 for Kids project (H5K), to define the relationship between parental use of inappropriate feeding practices (eg "knowing better than your child if he/she is hungry or full, trying to get your child to eat something at a meal when the child says, 'I'm not hungry', encouraging your child to try a new food by giving your child some kind of reward, and rewarding your child when your child takes at least one bite of everything on the plate" (Bante, et al. p. 29. 2007)) and their children's fruit and vegetable preference. Child feeding practices were measured with a modified version of the 31-item Child

Feeding Questionnaire, fruit and vegetable intakes were measured with The Saint Louis University Food Frequency Questionnaire, and children's fruit and vegetable preferences were measured by asking the parents about specific fruits and vegetables. Results from this study showed that with an increased use of inappropriate feeding practices by parents, children's intake of fruits and vegetables increased as preferences for fruits and vegetables decreased (Bante, et al. 2007).

A systematic review was done by Thomson & Ravia (2011) to look at the effect of behavioral interventions on the intake of fruit and vegetables. The inclusion criteria for the review was behavior-based interventions explicitly reporting the use of the behavior theory or construct with fruit and vegetable intake as an outcome measure that were "human, English, clinical trial, or randomized controlled trial, and studies with publication dates between 2005 and 2010" (Thomson, et al. p. 1524. 2011), and the exclusion criteria for the review were "non-U.S. studies, studies of individuals with a specific clinical diagnosis, and observational association studies" (Thomson, et al. p. 1525. 2011). These criteria resulted in 34 studies from 36 articles – 7 of which focused on children. The results of this review suggest that only modest increases in fruit and vegetable intake result from behavior-based interventions, and the changes in fruit and vegetable intake seen in these studies was not enough to meet recommended levels of intake. The review also noted that the results were much less supportive for reaching recommended intakes in minority and low-income populations and children, and significant changes in methods were critical to meeting recommended intake on a regular basis. The review stated that a major limitation of these studies was the fact that they all used a self-reported instrument to measure change, and this could lead to an over- or under-estimation of fruit and vegetable intake. The review also noted that "the lack of emphasis on variety as a modifiable outcome for behavior studies was of interest given the importance of variety to optimize exposure to healthful nutrients and bioactive compounds found in fruits and vegetables" (Thomson, et al. p. 1531. 2011). A

couple of keys to the success of future interventions the review noted were forming partnerships with influential organizations to achieve and sustain greater intakes of fruits and vegetables, and the use of "nutrition communication campaigns could provide tailored messaging at the community level and target intrinsic and extrinsic motivation to promote change in fruit and vegetable consumption" (Thomson, et al. p. 1533. 2011). Specifically regarding children, the review states that even greater efforts are necessary "to test behavior interventions with the goal to formulate healthy habits such as regular, varied intake of fruits and vegetables in early life" (Thomson, et al. p. 1534. 2011). The review concludes that meeting and sustaining the recommended intake for fruits and vegetables across the population necessitates interventions with stronger behavior components that are combined with alternative approaches such as social marketing and behavior economics. The study suggested that these interventions should focus on health benefits, cost, convenience, availability and access, competitive foods, and perceived value of consuming recommended intakes of fruits and vegetables on a regular basis (Thomson, et al. 2011).

Fresh Fruit and Vegetable Program Evaluation and Results

In 2003, Buzby, Guthrie, & Kantor conducted an evaluation of the pilot project of the FFVP, the FVPP, for the USDA's Economic Research Service (ERS). At the time of this pilot project, middle schools and high schools were included in addition to elementary schools. The four primary components of the evaluation are as follows: (1) analysis of administrative records of fruit and vegetable purchases, (2) review of pilot project reports describing how the FVPP was implemented and received, (3) site visits to participating schools, focus groups, and interviews with selected school stakeholders, and (4) a conference for FVPP program managers, other pilot staff, and policy stakeholders to discuss the findings of the evaluation and lessons learned from the pilot project. The study reported that a greater variety of fruits were offered than vegetables, and that the students found fruit more appealing than vegetables. A major barrier cited was the

inability to increase vegetable consumption without high-fat dips, condiments, and peanut butter. Additionally, principals and foodservice staff stated they felt that students were consuming more fruits and vegetables during school lunch since the implementation of the FVPP. Lastly, several schools reported that they had "no coordinated nutrition education component or promotion effort to educate school staff, parents, teachers, or the community as a whole about the implementation and purpose of the FVPP "Buzby, et al. p. 10. 2003), and the schools also felt the program could be made stronger if they were provided with guidelines for effective use of materials to promote this perceived need for education (Buzby, et al. 2003).

A Congressionally-mandated evaluation report was conducted by Olsho, Klerman, & Bartlett (2011) for the USDA to describe interim findings from the FFVP. This evaluation was conducted during SY 2010 to determine whether children increased their consumption of fruits and vegetables, decreased consumption of less nutrient-dense foods, or experienced some other significant effect due to their participation in the FFVP. The two main outcomes of the report were total quantity of fruits and vegetables consumed and total energy intake. Diary-assisted 24-hour recall interviews were conducted with 4,696 4^{th}-, 5^{th}-, and 6^{th}-grade children (approximately half FFVP students, and half non-FFVP students) in 214 schools across the U.S. to collect data, and the study design used regression discontinuity to compare schools just below (treatment) and above (comparison) the income cutoff to participate in the program. The study found that FFVP students consumed approximately a quarter cup more fruits and vegetables per day on days in which FFVP foods were served than did students in non-FFVP schools. However, results from the report showed no significant differences in fruit or vegetable consumption by gender, ethnicity, or free and reduced priced lunch status. Further, the results showed no significant difference between FFVP students and non-FFVP students in regards to total energy intake. The study concluded that the observed increase in fruit and vegetable consumption "is important

because population dietary increases are generally small and incremental" (Olsho, et al. p. 20, 2011).

Point of Sale

As previously mentioned in the School Food Environment and Policy section of the present Review of Literature (p. 8), Cullen, Watson, Zakeri, & Ralston (2006) investigated the impact of changes in school food policy on student lunch consumption in middle schools. Although not a primary outcome measure, the study did investigate whether point of sale (POS) data could be used as a proxy for student consumption. POS sales were derived as the percentage of total purchases in each category per week. Then, "for each week, item-specific servings purchased were summed, divided by all applicable servings, and then multiplied by 100" (Cullen, et al. p. 815, 2006). The reason this serving value was derived from purchases is because there was no consumption data by the students for any of these items. The researchers found that over the two year study period, POS data showed no significant differences in purchases, but student reported data showed significant differences in consumption. Researchers attributed this discontinuity to the following: (1) POS data for vending machines was not collected while many students reported consumption from vending machines, (2) POS data were collected for all students while reported consumption was only from a daily convenience sample of students who volunteered, (3) POS data were recorded as specific foods while food groupings used in student reports may have been too broad to detect differences, and (4) POS data collected did not account for foods brought from the home (Cullen, et al. 2006).

Gray, Lytle, Mays, Taylor, Perry, & Story (2002) tested the validity of using food taken by children in school lunches as a proxy measure of foods actually consumed. Trained observers recorded consumption of school aged children during school lunch. On average, students

consumed about 86% of the fruits and vegetables taken. The study concluded that its findings were not able to be generalized to the public as a whole since the study strictly focused on fifth grade students in a lunch room setting, but the observed results do "strengthen the candidacy of food taken as a proxy for food eaten, despite the valuable information that it ignores" (Gray, et al. p. 409. 2002).

Another study by Gray, Lytle, Perry, Story, Taylor, & Bishop (2007) hypothesized that fruits and vegetables taken on students' lunch trays could be used as proxies for fruits and vegetables eaten by children in the youngest school grade. This study took place in 26 schools of the Twin Cities, MN, metropolitan area with approximately 1168 children in grades 1 and 3 and followed them through grades 3 and 5, respectively. The purposes of the study are to "(a) evaluate earlier findings that an assessment of fruits and vegetables taken is correlated with fruits and vegetables eaten, as measured through observation; (b) evaluate whether the proxy of fruits and vegetables taken leads to similar conclusions about the success of an intervention, as does the criterion measure of fruits and vegetables eaten; and (c) test whether the validity of fruits and vegetables taken differs by sex and holds with young children at the earliest (grade 1; ages 6 to 7 years) school level" (Gray, et al. p. 1019, 2007). All of the children were observed by trained professionals when they were taking and eating their lunches to establish a baseline. It was found that students ate a large portion of the food taken on their trays, and this behavior increased as children got older. The study showed that assessing fruits and vegetables taken is just as effective at showing the effects of an intervention as is assessing fruits and vegetables eaten, however, it was not shown to be effective in examining differences by grade and sex (Gray, et al. 2007).

Summary

In summary, there is a defined need to increase fruit and vegetable intake in our nation's children. Several independent programs have been established to meet this need of our children, and many of them have been thoroughly evaluated. The USDA's FFVP is a newer program funded by the government, and only one pilot study and one interim evaluation have been conducted. The current study hopes to provide a more in-depth evaluation of the program, as the period for data collection was an entire semester in the school year following delivery of the FFVP in two schools. The present study also aims to give a more in-depth evaluation of the program at a local level.

CHAPTER III

METHODOLOGY

Sample

The population being tested was middle school students in the Shawnee Public School system in Shawnee, Oklahoma. Shawnee has four elementary schools – two of which participate in the FFVP, Jefferson Elementary School, and Will Rogers Elementary School, and two of that do not participate in the FFVP, Horace Mann Elementary School, and Sequoyah Elementary School. Horace Mann, Jefferson, and Will Rogers enrolled almost 45 – 50% Caucasian students, 35 – 40% American Indian/Alaskan Native students, 5-10% African American students, 5% Hispanic students, and had high percentages (84% – 98%) of students qualifying for free and reduced meals. Sequoyah, however, was predominately Caucasian enrollment with little enrollment from other racial/ethnic backgrounds and a much lower percentage of students qualifying for free and reduced meals (70%) (see Table 1).

The sample included students who were enrolled in 5th grade in school year (SY) 2010 and 6th grade in fall of SY 2011. Students were excluded from the study if they were in attendance as a fifth grader at their elementary school for less than the full SY 2010. Students must have been in attendance for the full SY 2010, having not exceeded the school's absence policy, as the FFVP is an ongoing program. Students were also excluded from the study if they attended as a sixth.

grader at the middle school for less than the full fall semester of SY 2011. Students must attend the full fall semester to get a more accurate analysis of their fruit and vegetable preferences

Research Design

The research design was post-test only with a comparison group. Participation in the FFVP serves as the intervention, and the intervention had already taken place and was completed by the time data collection took place. The comparison group included students who attended schools that did not participate in the FFVP.

Intervention

The FFVP at Jefferson Elementary School was conducted by the school counselor and a high school foodservice employee. The counselor ordered the food while the high school foodservice employee prepared the food on-site in the elementary foodservice facility. Students at Jefferson Elementary School received food from the FFVP at least two times per week. The food was delivered to the students in one serving dish to be self-served in the classroom. Teachers also consumed food in the presence of their students to exhibit positive adult modeling. Nutrition education was provided to students by each individual teacher in a manner they found to be appropriate for their respective classes. Examples of fruits and vegetables received by students at Jefferson Elementary School were strawberries, tomatoes, watermelon, tangerines, snap peas, and kale.

The FFVP at Will Rogers Elementary School was conducted by the school counselor and the president of the PTA at Will Rogers Elementary. Both the counselor and the parent ordered the food, and the parent prepared the food on-site in the teacher's lounge away from the elementary

foodservice facility. Students at Will Rogers Elementary School received food from the FFVP at least one time a week. The food was delivered to the students already portioned out into individual servings. Teachers also consumed food in the presence of their students to exhibit positive adult modeling. Nutrition education was provided to Will Rogers Elementary School by Oklahoma Cooperative Extension Service. Examples of fruits and vegetables received by students at Will Rogers Elementary School were strawberries, plums, kiwi, avocados, tomatoes, and bell peppers.

The fruits and vegetables received by the children were selected from a pre-approved list provided by the USDA. Items that were not allowed for purchasing with FFVP funds were as follows: processed or preserved fruits and vegetables; dip for fruit; fruit or vegetable juice; snack type fruit products such as fruit strips, fruit drops, or fruit leather; jellied fruit; trail mix; nuts; cottage cheese; fruit or vegetable pizza; smoothies; fruit that had added flavorings including fruit that had been injected with flavorings; carbonated fruit; and most non-food items, except those allowed under administrative operational costs (USDA 2010). Limits of the FFVP were as follows: dip for vegetables may be served if it was low-fat yogurt-based or another low-fat or non-fat dip and was a single serving size as noted by the nutrition facts label, and prepared vegetables that are cooked must be limited to one time a week and must always include a nutrition education lesson related to the prepared item (USDA 2010).

The Child Nutrition Programs of the Oklahoma State Department of Education require that all fresh fruits and vegetables delivered by the Fresh Fruit and Vegetable Program be delivered to the students with a corresponding education component (Oklahoma State Department of Education, 2011, August). This education component can range from a simple statement about the food's origins to a fully prepared nutrition lesson.

Data Collection

All Shawnee fifth graders attending school in SY 2010 had their food choices analyzed for the fall semester when they became sixth graders attending Shawnee Middle School in fall of SY 2011. Three separate sections of time were looked at for food analysis: the first two weeks in the fall semester of SY 2011, the last two weeks in the fall semester of SY 2011, and the full 86 days of the fall semester of SY 2011. This food analysis was completed by analyzing point-of-service (POS) machine electronic data from the schools' nutrition services. Data were obtained from the Shawnee Public School Information Technology department and contained the following information: student ID number, free/reduced price meal status, list of purchases, and dates of purchases. Using the POS method of data collection has been shown to yield accurate data (Cullen et al., 2006), and according to Gray et al., "the ratio of eaten-to-taken suggests that students eat a large proportion of the foods taken on their lunch trays" (2007, p. 1020). In addition, data shows that the ratio of eaten-to-taken is significantly higher in fifth graders than in first or third graders (Gray et al., 2007).

Foodservice employees keyed in items sold to each student during the lunch hour. The items used for analyses were "chef salad", "fried vegetable", "fruit", and "vegetable". When the student made a salad from the salad bar it was coded as a vegetable. Juice was coded as a fruit if it was a 4 ounce portion, but if it was more than 4 ounces it was coded as a drink, however, juice was rarely served during lunch (D. Taylor, personal communication, September 7, 2011). The only items coded fried vegetables were French fries, fried potatoes, and tater tots. Fried sweet potatoes and fried okra were coded as "vegetables". Additionally, the "fruit" code included fresh, frozen, and canned fruits.

The vegetables most commonly offered at lunch in the Shawnee Middle School were the items found on the menu-appropriate salad bar. These items included (but were not limited to) shredded

lettuce, cherry tomatoes, cucumbers, baby carrots, and celery. Other commonly offered vegetables were fresh salsa, radishes, onions, and shredded cabbage. The fruits most commonly offered at lunch in the Shawnee Middle School were melons, apples, pineapple, strawberries, apricots, peaches, and applesauce (D. Taylor, personal communication, September 7, 2011).

A variety of vegetables were offered daily for lunch at Shawnee Middle School, but usually only one fresh fruit and one frozen or canned fruit were offered. The Shawnee Public School Foodservice policy indicated that the reimbursable meal may include one fried vegetable and one fruit option, but unlimited non-fried vegetables. Any fried vegetable or fruit served exceeding this amount was charged with an a la carte price.

Student data were assigned an identification number by the Shawnee public school system to assure their anonymity throughout the research. The Shawnee public school system also provided data on gender, ethnicity, and elementary school enrollment. The Institutional Review Board at Oklahoma State University approved the study as non-human subject research (Appendix).

Research Questions

Do school age children who participated in the Fresh Fruit and Vegetable Program in elementary school select fruits and vegetables in school lunches more frequently in middle school compared to students who were not exposed to the FFVP in elementary school? The following hypotheses were analyzed:

1. Students who participated in the FFVP will select fruits in school lunches more frequently than students who did not participate in the FFVP.
   Statistical analysis used: two sided independent samples t test

2. Students who participated in the FFVP and who did not participate in the FFVP will show a difference in the change between the first two weeks and the last two weeks in fruit consumption.

   Statistical analysis used: two sided independent samples t test

3. The number of fruits selected will differ based on participation in the FFVP and time of semester.

   Statistical analysis used: ANOVA

4. Students who participated in the FFVP will select vegetables in school lunches more frequently than students who did not participate in the FFVP.

   Statistical analysis used: two sided independent samples t test

5. Students who participated in the FFVP and who did not participate in the FFVP will show a difference in the change between the first two weeks and the last two weeks in vegetable consumption.

   Statistical analysis used: two sided independent samples t test

6. The number of vegetables selected will differ based on participation in the FFVP and time of semester.

   Statistical analysis used: ANOVA

7. Students who participated in the FFVP will select fruits and vegetables in school lunches more frequently than students who did not participate in the FFVP.

   Statistical analysis used: two sided independent samples t test

8. Students who participated in the FFVP and who did not participate in the FFVP will show a difference in the change between the first two weeks and the last two weeks in fruit and vegetable consumption.

   Statistical analysis used: two sided independent samples t test

9. The number of fruits and vegetables selected will differ based on participation in the FFVP and time of semester.

   Statistical analysis used: ANOVA

10. Students who participated in the FFVP will select fried vegetables in school lunches less frequently than students who did not participate in the FFVP.

    Statistical analysis used: two sided independent samples t test

11. Students who participated in the FFVP and who did not participate in the FFVP will show a difference in the change between the first two weeks and the last two weeks in fried vegetable consumption.

    Statistical analysis used: two sided independent samples t test

12. The number of fried vegetables selected will differ based on participation in the FFVP and time of semester.

    Statistical analysis used: ANOVA

13. Students' participation in school lunch will not differ by FFVP participation.

    Statistical analysis used: two sided independent samples t test

If the analyses reveal significant differences, the results will be analyzed by school using analysis of variance with Scheffe's test.

What is the effect of gender and ethnicity on fruit and vegetable consumption in school age children who participated in the Fresh Fruit and Vegetable Program in elementary school compared to students who were not exposed to the FFVP in elementary school? The following hypotheses were analyzed:

14. Fruit selection will differ based on gender and participation in the FFVP.

    Statistical analysis used: ANOVA

15. Vegetable selection will differ based on gender and participation in the FFVP.

    Statistical analysis used: ANOVA

16. Fruit and vegetable selection will differ based on gender and participation in the FFVP.

    Statistical analysis used: ANOVA

17. Fried vegetable selection will differ based on gender and participation in the FFVP.

    Statistical analysis used: ANOVA

18. Fruit selection will differ based on ethnicity and participation in the FFVP.

    Statistical analysis used: ANOVA

19. Vegetable selection will differ based on ethnicity and participation in the FFVP.

    Statistical analysis used: ANOVA

20. Fruit and vegetable selection will differ based on ethnicity and participation in the FFVP.

    Statistical analysis used: ANOVA

21. Fried Vegetable selection will differ based on ethnicity and participation in the FFVP.

    Statistical analysis used: ANOVA

Table 1 - Demographic characteristics of students attending Shawnee Elementary Schools					
	Elementary School				**Middle School**
	Horace Mann	**Jefferson**	**Sequoyah**	**Will Rogers**	
Racial/Ethnic Background (%)[a]					
African American	11%	6%	7%	8%	6%
American Indian/Alaskan Native	36%	40%	21%	37%	16%
Caucasian	48%	45%	65%	48%	52%
Hispanic	4%	7%	6%	5%	8%
Other	1%	2%	1%	2%	18%
Students eligible for free and reduced price school meals (%)[bc]	98%	89%	70%	84%	76%

[a]D. Taylor, personal communication

[b]OSDE 2011

[c]OSDE 2012

CHAPTER IV

RESULTS

A total of 183 students participated in this study – 104 students who participated in FFVP in elementary school and 79 students who did not participate. Most of the students in the study were female Caucasians. There were no significant differences between FFVP participants and nonparticipants in distribution by gender or ethnicity (Table 2).

There were 86 days in the fall semester of SY 2011, and an average of 94.45% of middle school students attended school during the fall semester (D. Taylor, personal communication, January 30, 2012). There was no significant difference in school lunch participation between FFVP participants and nonparticipants; both groups participated in school lunch about 70 days during the semester (Table 3).

Students who participated in the FFVP selected significantly more fruits in school lunches than students who did not participate in the FFVP ($p = 0.008$, Table 4). Students participating in the FFVP selected an average of 33.0 ± 20.8 fruits during the whole semester while nonparticipants selected 25.6 ± 16.6 fruits (Table 4). Additionally, students participating in the FFVP selected significantly more fruits in school lunches during the first two weeks of the semester and during the last two weeks of the semester than did nonparticipants ($p = 0.009$ and 0.029 respectively, Table 4). When evaluated using ANOVA, there were significant main effects of FFVP participation ($p < 0.001$) and time of semester ($p = 0.005$), but there was no significant interaction

between time and FFVP participation. Change scores were calculated as the amount selected during the last two weeks minus the amount selected during the first two weeks. There was no significant difference between FFVP participants and nonparticipants in the change in fruit selection between the first two weeks and last two weeks of the semester (Table 4); both groups selected more fruit in the first two weeks than the last two weeks.

There were no significant differences by FFVP participation for vegetable selection. When evaluated using ANOVA, there was no significant interaction between time of semester and FFVP participation, and there were no significant main effects of FFVP participation or time of semester. Additionally, there was no significant difference in change scores between participants and nonparticipants for vegetable selection.

There were no significant differences by FFVP participation for total fruit and vegetable selection. However, a non-significant trend ($p = 0.054$) was seen between FFVP participants and nonparticipants for total fruit and vegetable selection for the full semester. On average, FFVP participants selected 61.4 ± 31.7 fruits and vegetables during the whole semester while nonparticipants selected 52.5 ± 29.1 fruits and vegetables (Table 4). When evaluated using ANOVA, there was a trend for main effect of FFVP participation ($p = 0.055$) and a significant main effect of time of semester ($p = 0.003$), but there was no significant interaction between time and FFVP participation. There was no significant difference in change scores between participants and nonparticipants for total fruits and vegetables. Both groups selected fewer fruits and vegetables in the first two weeks than the last two weeks.

There were no significant differences by FFVP participation for fried vegetable selection. When evaluated using ANOVA, there was a significant interaction between time and FFVP participation ($p = 0.024$, Figure 1). There was also a significant difference in change score between participants and nonparticipants for fried vegetables ($p = 0.024$, Table 4). Participants

decreased their intake of fried vegetables between the first two weeks and last two weeks more than nonparticipants.

Females selected fruit and total fruit and vegetables significantly more than male participants, nonparticipants, and total students (Table 5). Females in the study selected an average of 35.1 ± 20.1 fruits over the course of the semester while males selected an average of 23.8 ± 16.8 fruits. Females in the study selected an average of 64.7 ± 31.4 total fruits and vegetables over the course of the semester while males selected an average of 49.5 ± 28.4 total fruits and vegetables. When evaluated using ANOVA, there were significant main effects of gender ($p < 0.001$) and FFVP participation ($p = 0.009$) on fruit selection, and a significant main effect of gender ($p = 0.001$) and a trend toward a main effect of FFVP participation ($p = 0.052$) for total fruit and vegetable selection. There was not, however, a significant interaction between gender and FFVP participation on fruit, vegetable, total fruit and vegetable, or fried vegetable selection.

For all students in the study, fruit selection by African American students was significantly greater ($p = 0.034$, Table 6) than fruit selection by Caucasian, Hispanic, and students with multiple ethnicities. There were no other significant differences by ethnicity on selection of fruits, vegetables, total fruits and vegetables, or fried vegetables. However, a trend ($p = 0.055$) was noticed in which African American students tended to select more fruits and vegetables during the whole semester than Hispanic students. When evaluated using ANOVA, there were significant main effects of ethnicity ($p = 0.034$) and FFVP participation ($p = 0.006$) for fruit selection and a significant main effect of FFVP participation on total fruit and vegetable selection ($p = 0.046$). There was no significant interaction between ethnicity and participation in FFVP on fruit, vegetable, total fruit and vegetable, or fried vegetable selection.

When comparing selection by school, there was a significant difference in fruit selection during both the first two weeks and the entire semester between students who attended Jefferson

Elementary that participated in the FFVP and Sequoyah Elementary that did not participate in the FFVP ($p = 0.018$ and 0.022 respectively, Table 7). Children from Jefferson Elementary School selected more fruit than children from Sequoyah Elementary School. Fruit intake by students from Will Rogers Elementary School and Horace Mann Elementary School was not different from the other schools (Table 7). There was a trend for fruit selection during the last two weeks of the semester between schools ($p = 0.092$) in which students from Jefferson selected the most fruit followed by Will Rogers, Sequoyah, and Horace Mann. There was no significant difference between schools in the change in fruit selection between the first two weeks and last two weeks of the semester (Table 7); each school selected more fruit in the first two weeks than the last two weeks.

No significant differences by schools were noted for vegetable or total fruit and vegetable selection. There was a trend with total fruit and vegetable selection for the whole semester ($p = 0.051$) and during the first two weeks of the semester ($p = 0.077$) between the schools in which students from Jefferson selected the most followed by Will Rogers, Horace Mann, and Sequoyah. There was no significant difference between schools in the change in vegetable selection and total fruit and vegetable selection between the first two weeks and last two weeks of the semester (Table 7).

Lastly, no significant differences by schools were noted for fried vegetable selection, but there was a trend ($p = 0.069$) in fried vegetable selection for the whole semester in students from Horace Mann who selected the most fried vegetables followed by Jefferson, Sequoyah, and Will Rogers respectively. There was a significant difference between schools in the change in fried vegetable selection between the first two weeks and the last two weeks of the semester ($p = 0.013$, Table 7). When comparing change scores for fried vegetable selection by school, there was a significant difference between students who attended Will Rogers Elementary that participated in the FFVP and Horace Mann Elementary that did not participate in the FFVP ($p = 0.001$).

Although there were no other significant differences in change score for fried vegetable selection between schools, there was a trend toward a difference between Jefferson Elementary that participated in the FFVP and Horace Mann Elementary that did not participate in the FFVP ($p = 0.059$) as well as a trend between Horace Mann and Sequoyah Elementary schools that did not participate in the FFVP ($p = 0.063$).

Table 2 - Demographic characteristics of students who were included in the study						
	FFVP participants (n=104)		**FFVP nonparticipants (n=79)**		**All Students (n=183)**	
	n	**%**	**n**	**%**	**n**	**%**
Gender						
Female	56	53.8	41	51.9	97	53.0
Male	48	46.2	38	48.1	86	47.0
Ethnicity						
African American	4	3.8	8	10.1	12	6.6
American Indian	15	14.4	8	10.1	23	12.6
Caucasian	52	50.0	47	59.5	99	54.1
Hispanic	10	9.6	5	6.3	15	8.2
Pacific Islander	0	0.0	1	1.3	1	0.5
Multiple	23	22.1	10	12.7	33	18.0

Table 3 - Number of days students participated in school lunch by FFVP participation and time of semester		
	FFVP participants	**FFVP nonparticipants**
	Mean ± Standard Deviation	
Days		
First Two Weeks	8.6 ± 2.6	9.0 ± 2.0
Last Two Weeks	8.1 ± 2.7	8.6 ± 2.3
Total	69.8 ± 20.2	73.1 ± 16.8

Table 4 - Frequency of selection of fruits, vegetables, total fruits and vegetables, and fried vegetables by FFVP participation and time of semester

	FFVP participants	FFVP nonparticipants	*p* value for means[a]
	Mean ± Standard Deviation		
Fruits			
First Two Weeks	4.8 ± 2.9	3.7 ± 2.7	0.009
Last Two Weeks	3.8 ± 3.0	2.9 ± 2.5	0.029
Change Score[b]	-1.0 ± 3.0	-0.7 ± 3.2	0.633
Total	33.0 ± 20.8	25.6 ± 16.6	0.008
Vegetables			
First Two Weeks	3.5 ± 3.2	3.4 ± 2.8	0.900
Last Two Weeks	3.4 ± 2.4	3.3 ± 2.4	0.795
Change Score[b]	-0.2 ± 3.0	-0.2 ± 2.8	0.934
Total	28.4 ± 17.2	26.9 ± 18.9	0.590
F & V			
First Two Weeks	8.3 ± 4.6	7.1 ± 4.6	0.088
Last Two Weeks	7.2 ± 4.4	6.2 ± 4.0	0.115
Change Score[b]	-1.1 ± 4.4	-0.9 ± 4.8	0.791
Total	61.4 ± 31.7	52.5 ± 29.1	0.054
Fried			
First Two Weeks	3.5 ± 1.6	3.2 ± 1.6	0.280
Last Two Weeks	2.6 ± 1.4	2.9 ± 1.5	0.104
Change Score[b]	-0.9 ± 1.8	-0.3 ± 1.9	0.024
Total	25.3 ± 11.1	27.3 ± 10.6	0.201

[a]Two-sided independent samples *t* test comparing the means

[b]Change score refers to the amount selected during the last two weeks minus the selection during the first two weeks

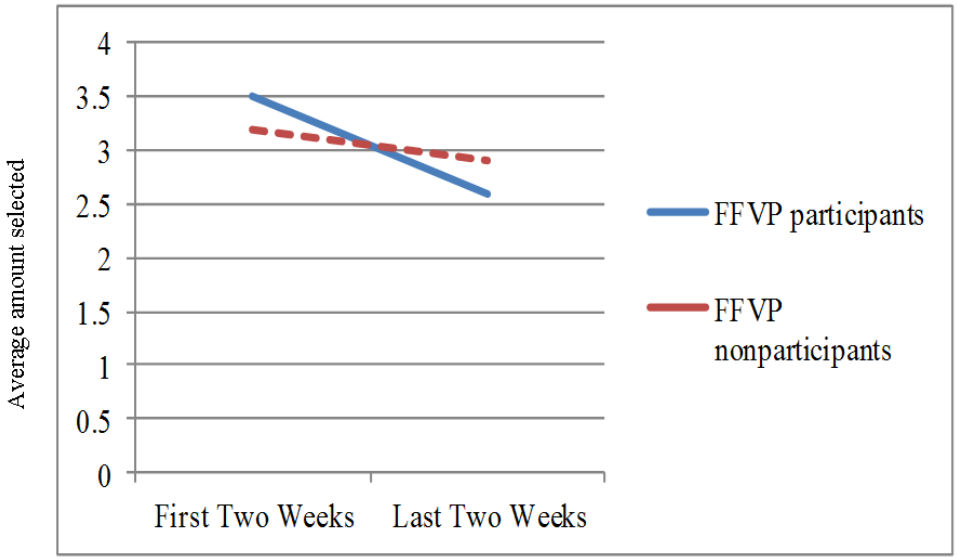

Figure 1 - Change in fried vegetable selection for FFVP participants and nonparticipants

Table 5 - Frequency of selection of fruits, vegetables, total fruits and vegetables, and fried vegetables by gender and FFVP participation

	Participants		**Nonparticipants**		**All Students**	
	Female (n=56)	**Male (n=48)**	**Female (n=41)**	**Male (n=38)**	**Female (n=97)**	**Male (n=86)**
	Mean ± Standard Deviation					
Selection						
Fruits	38.0 ± 22.2*	27.2 ± 17.6	31.2 ± 16.3*	19.6 ± 15.0	35.1 ± 20.1*	23.8 ± 16.8
Vegetables	29.4 ± 16.0	27.3 ± 18.7	30.0 ± 19.5	23.7 ± 17.8	29.6 ± 17.5	25.7 ± 18.3
F & V	67.4 ± 32.8*	54.4 ± 29.3	61.1 ± 29.3*	43.3 ± 26.2	64.7 ± 31.4*	49.5 ± 28.4
Fried	24.9 ± 10.9	25.7 ± 11.4	26.5 ± 8.8	28.3 ± 12.2	25.6 ± 10.1	26.8 ± 11.8

*Significantly different from males at 0.05 level using two-sided independent samples *t* test comparing the means

Table 6 - Frequency of selection of fruits, vegetables, total fruits and vegetables, and fried vegetables by ethnicity and FFVP participation

	Participants				
		Fruits	Vegetables	F & V	Fried
	n	Mean ± Standard Deviation			
Ethnicity					
African American	4	53.5 ± 24.1	27.3 ± 13.6	80.8 ± 33.8	24.0 ± 7.5
American Indian	15	36.1 ± 19.4	32.0 ± 12.0	68.1 ± 24.4	29.1 ± 8.4
Caucasian	52	32.6 ± 20.1	28.8 ± 20.7	61.3 ± 34.4	25.2 ± 11.8
Hispanic	10	27.9 ± 24.7	25.4 ± 10.6	53.3 ± 31.3	20.4 ± 6.8
Multiple	23	30.7 ± 20.7	26.6 ± 14.8	57.3 ± 29.7	25.2 ± 12.7
	Nonparticipants				
		Fruits	Vegetables	F & V	Fried
	n	Mean ± Standard Deviation			
Ethnicity					
African American	8	37.6 ± 13.3	25.9 ± 13.8	63.5 ± 22.7	27.3 ± 6.9
American Indian	8	25.5 ± 11.8	28.9 ± 12.2	54.4 ± 20.7	29.9 ± 7.2
Caucasian	47	24.6 ± 17.1	27.0 ± 22.3	51.6 ± 32.2	25.5 ± 11.2
Hispanic	5	14.8 ± 17.6	17.2 ± 10.8	32.0 ± 22.7	29.0 ± 16.8
Multiple	10	24.2 ± 16.8	31.5 ± 11.7	55.7 ± 26.4	32.2 ± 8.1
	All Students				
		Fruits*	Vegetables	F & V	Fried
	n	Mean ± Standard Deviation			
Ethnicity					
African American	12	43.0 ± 18.2[a]	26.3 ± 13.1	69.3 ± 26.7	26.2 ± 6.9
American Indian	23	32.4 ± 17.6[ab]	30.9 ± 11.9	63.3 ± 23.7	29.4 ± 7.8
Caucasian	99	28.8 ± 19.1[b]	27.9 ± 21.4	56.7 ± 33.6	25.4 ± 11.4
Hispanic	15	23.5 ± 22.9[b]	22.7 ± 11.1	46.2 ± 29.7	23.3 ± 11.3
Multiple	33	28.7 ± 19.5[b]	28.1 ± 14.0	56.8 ± 28.4	27.3 ± 11.8

*$p = 0.034$

[ab]Means in columns that share the same superscript are not significantly different from one another, using ANOVA with LSD post-hoc comparisons

Table 7 - Frequency of selection of fruits, vegetables, total fruits and vegetables, and fried vegetables by school and time of semester

	Participating Schools		Nonparticipating Schools		*p* value for means*
	Jefferson (n = 45)	Will Rogers (n = 59)	Horace Mann (n = 28)	Sequoyah (n = 51)	
	Mean ± Standard Deviation		Mean ± Standard Deviation		
Fruits					
First Two Weeks	5.2 ± 2.9[a]	4.4 ± 2.9[ab]	4.3 ± 2.6[ab]	3.3 ± 2.7[b]	0.018
Last Two Weeks	4.1 ± 2.9	3.6 ± 3.1	2.5 ± 1.8	3.2 ± 2.8	0.092
Change Score**	-1.9 ± 3.1	-0.8 ± 2.9	-1.8 ± 2.3	-0.2 ± 3.4	0.135
Total	36.4 ± 18.4[a]	30.4 ± 22.3[ab]	27.6 ± 17.0[ab]	24.5 ± 16.5[b]	0.022
Vegetables					
First Two Weeks	4.0 ± 4.0	3.1 ± 2.4	3.5 ± 3.3	3.4 ± 2.5	0.572
Last Two Weeks	3.4 ± 2.5	3.3 ± 2.2	3.0 ± 2.0	3.4 ± 2.7	0.865
Change Score**	-0.6 ± 3.2	0.2 ± 2.7	-0.5 ± 3.2	0.0 ± 2.6	0.514
Total	32.6 ± 19.8	25.9 ± 14.7	27.4 ± 19.5	26.7 ± 18.7	0.403
F & V					
First Two Weeks	9.2 ± 4.9	7.6 ± 4.3	7.8 ± 5.2	6.7 ± 4.2	0.077
Last Two Weeks	7.5 ± 4.4	6.9 ± 4.4	5.4 ± 2.8	6.6 ± 4.4	0.231
Change Score**	-1.7 ± 4.7	-0.7 ± 4.1	-2.3 ± 4.6	-0.2 ± 4.9	0.149
Total	68.1 ± 31.2	56.3 ± 31.5	55.0 ± 30.9	51.2 ± 28.3	0.051
Fried					
First Two Weeks	3.4 ± 1.6	3.5 ± 1.6	3.0 ± 1.5	3.3 ± 1.7	0.483
Last Two Weeks	2.8 ± 1.3	2.4 ± 1.4	3.2 ± 1.7	2.8 ± 1.4	0.134
Change Score**	-0.6 ± 1.8[ab]	-1.1 ± 1.7[a]	0.2 ± 1.8[b]	-0.6 ± 1.8[ab]	0.013
Total	28.0 ± 10.6	23.2 ± 11.1	28.6 ± 10.6	26.7 ± 10.6	0.069

*Comparing the means by Analysis of Variance

**Change score refers to the amount selected during the last two weeks minus the selection during the first two weeks

[ab]Means in rows that share the same superscript are not significantly different from one another, using ANOVA with Scheffe's test

CHAPTER V

DISCUSSION

The present study found a significant difference in fruit selection between FFVP participants and nonparticipants, whereas a non-significant trend (p=0.054) was seen with total fruit and vegetable selection. Participants selected more fruits and tended to select more total fruits and vegetables than nonparticipants in the semester following participation in the FFVP. The interim evaluation report of the FFVP (Olsho, et al. 2011) showed similar results; participants reported consuming more fresh fruits and vegetables than nonparticipants on days in which FFVP foods were served. In the evaluation of the pilot study for the FFVP (Buzby, et al. 2003), it was reported that a more varied selection of fruits was offered than vegetables, and students found more appealing than vegetables. In previous research (e.g., Hendy, et al. 2005; Perry, et al. 1998; Tuuri, et al. 2009), interventions focusing on increasing children's fruit and vegetable intake have been successful at increasing fruit intake and total fruit and vegetable intake, but not vegetable intake. These findings were similarly represented in the present study.

Students in this study selected significantly more fruits during the first two weeks of the semester than the last two weeks of the semester. However, there was no interaction between time of semester and participation in FFVP on fruit selection and no difference in change scores between FFVP participants and nonparticipants for fruit selection. Both participants and nonparticipants

decreased their fruit intake over time. This was expected at least for FFVP participants because research has shown that the further out from an intervention a child gets, the more their preference and selection go back to baseline levels (Hendy, et al. 2005). Additionally, foodservice. staff at Shawnee Middle School reported that in past years, when students begin sixth grade, they select more fruits and vegetables during the first two weeks than they do the last two weeks.

The foodservice staff attributes this change to peer modeling which evidence supports (O'Connell, et al. 2012). Cullen, et al. (2004) suggested this decrease may result from the lack of an a la carte line in elementary school and the novelty of the presence of an a la carte line in middle school. This change could also be due to a seasonal influence because more of a variety of fruits and vegetables are available in August than in December.

Based on previous research (e.g., Baxter & Thompson. 2012; Perry, et al. 2004), it was not expected that participants would select significantly more vegetables than nonparticipants. There were no differences between participants and nonparticipants or between the beginning and end of the semester for vegetable selection. There was no interaction between participation in FFVP and time of semester or change score. A possibility for this is that since the rules and regulations of the FFVP do not require a certain ratio of fruits and vegetables to be served (USDA 2010), it is possible that FFVP students were being disproportionately exposed to more fruits than vegetables, as evidenced in a study by Buzby, et al. (2003). Another possibility could be that vegetables served in the FFVP were not served in the NSLP at Shawnee Middle School. Perry, et al. (2004) suggested that lack of effect on vegetable selection could be due to an absence of verbal encouragement from foodservice staff whereas Baxter and Thompson (2002) suggested that children simply do not like vegetables.

There was a significant difference in total fruit and vegetable selection between the beginning and the end of the semester and a trend for participants to select more total fruits and vegetables than nonparticipants. This may be attributed to the fact that nonparticipants never received the intervention and were less likely than participants to select fruits and vegetables upon transitioning to middle school.

As one of the studies we looked at analyzed french fries and fried potatoes separately from vegetables (Perry, et al. 2004), we did the same. There was a significant interaction between time of semester and FFVP participation in fried vegetable selection (Figure 1). The change score for fried vegetables between the first two weeks and the last two weeks of the fall semester of SY 2011 was significantly greater in participants than nonparticipants. Students who attended Will Rogers Elementary that participated in the FFVP had a larger change score than students who attended Horace Mann Elementary that did not participate in the FFVP. It has been demonstrated in other studies (e.g., Mathias, et al. 2012; Olsho, et al. 2011) that when children increase their consumption of calories from fruits and vegetables they do not increase their total calories. They simply are decreasing calories consumed from other foods. This could be a possible explanation for this observed difference in change score with selection of fried vegetables between the first two weeks and last two weeks of the semester by FFVP participants.

In every case (participants, nonparticipants, and total students), females selected more fruits and more total fruits and vegetables than males. This agrees with a study done by Cullen, et al. (2003) in that availability and accessibility of fruits and vegetables are direct indicators of consumption by females but not males. Having said that, we would have expected females to have selected more fruits and vegetables than males did since in males and females had the same fruits and vegetables available and accessible to them in the NSLP at Shawnee Middle School. However, the results of the present study do not agree with studies by Olsho, et al. (2011) and Wordell, et

al. (2012) that showed no gender differences in fruit and vegetable consumption at school or during school hours.

The significant difference in fruit selection between African American students and Caucasian, Hispanic, and students with multiple ethnicities is puzzling, as previous research has not identified ethnic differences among children in regards to fruit and vegetable intake (Olsho, et al. 2011). Although a study done by Reinaerts, et al. (2007) stated that factors influencing fruit and vegetable consumption such as preferences, modeling, and self-efficacy differed by ethnicity.

When it comes to differences between elementary schools, it was expected that students at Jefferson Elementary would select more fruits than Sequoyah Elementary during the first two weeks of the semester and for the entire semester as Jefferson Elementary was an FFVP school. What was not expected was that there was not a significant difference in fruit selection between Jefferson Elementary and Horace Mann Elementary. The manner in which the FFVP was implemented in the participant schools, Jefferson Elementary and Will Rogers Elementary, also affected the results. While Will Rogers Elementary had individuals from Oklahoma Cooperative Extension Service provide group nutrition education lessons, Jefferson Elementary did not have this opportunity. Additionally, we expected there to be significant differences between FFVP schools and non-FFVP schools with vegetable, total fruit and vegetable, and fried vegetable selection. The interim evaluation report of the FFVP (Olsho, et al. 2011) showed a significant difference between FFVP schools and non-FFVP schools for total fruit and vegetable intake, but the present study only saw a strong trend at $p = 0.051$. It is worth noting that the study conducted by Olsho, et al. (2011) included only schools plus or minus two and a half percentage points away from the cutoff for percentage of students eligible for free and reduced price school meals, whereas the present study looked at schools with percentages ranging from 70% to 98%. It is also worth noting that the two FFVP schools in the present study were at percentages of 84% and 89%.

This study was subject to some limitations. First, the researcher had no control over the implementation of the FFVP in Jefferson Elementary and Will Rogers Elementary schools. Although foods offered through the FFVP had to come from a pre-approved list provided by the USDA, there were no rules for how often the foods had to be fruits and how often they had to be vegetables. This decision was left to the discretion of the individual schools. Having said this, it is quite reasonable to assume that the students participating in the FFVP in one school may have been exposed to more vegetables whereas students participating in the other FFVP school may have been exposed to more fruits. This could have a significant effect on observed selection. Additionally, we were not able to collect data from the students during the intervention – we were only able to collect data post-intervention. As we were unable to collect this data, it could be said there was no true baseline collected for the study. Unlike a 24-hour recall or a food frequency questionnaire, we know exactly what the student selected at each lunch. Although we do not know what the students actually consumed, we did not rely on their memory, which several studies have listed as a limitation (eg. Bante, et al. 2007; Baranowski, et al. 2000; Cullen & Zakeri, 2004), and a review (Thomson, et al. 2011) listed as a major limitation. Furthermore, the attendance rate of the students in the study was very high at 94.45%, and there were no significant differences in participation of school lunch by FFVP participation.

Conclusions

This study demonstrated that within the methods of implementation in the present study, the FFVP participation was associated with increased fruit selection and changed selection of fried vegetables in middle school children. Also demonstrated was that regardless of participation in the FFVP, female middle school children selected more fruits and total fruits and vegetables than male middle school children. Findings of this study cannot be applied to all FFVP schools, as the

schools in the present study are all located in the same Oklahoma town. Additionally, schools in the present study are likely to have different methods of FFVP implementation than other FFVP schools in other locations. Future research should include a longer time for intervention and collection as well as a larger, more diverse population.

Recommendations for the FFVP are to require an equal ratio of fruits and vegetables served to children throughout the school year, stricter regulations for program implementation, and a more in-depth nutrition education component for program delivery. These recommendations are made with the hopes of equalizing fruit and vegetable exposure among children, providing continuity of the FFVP between schools, and increasing children's knowledge and interest in fruits and vegetables respectively. Additionally, it is recommended that the FFVP focus on offering students fresh fruits and vegetables that are more affordable and accessible rather than exotic and novel. This recommendation is made with the hopes of increasing children's preferences for fresh fruits and vegetables that are affordable and accessible in a low-income environment because exotic and novel fresh fruits and vegetables are not always affordable or readily available.

REFERENCES

Bante, H., Elliott, M., Harrod, A., & Haire-Joshu, D. (2007). The use of inappropriate feeding practices by rural parents and their effects on preschoolers' fruit and vegetable preferences and intake. *Journal of Nutrition Education and Behavior 40* (1), 28-33. doi:10.1016/j.jneb.2007.02.007

Baranowski, T., Davis, M., Resnicow, K., Baranowski, J., Doyle, C., Lin, LS., Smith, M., & Wang, D.T. (2000). Gimme 5 fruit, juice, and vegetables for fun and health: outcome evaluation. *Health Education & Behavior 27* (1), 96-111. doi:10.1177/109019810002700109

Baxter, S.D., & Thompson, WO. (2002). Fourth-grade children's consumption of fruit and vegetable items available as part of school lunches is closely related to preferences. *Journal of Nutrition Education and Behavior,* 34, 166-171.

Briefel, R.R., Crepinsek, M.K., Cabili, C., Wilson, A., & Gleason, P.M. (2008a). School food environments and practices affect dietary behaviors of US public school children. *Journal of the American Dietetic Association, 109 (*2), S91-S107. doi:10.1016/j.jada.2008.10.059

Briefel, R.R., Wilson, A., & Gleason, P.M. (2008b). Consumption of low-nutrient, energy-dense foods and beverages at school, home, and other locations among school lunch participants and nonparticipants. *Journal of the American Dietetic Association, 109* (2), S79-S90. doi:10.1016/j.jada.2008.10.064

Buzby, J.C., Guthrie, J.F., & Kantor, L.S. (2003). *Evaluation of the USDA Fruit and Vegetable Pilot Program: Report to Congress*. Washington, DC: Food Assistance and nutrition Research Program, Food and Rural Economics Division, Economic Research service, U.S. Department of Agriculture. Retrieved April 17, 2012, from http://www.ers.usda.gov/publications/efan03006/efan03006.pdf

Centers for Disease Control (CDC) (2009). *CDC's High School Youth Risk Behavior Survey*. Retrieved November 29, 2011, from http://apps.nccd.cdc.gov/youthonline/App/Results.aspx?LID=OK

Childstats.gov's HEALTH6 Diet Quality Table. (2008). Retrieved October 17, 2011, from http://www.childstats.gov/americaschildren/tables/health6.asp?popup=true

Condon, E.M., Crepinsek, M.K., & Fox, M.K. (2008). School meals: types of foods offered to and consumed by children at lunch and breakfast. *Journal of the American Dietetic Association, 109* (2), S67-S78. doi:10.1016/j.jada.2008.10.062

Cullen, K.W., Baranowski, T., Owens, E., Marsh, T., Rittenberry, L., & de Moor, C. (2003). Availability, accessibility, and preferences for fruit, 100% fruit juice, and vegetables influence children's dietary behavior. *Health Education & Behavior, 30* (5), 615-626. doi:10.1177/1090198103257254

Cullen, K.W., Watson, K.B., & Konarik, M. (2009). Differences in fruit and vegetable exposure and preferences among adolescents receiving free fruit and vegetable snacks at school. *Appetite,* 52, 740-744. doi:10.1016/j.appet.2009.04.001

Cullen, K.W. & Zakeri, I. (2004). Fruits, vegetables, milk, and sweetened beverages consumption and access to a la carte/snack bar meals at school. *American Journal of Public Health, 94* (3), 463-467.

Cullen, K.W., Watson, K., Zakeri, I., & Ralston, K. (2006). Exploring changes in middle-school student lunch consumption after local school food service policy modifications. *Public Health Nutrition, 9* (6), 814-820. doi:10.1079/phn2005878

Domel, S.B., Thompson, W.O., Davis, H.C., Baranowski, T., Leonard, S.B., & Baranowski, J. (1996). Psychosocial predictors of fruit and vegetable consumption among elementary school children. *Health Education Research: Theory & Practice, 11* (3), 299-308.

Fox, M.K., Gordon, A., Nogales, R., & Wilson, A. (2008). Availability and consumption of competitive foods in the US public schools. *Journal of the American Dietetic Association, 109* (2), S57-S66. doi:10.1016/j.jada.2008.10.063

Gray, C., Lytle, L.A., Mays, R., Taylor, G., Perry, C., & Story, M. (2002). Foods on students' trays when the leave the cafeteria line as a roxy for foods eaten at lunch in a school-based study. *Journal of the American Dietetic Association, 102* (3), 407-409.

Gray, C., Lytle, L.A., Perry, C., Story, M., Taylor, G., & Bishop, D. (2007). Fruits and vegetables taken can serve as a proxy measure for amounts eaten in a school lunch. *Journal of the American Dietetic Association, 107* (6), 1019-1023. doi:10.1016/j.jada.2007.03.001

Hartstein, J., Cullen, K.W., Reynolds, K.D., Harrell, J., Resnicow, K., Kennel, P., & STOPP T2D Prevention Study Group. (2008). Impact of portion-size control for school a la carte

items: changes in kilocalories and macronutrients purchased by middle school students. *Journal of the American Dietetic Association, 108* (1), 140-144. doi:10.1016/j.jada.2007.10.005

Hendy, H.M., Williams, K.E., & Camise, T.S. (2005). "Kids Choice" school lunch program increases children's fruit and vegetable acceptance. *Appetite 45* (3), 250-263. doi:10.1016/j.appet.2005.07.006

Jansen, E., Mulkens, S., & Jansen, A. (2010). How to promote fruit consumption in children. Visual appeal versus restriction. *Appetite 54,* 599-602. doi:10.1016/j.appet.2010.02.012

Mathias, K.C., Rolls, B.J., Birch, L.L., Kral, T.V.E., Hanna, E.L., Davey, A., & Fisher, J.O. (2012). Serving larger portions of fruits and vegetables together at dinner promotes intake of both foods among young children. *Journal of the Academy of Nutrition and Dietetics, 112* (2), 266-270. doi:10.1016/j.jada.2011.08.040

Neumark-Sztainer, D., Wall, M., Perry, C., & Story, M. (2003). Correlates of fruit and vegetable intake among adolescents: findings from Project EAT. *Preventative Medicine, 37*, 198-208. doi:10.1016/S0091-7435(03)00114-2

O'Connell, M.L., Henderson, K.E., Luedicke, J., & Schwartz, M.B. (2012). Repeated exposure in a natural setting: a preschool intervention to increase vegetable consumption. *Journal of the Academy of Nutrition and Dietetics, 112* (2), 230-234. doi:10.1016/j.jada.2011.10.003

Olsho, L., Klerman, J., & Bartlett, S. (2011). *Food and Nutrition Service evaluation of the Fresh Fruit and Vegetable Program (FFVP): Interim Evaluation Report*. Cambridge, MA: Abt Associates. Retrieved February 1, 2012, from http://www.fns.usda.gov/ora/menu/published/cnp/FILES/FFVPInterim.pdf

Oklahoma State Department of Education (OSDE). (2011, August). *Fresh Fruit/Vegetable Program*. Training session presented in Shawnee, OK.

OSDE (2011). 2010-2011 Low Income Report. *Oklahoma State Department of Education: Child Nutrition Programs*. Retrieved April 17, 2012, from http://ok.gov/sde/sites/ok.gov.sde/files/LowIncomeReport1011.pdf

OSDE (2012). Oklahoma 2011-2012 Low Income Report. *Oklahoma State Department of Education: Child Nutrition Programs*. Retrieved April 17, 2012, from http://ok.gov/sde/sites/ok.gov.sde/files/LowIncomeReport1112.pdf

Perry, C.L., Bishop, D.B., Taylor, G.L., Davis, M., Story, M., Gray, C., Bishop, S.C., Warren Mays, R.A., Lytle, L.A., & Harnack, L. (2004). A randomized school trial of environmental strategies to encourage fruit and vegetable consumption among children. *Health Education & Behavior 31* (65), 65-76. doi:10.1177/1090198103255530

Perry, .CL., Bishop, D.B., Taylor, G., Murray, D.M., Warren Mays, R., Dudovitz, B.S., Smyth, M., & Story, M. (1998). Changing fruit and vegetable consumption among children: the 5-a-Day Power Plus program in St. Paul, Minnesota. *American Journal of Public Health, 88* (4), 603-609.

Poti, J.M., & Popkin, B.M. (2011). Trends in energy intake among US children by eating location and food source, 1977-2006. *Journal of the American Dietetic Association, 111* (8), 1156-1164. doi:10.1016/j.jada.2011.05.007

Reinaerts, E., de Nooijer, J., Candel, M., & de Vries, N. (2007). Explaining school children's fruit and vegetable consumption: the contributions of availability, accessibility, exposure, parental consumption and habit in addition to psychosocial factors. *Appetite, 48*, 248-258. doi:10.1016/j.appet.2006.09.007

Robinson-O'Brien, R., Neumark-Sztainer, D., Hannan, P.J., Burgess-Champoux, T., & Haines, J. (2008). Fruits and vegetables at home: child and parent perceptions. *Journal of Nutrition Education and Behavior, 41* (5), 360-364. doi:10.1016/j.jneb.2008.08.003

Story, M., Kaphingst, K.M., Robinson-O'Brien, R., & Glanz, K. (2008). Creating healthy food and eating environments: policy and environmental approaches. *Annual Review of Public Health*, 29, 253-272. doi:10.1146/annurev.publhealth.29.020907.090926

Thomson, C.A., & Ravia, J. (2011). A systematic review of behavioral interventions to promote intake of fruit and vegetables. *Journal of the American Dietetic Association, 111* (10), 1523-1535. doi:10.1016/j.jada.2011.07.013

Tuuri, G., Zanovec, M., Silverman, L., Geaghan, J., Solmon, M., Holston, D., Guarino, A., Roy, H., & Murphy, E. (2009). "Smart Bodies" school wellness program increased children's knowledge of healthy nutrition practices and self-efficacy to consume fruit and vegetables. *Appetite, 52*, 445-451. doi:10.1016/j.appet.2008.12.007

USDA (2009). *USDA's Oklahoma Nutrient Intakes*. Retrieved October 17, 2011, from http://www.ars.usda.gov/Services/docs.htm?docid=15723

USDA (2010, December). Fresh Fruit and Vegetable Program: Handbook for schools. *United States Department of Agriculture: Food and Nutrition Service*. Retrieved April 3, 2011, from http://www.fns.usda.gov/cnd/ffvp/handbook.pdf

USDA (2011, March 23). News Release. *USDA Expands Access to Fresh Fruits and Vegetables for Schools Across the Nation*. Retrieved April 3, 2011, from http://www.fns.usda.gov/cga/PressReleases/2011/0133.htm

USDA & U.S. Department of Health and Human Services. (2010). *Dietary guidelines for Americans 2010*. Retrieved from http://www.cnpp.usda.gov/Publications/DietaryGuidelines/2010/PolicyDoc/PolicyDoc.pdf

Velazquez, C.E., Pasch, K.E., Ranjit, N., Mirchandani, G., & Hoelscher, D.M. (2011). Are adolescents' perceptions of dietary practices associated with their dietary behaviors? *Journal of the American Dietetic Association, 111* (11), 1735-1740. doi:10.1016/j.jada.2011.08.003

Vereecken, C., Rovner, A., & Maes, L. (2010). Associations of parenting styles, parental feeding practices and child characteristics with young children's fruit and vegetable consumption. *Appetite 55*, 589-596. doi:10.1016/j.appet.2010.09.009

Wordell, D., Daratha, K., Mandal, B., Bindler, R., & Nicholson Butkus, S. (2012). Changes in a middle school food environment affect food behavior and food choices. *Journal of the Academy of Nutrition and Dietetics, 112* (1), 137-141. doi:10.1016/j.jada.2011.09.008

APPPENDIX

Oklahoma State University Institutional Review Board

Request for Determination of Non-Human Subject or Non-Research

Federal regulations and OSU policy require IRB review of all research involving human subjects. Some categories of research are difficult to discern as to whether they qualify as human subject research. Therefore, the IRB has established policies and procedures to assist in this determination.

1. Principal Investigator Information

First Name: Sydney	Middle Initial: E	Last Name: Jackson
Department/Division: Nutritional Sciences		College: Human Sciences
Campus Address:		Zip+4:
Campus Phone:	Fax:	Email: sydneyj@okstate.edu
Complete if PI does not have campus address:		
Address: 114 S. Duncan #6		City: Stillwater
State: Oklahoma	Zip: 74074	Phone: 918.223.5682

2. Faculty Advisor (complete if PI is a student, resident, or fellow) ☐ **NA**

Faculty Advisor's name: Gail Gates		Title: Regents Service Professor
Department/Division: Nutritional Sciences		College: Human Sciences
Campus Address: 314 HS		Zip+4: 74078-6141
Campus Phone: 405.744.3845	Fax: 405.744.1357	Email: gail.gates@okstate.edu

3. Study Information:

A. Title

An evaluation of the Fresh Fruit and Vegetable Program in Shawnee, Oklahoma

B. Give a brief summary of the project. (See instructions for guidance)

The Shawnee public school system implemented the Fresh Fruit and Vegetable Program in school year 2010 (fall 2010, spring 2011). The Fresh Fruit and Vegetable Program was established by the United States Department of Agriculture as a nutrition assistance program for students in low-income elementary schools. The purpose of this study is to conduct an evaluation of the effects of the Fresh Fruit and Vegetable Program. The Fresh Fruit and Vegetable Program was administered by the Shawnee Public Schools as a normal education practice. The two elementary schools in Shawnee that participated the program were Jefferson Elementary School and Will Rogers Elementary School. The research question is "Do school age children who participate in the Fresh Fruit and Vegetable Program in elementary school select fruits and vegetables in school lunches more frequently in middle school compared to students who are not exposed to the Fresh Fruit and Vegetable Program in elementary school?"

C. Describe the subject population/type of data/specimens to be studied. (See instructions for guidance)

The population of interest in this study is all sixth grade students (approximately 300 students) attending Shawnee Middle School in Shawnee, OK in fall 2011. Subject selection is a convenience sample. The sample will include students who were enrolled in 5th grade in school year 2010 and 6th grade in fall 2011.

Students will be excluded from the study if they were in attendance as a fifth grader at their elementary school for less than the full school year 2010. Students must be in attendance for the full school year, having not exceeded the school's absence policy, as the Fresh Fruit and Vegetable Program is an ongoing program. Students will also be excluded from the study if they are only in attendance as a sixth grader at the middle school for less than the full fall semester of school year 2011 (fall 2011, spring 2012). Student food purchase data will be collected daily for one semester (fall 2011) to be analyzed. This food analysis will be completed by analyzing point-of-service machine (cash register) electronic data from the schools' nutrition services. Foodservice employees will follow normal procedures and key in items sold to each student during the lunch hour. The items used for analyses will be "chef salad", "fried vegetable", "fruit", and "vegetable". There will be no interaction with or manipulation of human subjects. No questionnaires, tests, or other written instruments will be used in this study, and all information received will be de-identified and contain only coded records of normal school lunch transactions.

4. **Determination of "Research".**
45 CFR 46.102(d): *Research* means a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge. Activities which meet this definition constitute research for purposes of this policy whether or not they are conducted or supported under a program which is considered research for other purposes.

One of the following must be "no" to qualify as "non-research":

A. Will the data/specimen(s) be obtained in a systematic manner?
☐ No ☒ Yes

B. Will the intent of the data/specimen collection be for the purpose of contributing to generalizable knowledge (the results (or conclusions) of the activity are intended to be extended beyond a single individual or an internal program, e.g., publications or presentations)?
☐ No ☒ Yes

5. **Determination of "Human Subject".**
45 CFR 46.102(f): *Human subject* means a living individual about whom an investigator (whether professional or student) conducting research obtains: (1) data through intervention or interaction with the individual or (2) identifiable private information. Intervention includes both physical procedures by which data are gathered (for example venipuncture) and manipulations of the subject or the subject's environment that are performed for research purposes. Interaction includes communication or interpersonal contact between investigator and subject. Private information includes information about behavior that occurs in a context in which an individual can reasonably expect that no observation or recording is taking place, and information which has been provided for specific purposes by an individual and which the individual can reasonably expect will not be made public (for example, a medical record). Private information must be individually identifiable (i.e., the identity of the subject is or may be ascertained by the investigator or associated with the information) in order for obtaining the information to constitute research involving human subjects.

A. Does the research involve obtaining information about living individuals?
☐ No ☒ Yes
If no, then research does not involve human subjects, no other information is required.
If yes, proceed to the following questions.

All of the following must be "no" to qualify as "non-human subject":

B. Does the study involve intervention or interaction with a "human subject"?
☒ No ☐ Yes

C. Does the study involve access to identifiable private information?
☒ No ☐ Yes

D. Are data/specimens received by the Investigator with identifiable private information?

Oklahoma State University Institutional Review Board

Request for Determination of Non-Human Subject or Non-Research

☒ No ☐ Yes

E. Are the data/specimen(s) coded such that a link exists that could allow the data/specimen(s) to be re-identified?
☒ No ☐ Yes
If "*Yes*," is there a written agreement that prohibits the PI and his/her staff access to the link?
☐ No ☐ Yes

The researchers have no intentions of receiving or possessing any documents connecting student ID numbers with student information.

6. Signatures

Signature of PI _____ **Date** 8/30/2011

Signature of Faculty Advisor (If PI is a student) Gail Gates **Date** 8/30/11

☒ Based on the information provided, the OSU-Stillwater IRB has determined that this project **does not** qualify as human subject research as defined in 45 CFR 46.102(d) and (f) and **is not subject to oversight by the OSU IRB.**

☐ Based on the information provided, the OSU-Stillwater IRB has determined that this research **does** qualify as human subject research and **submission of an application for review by the IRB is required.**

Shelia M. Kennison — 8/31/11

Dr. Shelia Kennison, IRB Chair — Date

VITA

Sydney Elyse Jackson

Candidate for the Degree of

Master of Science

Thesis: AN EVALUATION OF THE FRESH FRUIT AND VEGETABLE PROGRAM IN SHAWNEE, OKLAHOMA

Major Field: Nutritional Sciences

Biographical:

Education:

Candidate for the degree of Master of Science in Nutritional Sciences at Oklahoma State University, Stillwater, Oklahoma in May, 2012

Completed the requirements for the Bachelor of Science in Nutritional Sciences at Oklahoma State University, Stillwater, Oklahoma in December, 2010

Experience:

Dietetic intern, Oklahoma State University, January 2011 to present

Graduate and undergraduate research assistant in the Department of Nutritional Sciences, Oklahoma State University, Stillwater, Oklahoma, February 2010 to May 2011

Academic tutor, Student Support Services, Oklahoma State University, Stillwater, Oklahoma, April 2011 to May 2011

Fitness instructor, Colvin Recreational Center and Seretean Wellness Center, Oklahoma State University, Stillwater, Oklahoma, August 2010 to June 2011

Business owner, The Alabaster Jar, Stillwater, Oklahoma, December 2009 to present

Professional Memberships:

Academy of Nutrition and Dietetics
Oklahoma Academy of Nutrition and Dietetics

Name: Sydney Elyse Jackson Date of Degree: May 2012

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: AN EVALUATION OF THE FRESH FRUIT AND VEGETABLE PROGRAM IN SHAWNEE, OKLAHOMA

Pages in Study: 65 Candidate for the Degree of Master of Science

Major Field: Nutritional Sciences

Scope and Method of Study: The Fresh Fruit and Vegetable Program (FFVP) was established by the U.S. Department of Agriculture as a nutrition assistance program for students in low-income elementary schools because studies showed that children do not eat enough fruits and vegetables. The purpose of the study was to test the effectiveness of the FFVP on fruit and vegetable selection in school age children in Shawnee, Oklahoma. The research study design was post-test only with a comparison group. Participants in the study included 183 sixth grade students in the Shawnee Public School system who attended their entire fifth grade year at one of the four Shawnee elementary schools. The intervention, the FFVP, was conducted in two schools during the students' fifth grade year, and data collection of fruit and vegetable selection occurred during the first semester of the students' sixth grade year. During the FFVP students received a fresh fruit or vegetable one to three times a week during their school day as a separate meal from the School Breakfast Program, National School Lunch Program, and any after school program. The primary outcome measures included fruit, vegetable, total fruit and vegetable, and fried vegetable selection during school lunch. Statistical analyses performed included chi-square, two-sided independent samples *t* tests, and analysis of variance (ANOVA).

Findings and Conclusions: FFVP participants selected significantly more fruits in school lunches than nonparticipants ($p = 0.008$). When using ANOVA, there were significant main effects of FFVP participation ($p < 0.001$) and time of semester ($p = 0.005$) on fruit selection, but there was no significant interaction between time and FFVP participation. A non-significant trend ($p = 0.054$) was seen between FFVP participants and nonparticipants for total fruit and vegetable selection for the full semester. When using ANOVA, there was a significant main effect of time of semester ($p = 0.003$) on total fruit and vegetable selection, but there was no significant interaction between time and FFVP participation. There was a significant interaction between time and FFVP participation for fried vegetables ($p = 0.024$); participants decreased their intake of fried vegetables between the first two weeks and last two weeks of the semester more than nonparticipants. Females selected significantly more fruits ($p = 0.007$) and total fruits and vegetables ($p = 0.037$) than males in each group (participants, nonparticipants, all students). In conclusion, findings of this study showed that FFVP participation was associated with increased fruit selection and changed selection of fried vegetables in children the semester following participation in the FFVP. Recommendations for the FFVP are to require an equal ratio of fruits and vegetables served to children throughout the school year, stricter regulations for program implementation, and a more in-depth nutrition education component for program delivery.

ADVISER'S APPROVAL: Dr. Gail E. Gates