

EVALUATION OF THE FARM TO YOU  
NUTRITION EDUCATION  
INTERACTIVE EXHIBIT

By

ABBY FISCHER STOVER

Bachelor of Science in Nutritional Sciences

Oklahoma State University

Stillwater, Oklahoma

2007

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  
July, 2009

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Thesis Approved:

Dr. Deana Hildebrand

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Thesis Adviser

Dr. Janice Hermann

---

Committee Member

Dr. Barbara Brown

---

Committee Member

Dr. A. Gordon Emslie

---

Dean of the Graduate College

## ACKNOWLEDGMENTS

I would like to express my sincere appreciation to my chair, Dr. Deana Hildebrand, for her guidance and support. She is a wonderful mentor and has been instrumental to my success as a graduate student. I would also like to thank my committee members, Dr. Janice Hermann and Dr. Barbara Brown, who helped guide me through the research process. In addition, I would also like to acknowledge the Oklahoma Cooperative Extension educators who volunteered to help with the project. The research would not have been possible without their valued efforts.

I also want to thank my husband, Ross, for his patience, support, and encouragement while I completed my educational goals. Lastly, I want to thank my parents, Don and Jo Ann Fischer, who instilled in me the confidence to do whatever I set my mind to.

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## CHAPTER I

### INTRODUCTION

Oklahoma children need to improve their health behaviors related to diet and exercise. This is evidenced by increasing obesity rates and related co-morbidities, including cardiovascular disease (CVD) and type two diabetes mellitus (T2DM) (OSDH, 2007). Studies have indicated that the diets of U.S. children and adolescents do not meet the current national dietary recommendations for good health (Guenther, 2006). Eating and physical activity habits developed during childhood most often continue throughout the lifecycle (Birch, 1999) and influence not only their present but future health status (Magarey, 2003). Evidence supports that theory-based nutrition education interventions are successful at positively changing the dietary behaviors of children (Lytle, 1996; Nader, 1999; Turri, 2009).

The *Farm to You* is a theoretically-based, interactive exhibit designed for elementary school children that follows food from the farm, to the market, and through the body to explore the relationship between agriculture, food and health (Farm to You, 2009). It was designed to serve as a capstone event and support on-going Oklahoma Cooperative Extension Service (OCES) nutrition education programs such as the Healthy Oklahoma Youth (HOY) curriculum. Both *Farm to You* and the HOY lessons are based on Social Cognitive Theory (SCT) and build upon the idea that increasing nutritional

awareness and knowledge in a manner that develops valued outcome expectancies will result in desired dietary behavior changes.

The HOY curriculum is a series of six lessons designed for fourth through sixth grade students. It is taught by OCES county educators in elementary classrooms throughout Oklahoma. Lesson titles are: *Keeping Balance with MyPyramid*, *Mix it Up for Fitness*, *Snack Wise*, *Beverage Buzz*, *Break Fast with Breakfast*, and *Making Fast Food Fit*. The lessons address behaviors and situations in which students have greater control in making food decisions. Evaluation of the lesson series consists of a pre/post, ten-item questionnaire to assess changes in the frequency students practice health-promoting food behaviors.

The same questionnaire was used following the *Farm to You* intervention to measure the degree of behavior change the exhibit made beyond that achieved by the HOY lessons. The exhibit reinforces the concepts taught in the HOY lessons. At the *Farm to You* exhibit students learn how foods from the farm are used by the body for good health. Students make their way through the exhibit by visiting unique *Farm to You* stations: *The Cheeseburger Farm*, *the Market*, *Healthy Cool Café*, *Mouth*, *Stomach*, *Small Intestine*, *Muscle*, *Bone*, and *Skin*.

### **Significance of Study**

Previous evaluation of a lesson series similar to the HOY series has revealed significant changes in student dietary behaviors (Hermann, 2008). However, evaluation of the combined impact of the two interventions on students dietary and physical activity behaviors has not been conducted. Because a great deal of resources from a variety of community stakeholders were committed to the *Farm to You* project, there is need to



evaluate the impact of the *Farm to You* project over and above that created by the more traditional lesson series. Additionally, there has been no research found to date that evaluated an interactive nutrition education exhibit like the *Farm to You* exhibit alone. The *Smart Bodies* program conducted by Tuuri and colleagues (2009) included *The Body Walk* interactive exhibit, but the effects on behavior that the exhibit alone created was not measured. The evaluation of the *Farm to You* exhibit is the first assessment of an intervention of this sort. The information learned from the evaluation will help guide future development of similar interventions in Oklahoma and contribute to the existing body of literature related to the efficacy of SCT based interventions in school and community settings.

### **Purpose of the Study**

The purpose of this study is to evaluate if the *Farm to You* exhibit is an effective nutrition education tool; specifically, to determine if participation in the educational program enhances behavior change in fourth and fifth grade students beyond that seen after students participate in the Healthy Oklahoma Youth (HOY) nutrition curriculum program.

### **Hypothesis**

H<sub>0</sub>: Students who participate in the *Farm to You* exhibit following the Healthy Oklahoma Youth (HOY) lessons will practice the same or fewer health-related behaviors than students who only participated in the HOY lesson series.

H<sub>1</sub>: Students who participate in the *Farm to You* exhibit following the Healthy Oklahoma Youth (HOY) lessons will practice a greater number of health-related behaviors than students who only participated in the HOY lesson series.

### **Assumptions of the Study**

1. The students surveyed understood and truthfully reported their nutrition and health behaviors.
2. The Oklahoma Cooperative Extension educators followed the guidelines given to them for teaching the HOY lessons and coordinating the *Farm to You* project.

### **Limitations of the Study**

1. The data gleaned from the questionnaire responses were self-reported, and the accuracy of the information was dependent on the truthfulness, cooperation, and understanding of the students.
2. The evaluation protocol that was developed to help maintain consistency in the way the questionnaire was explained to each group of students was not used by some of the educators.
3. One of the Healthy Oklahoma Youth lessons was not taught to an intervention group which may have reduced possible changes in behavior.

### **Definitions of Terms**

1. Body mass index (BMI): A measurement defined and used by the Centers for Disease Control as an index of a person's weight in relations to height. It is determined by dividing the weight, in kilograms, by the square of the height, in meters (CDC, 2009).
2. Centers for Disease Control and Prevention (CDC): A component of the United States Department of Health and Human Services. It utilizes public health strategies to prevent and control infectious and chronic diseases, workplace injuries and hazards and environment health threats (CDC 2009).

3. National Health and Nutrition Examination Survey (NHANES): The National Health and Nutrition Examination Survey (NHANES) is a program of studies designed to assess the health and nutritional status of adults and children in the United States. The survey is unique in that it combines interviews and physical examinations.
4. Obesity: A term used to describe a physical state characterized by excessively high adipose tissue in relation to lean body tissue. The Centers for Disease Control and Prevention use growth charts to plot the BMI score. A BMI score greater than 95<sup>th</sup> percentile for age in children two through nineteen years of age to identify obesity.
5. Overweight: A term used by the Centers for Disease Control and Prevention to describe children aged two through nineteen years whose BMI is between the 85<sup>th</sup> and 95<sup>th</sup> percentile for age.
6. Oklahoma Cooperative Extension Services (OCES): Is a division of Oklahoma State University, a land-grant university, designed to help people use research-based knowledge to improve their lives in the areas of agriculture and food, home and family, the environment, community economic development, and youth activities.
7. Social Cognitive Theory (SCT): A theory founded by Albert Bandura which proposes as a major organizing principle for understanding behavior the concept of reciprocal determinism, in which personal, behavioral, and environmental factors work in a dynamic and reciprocal fashion to influence health behavior.

## CHAPTER II

### REVIEW OF LITERATURE

#### **Determinants of Health Behaviors in Children**

There are multiple determinants of a person's dietary patterns. Evidence supports that eating behaviors begin to develop as infants' transition from a milk-based diet to solid foods which is around six months to one year of age, and continue into older childhood and adolescence (Birch, 2008). When children are young, parents have the strongest influence on a child's dietary habits. Parents serve as models for food choices and eating behaviors. They also have more control of the child's eating environment and food availability (Birch, 2008). As children get older, the influence of their fellow peers and the school environment becomes a strong influence on eating behaviors (Birch, 1999; Briefel, 2009).

Briefel (2009) found the availability of low-nutrient, energy dense foods in the school cafeteria, vending machines, and snack bars influence children's dietary behavior. O'Tool and colleagues (2007) found that nationwide, twenty-one-percent of elementary schools had one or more vending machines that students could purchase food or beverages, and twelve-percent of elementary schools allowed students to purchase foods and beverages high in fat, sodium, or added sugars from a vending machine, or in a school store, or snack bar during school lunch periods. Low-nutrient, energy-dense foods

provide excess energy relative to their nutrient value (O'Tool, 2007), leading to increased energy intake and higher body mass index (Kubik, 2005). In addition, the amount of time children spend engaging in physical activity during school can contribute to meeting the daily recommended levels of physical activity (Strong, 2005). Most students are only engaging in thirty to forty-five minutes of moderate to vigorous physical activity three to five days per week (Strong, 2005), which is not meeting the national recommendations for children of sixty minutes of moderate to vigorous physical activity every day (USDHHS & USDA, 2005). These eating and physical activity habits developed during childhood most often continue throughout the lifecycle (Birch, 1999) and influence not only their present but future health status.

### **Major Health Concerns Associated with Diet and Physical Activity**

Over the past three decades, the rate of childhood and adolescent obesity has almost tripled in the United States. The health and nutrition status of adults and children in the United States is assessed by the National Health and Nutrition Examination Survey (NHANES) which is conducted by the National Center for Health Statistics (NCHS). In 1980, NHANES estimated only six-percent of children and adolescents were obese. The most recent NHANES data from 2006 indicates that thirty-two-percent of children are overweight with sixteen-percent of these children categorized as obese (Ogden, 2008). Obesity is a result of an energy imbalance that occurs when excessive energy is consumed and inadequate energy is used for physical activity leading to the deposition of excess body fat (Williams, 2007).

A well accepted tool to measure overweight and obesity is body-mass-index (BMI). BMI is a measurement defined and used by the Centers of Disease Control

(CDC) as an index of a person's weight in relation to height. It is determined by dividing the weight, in kilograms, by the square of the height, in meters (CDC, February, 2009). Unlike adults, BMI for children and adolescents (aged 2 through 19 years) is age and gender specific and is referred to as BMI-for-age percentile. The CDC defines obesity in children as a BMI greater than the 95<sup>th</sup> percentile on a growth chart and overweight as a BMI between the 85<sup>th</sup> and 95<sup>th</sup> percentile for age (CDC, February 2009).

Overweight and obese children are at increased risk for developing many serious diseases that include cardiovascular diseases (CVD), type two diabetes mellitus (T2DM), sleep apnea, respiratory problems, and osteoarthritis (CDC, 2009). Neovius and colleagues (2009) found that being overweight as an adolescent was as hazardous to life expectancy as smoking. Children who are overweight or obese face serious medical problems during both childhood and later in adulthood.

Numerous studies have provided strong evidence that a higher body weight during childhood can lead to an adult that also has a higher body weight. A well recognized study by Serdula and colleagues (1993) found that obese children were eighty-percent more likely to become obese adults. Magarey and colleagues (2003) determined that the BMI-for-age of a six year old was a strong predictor and positively associated with BMI later in life. This is in keeping with Johannsson's (2006) study that found overweight children at age nine years were much more likely (OR 18.6) to be overweight at age fifteen years compared to their normal weight peers. Laitinen and colleagues (2001) found that fifty-six-percent of overweight boys and forty-two-percent of overweight girls became overweight adults, and twenty-four-percent of overweight boys and twenty-two-percent of overweight girls became obese adults. Among obese

youth, forty-one-percent of boys and twenty-seven-percent of girls became overweight adults and forty-seven-percent of boys and fifty-five-percent of girls became obese adults. Thus, overweight children and adolescents are at increased risk of remaining overweight as they age.

Because excess adiposity has been shown to track from childhood into adulthood, overweight and obese children also have an increased risk for developing CVD in later life. A study of five to seventeen year olds found that fifty-eight-percent of overweight schoolchildren had at least one additional risk factor related to CVD (Freedman, 1999), including high cholesterol, high blood pressure, physical inactivity, smoking, and being overweight or obese (American Heart Association [AHA], 2009). These risk factors are often the result of poor dietary habits such as high intakes of dietary fat, cholesterol, sodium, and less than adequate intakes of fiber from fruit and vegetable and whole grains (Wang, 2004).

An additional risk factor for developing CVD is having obstructive sleep apnea (OSA) (Tauman, 2006). OSA and obesity-related hypoventilation may contribute to pulmonary arterial hypertension (Speiser, 2005). The increase in OSA among children parallels the rise in childhood obesity rates. Redline and colleagues (1999) examined the risk factors for sleep disordered breathing in children two to eighteen years, and found that the risk for developing OSA among obese children was increased four to five fold. The same study found that for every increment in BMI beyond the mean BMI for age and gender, the risk of OSA increased by twelve-percent (Redline, 1999).

In addition to OSA, a host of other respiratory problems accompany obesity. It is thought that obesity may have a direct effect on the mechanical behavior of the

respiratory system by altering compliance or elastic recoil, resulting in reduced effective lung volume, airway caliber, or respirator muscle strength (Schachter, 2003). A cross-sectional controlled study that conducted respiratory function tests and airway hyper-responsiveness was done with thirty-eight obese patients nine to fifteen years, and thirty normal weight children. The findings indicated that basal respiratory function test parameters were lower in obese children compared to normal weight children, and there was a strong negative correlation between BMI and respiratory function (Ulger, 2006).

Furthermore, there has been a significant rise in type two diabetes mellitus (T2DM) among children. A retrospective diabetes clinic-based study revealed that the incidence of T2DM among children and adolescents ( $\leq 19$  years of age) increased ten-fold between 1982 and 1994 (Pinhas-Hamiel, 1996). T2DM was previously considered adult on-set diabetes, but in recent years T2DM is responsible for up to about one-fifth of new diagnoses of diabetes in pubertal children (Speiser, 2005). There is a strong association between overweight and obesity and T2DM. Obesity decreases the sensitivity of insulin sensitive tissues in the pancreas, muscle, and adipose tissue (Hannon, 2005). To compensate, the Beta cells in the pancreas secrete more insulin. Eventually the Beta cells fail, resulting in insufficient insulin secretion, and clinical T2DM prevails (Hannon 2005).

Childhood obesity has also been linked to low bone mass and low bone area development, predisposing obese children to osteoarthritis later in life (Goulding, 2000). Goulding and colleagues (2000) found the values for age-adjusted total body bone mineral content and bone area relative to body weight were each lower than predicted values, in both overweight and obese children (2.5-10.1% less,  $P < 0.05$ ) compared to



children of lower adiposity. This could be due to a low intake of calcium rich foods (Cashman, 2002).

In addition to physical conditions, obese children are likely to suffer from psychological problems. Because personalities develop during childhood, children who are overweight or obese may suffer from greater social-emotional problems than when excess adiposity first occurs during adulthood (Williams, 2007). In a controlled study of clinical and nonclinical samples of obese and non-obese children age nine to twelve, Braet and colleagues (1997) found that obesity may impede the development of a satisfying self-image and social status, thereby impairing psychological development. Obese children were often victims of ridicule and rejection by their peers, superiors, and sometimes even adults. This results in a negative self-image, low self-esteem, and sometimes serious psychological illness, resulting in a lower quality of life. Since lifelong dietary and activity behaviors are formed during childhood (Birch, 2008) and impact health status, it is important for nutrition and health educators to examine and understand the factors contributing to these behaviors.

### **Contributing Factors to Major Health Conditions**

While the underlying cause of obesity and related health concerns is an imbalance between energy intake and expenditure, the contributing factors are complex and multifaceted. Lifestyle and behavior choices significantly influence obesity and related conditions. Research shows that the diets of U.S. children do not meet the current national dietary recommendations resulting in low consumption of calcium, potassium, fiber, magnesium, and vitamin E (Gleason, 2001; *USDHHS & USDA [United States Department of Health and Human Services & United States Department of Agriculture]*,

2005). Furthermore, children are most likely to consume higher than recommended amounts of fat, sugar, and sodium (Gleason, 2001). These poor dietary patterns, characterized by low consumption of nutrient-dense foods, such as fruits and vegetables, whole grains, and dairy foods, and high intakes of low-nutrient, energy-dense foods high in fat and added sugars (Story, 2002) coupled with low levels of physical activity help to explain the energy imbalance leading to the poor health status of many children.

Insufficient Intake of Nutrient-Dense Foods: Children are not meeting the recommended amount of fruits and vegetables (Guenther, 2006; USDHHS & USDA, 2005). A study by Guenther, which estimated the percent of the population meeting the 2005 Dietary Guidelines for Americans, found that only one in four children nine to eighteen years meet the dietary recommendations of five or more servings of fruits and vegetables per day. Moreover, the study found that the majority of vegetables consumed were starchy vegetables and children were not meeting the recommendations for dark-green leafy vegetables, orange vegetables, or legumes (Guenther, 2006). The 2005 Behavioral Risk Factor Surveillance System (BRFSS) ranked Oklahoma 50<sup>th</sup> in the nation for consumption of fruits and vegetables (CDC, 2009). This is detrimental to the health of children as a large body of evidence supports that fruits and vegetables aid with weight loss and help maintenance of a healthy body weight (Rolls, 2004), prevent CVD (Hu, 2003), and reduce the risk of cancer (Riboli, 2003). In part it is thought that the fiber available in fruit and vegetables increases satiety; thus helping with weight loss and maintenance (Pereira, 2001; Rolls, 2004), reduces cholesterol, preventing cardiovascular disease (Dauchet, 2006; Flight, 2006), and helps maintain a healthy gastrointestinal track, preventing some types of cancer (Flight, 2006; Riboli, 2003).

As with fruits and vegetables, most children in the United States currently do not meet the recommended intake of calcium-rich foods. A study by Kranz and colleagues (2007) measured dairy and calcium intakes in nine through thirteen year olds, and found children were consuming significantly less than the recommended three servings per day ( $P = <.001$ ) of dairy foods. Calcium-rich foods have been proven as a key component in achieving and maintaining peak bone mass and density, reducing the risk of fractures and preventing osteoporosis later in life (Greer, 2006). It is especially important that children and adolescents consume adequate amounts of calcium-rich foods as their bones grow and develop. In addition to bone health, research indicates that a low intake of dairy and calcium-rich foods may be associated with increased adiposity among children (ADA Evidence Library, 2009). In a study of preschool children, higher longitudinal mean calcium (mg/day) intakes and more daily servings of dairy products were associated with lower body fat (Carruth, 2001). While the mechanism of how low-fat dairy foods support healthy weight has not yet been identified, the consumption of low-fat dairy foods seems to be inversely related with consumption of sugar-sweetened beverages, discussed below in excessive consumption of energy-dense foods.

Current research indicates that children are not meeting current recommendations for whole grain consumption, which is also a risk factor linked to the development of CVD (Ventura, 2008; Harnack, 2003). Harnack and colleagues (2003) found that most adolescents ate only one serving of whole grain per day, compared to the Dietary Guidelines recommendation of at least three servings for ages nine and older (USDHHS & USDA for Americans, 2005). Ventura and colleagues (2008) found that children's dietary fiber intake from fruits, vegetables, and whole grains was inversely related to

waist circumference, and fiber intake was higher in children who had zero risk factors for developing metabolic syndrome.

An additional contributing factor to the poor health of children is linked to inadequate breakfast consumption. Population-based surveys have revealed that skipping breakfast has increased in recent years (Boutelle, 2002). Common reasons cited by children and adolescents for skipping breakfast include not having enough time in the morning to eat, not hungry or do not feel like eating, or would rather sleep (Sweeney, 2005; Neumark-Sztainer, 1999). The skipped meal is of concern because breakfast not only supports good health but is also associated with higher academic performance. Much evidence supports that skipping breakfast is associated with overweight in childhood and adolescents. Gleason and colleagues (2009) found that overweight children and adolescents were more likely to skip breakfast than their leaner counterparts. Moreover, Rampersaud (2005) found that students who skipped breakfast were not meeting the daily dietary recommendations of nutrient-dense foods, especially low-fat dairy foods and whole grains. He also found evidence that eating breakfast improved cognitive function, test scores, and school attendance amongst children (Rampersaud, 2005).

Excessive Consumption of Energy-Dense Foods: Increased snacking and exaggerated portion sizes of sugar-sweetened beverages and fast foods are recent phenomena that contribute to overconsumption of energy. A study by Briefel and colleagues (2009) found that children consume more than five-hundred calories a day from low-nutrient, energy-dense foods. This indicates the lack of dietary quality in the diets of children. Evidence suggest as the number of eating occasions increase, so does daily energy intake

and percentage of energy from sugars, total carbohydrates, and sodium (Dwyer, 2001). Sebastian and colleagues (2007) found the foods children typically select for snacks contribute thirty-five-percent of the total discretionary calorie intake, and forty-three-percent of the total added sugar intake. They also found that fruit intake increased significantly with snacking frequency. As such snacking could help children meet dietary recommendations if they made more healthful food decisions when choosing snacks.

The increase of portion sizes over the past thirty years also parallels the dramatic increase in the prevalence of obesity. The portion sizes of foods in the U.S. today range from two times up to eight times more than the standard serving size defined by the USDA (Young, 2003). These large portion sizes have become so typical that both adults and children have difficulty recognizing the appropriate amount of food for their weight and activity level (Young, 1998). However, it has been shown that educational programs that taught children how to read and understand the Nutrition Facts label may increase behavior change. Using a pre/post evaluation method, Hawthorne et al. (2006) evaluated students understanding of the Nutrition Facts label before and after an education intervention. The students' scores significantly improved ( $P < 0.0001$ ) after the education intervention, thus indicating the students had a greater behavioral capability to make better food choices after the intervention (Hawthorne, 2006).

An additional contributing factor to the poor health conditions of today's children may lie within the excess intake of sugar-sweetened beverages. Overall the mean energy intake for all Americans age two and older has increased by 150 to 300 calories per day during the past twenty to thirty years, and approximately fifty-percent of this increase is

attributed to the consumption of sugar-sweetened beverages (Popkin, 2006). Briefel and colleagues (2009) found that overall sixty-eight-percent of all school children consumed sugar-sweetened beverages daily. In 1999 to 2004, U.S. youth consumed a mean of 224 calories per capita per day from sugar-sweetened beverages, representing eleven-percent of their daily energy intake (Wang, 2008). It is logical that the increased calorie consumption is contributing to the increased rates in obesity. Ludwig and colleagues (2001) found that for each additional serving of sugar-sweetened drink consumed BMI ( $P= 0.03$ ) and frequency of obesity ( $P= 0.02$ ) increased after adjustment for anthropometric, demographic, dietary, and lifestyle variables. There also is evidence that supports an inverse relationship between sugar-sweetened beverage and milk consumption. A study by Blum and colleagues (2005) found an inverse relationship between milk consumption and sugar-sweetened beverages for overweight ( $r = -0.63$ , %,  $p < 0.05$ ) and subjects who gained weight ( $r = -0.94$ , %  $p < 0.05$ ). Blum (2005) found that milk consumption among elementary school children significantly decreased from ~19.5 to 16 oz/d. Lytle and colleagues (2000) reported as children moved from third to fifth grade milk consumption decreased from sixty-nine-percent to sixty-four-percent while soda consumption rose from seven-percent to eleven-percent of total beverages consumed. The replacement of milk by sugar-sweetened beverages is concerning because of the subsequent lower intake of nutrients such as calcium (Troiano, 2000).

There is some association between fast-food consumption and adiposity, as well as poor dietary quality among children. Because fast foods are highly processed, they frequently have high amounts of fat and added sugars. In a national household survey of 6,212 children, Bowman and colleagues (2004) found children who ate fast food,

compared with those who did not, consumed more total energy (187 kcal; 95% confidence interval [CI]: 109–265), more energy per gram of food (0.29 kcal/g; 95% CI: 0.25–0.33), more total fat (9 g; 95% CI: 5.0–13.0), more total carbohydrate (24 g; 95% CI: 12.6–35.4), more added sugars (26 g; 95% CI: 18.2–34.6), more sugar-sweetened beverages (228 g; 95% CI: 184–272), less fiber (–1.1 g; 95% CI: –1.8 to –0.4), less milk (–65 g; 95% CI: –95 to –30), and fewer fruits and non-starchy vegetables (–45 g; 95% CI: –58.6 to –31.4). Similar data was obtained in a cross-sectional study of 17,370 adults and children (Paeratakul, 2003). Fast-food use was reported by thirty-seven-percent of the adults and forty-two-percent of the children. Adults and children who reported eating fast food had higher intakes of energy, fat, saturated fat, sodium, carbonated soft drink, and lower intakes of vitamins A and C, milk, fruits and vegetables than those who did not report eating fast food ( $P < 0.001$ ) (Paeratakul, 2003).

Low Levels of Physical Activity: There are undeniable health benefits associated with a physically active lifestyle in children, including weight control, lower blood pressure, improved psychological well-being, and a predisposition to increased physical activity in adulthood. Increased physical activity has been associated with an increased life expectancy and decreased risk of cardiovascular disease (Williams, 2002). However, the majority of U.S. children are not meeting the 2005 Dietary Guideline recommendations of sixty minutes or more of moderate to intense physical activity five or more days per week (USDHHS & USDA, 2005; CDC, 2009). The 2007 YRBSS found that only thirty-five-percent of adolescents in grades nine to twelve met the recommendation of sixty minutes or more of physical activity five or more days per week (CDC YBRSS, 2008). According to the 2005 Behavioral Risk Factor Surveillance System, Oklahoma is ranked

46<sup>th</sup> in the nation for lack of exercise (CDC, 2009). This could partially be due to the decrease in physical education (PE) in schools.

The CDC analyzed data from the national YRBSS and found that the proportion of students attending PE class daily declined significantly from 1991 to 1995 and did not change from 1995 to 2003. Prior to the 2009 school year, Oklahoma schools were only requiring sixty minutes of PE each week or exercise in addition to time spent in recess for children in full day kindergarten through fifth grade. However, beginning with the 2009 school year, Oklahoma Senate Bill 1186 mandated the Oklahoma State Board of Education to require an additional sixty minutes of PE, exercise programs, fitness breaks, recess, classroom activities, and wellness and nutrition education each week (Oklahoma State Department of Education [OSDE], 2008). Creating a more active school environment should help children establish a more physically active lifestyle and contribute to achievement of an energy balance.

Although more time for physical activity is being created in schools, it is an uphill battle to get children to become more physically active. On average, children spent four hours per day in front of the TV or computer (Wang, 2004). Average weeknight viewing for children between ages five and fifteen years was associated with higher body-mass indices, lower cardio respiratory fitness, increased cigarette smoking, and raised serum cholesterol (Hancox, 2004). The 2007 YRBSS data showed that twenty-five-percent of responding youth watched three or more hours of TV per day, and thirty-five-percent spent three or more hours at the computer per day (CDC, 2008). This high amount of sedentary time is thought to be an important contributing factor to childhood overweight. Research also shows that watching TV is associated with increased calorie consumption.



Wiecha and colleagues (2006) found that for every hour of TV viewed children consumed an additional 167 calories per day (95% CI, 136-198 kcal/d;  $p < .001$ ). This could be associated with “mindlessly” eating while watching TV (Coon, 2001), and the influence of advertising by the food industry (Story, 2004).

Because many of the contributing factors leading to insufficient dietary and activity behaviors that result in poor health consequences develop during childhood, it seems logical that interventions to reverse the trends should focus on prevention rather than treatment. Previous studies have shown that theory-based behavior interventions are useful in explaining and addressing health-related behavior determinants and therefore tend to result in positive outcomes.

### **Behavior Change and Cognitive Development**

Social Cognitive Theory: There are numerous theories that have been used to describe behavior and behavior change. Social cognitive theory (SCT) is one of the leading models used for understanding and impacting health behaviors. This is because SCT provides a unified, conceptual framework for understanding the personal, behavioral, and environmental factors that influence health behavior. SCT proposes that personal, behavioral, and environmental factors are reciprocally influential in determining behavior and behavior change (Bandura, 1986). Thus, if one factor of the theory changes the other factors will also be influenced; such as, a change in personal factors will influence change in behavioral factors, and changes in environmental factors.

The personal factors involve one’s attitudes and beliefs, and are often guided by outcome expectations and self-efficacy. Outcome expectations are the values we place on outcomes, also called incentives by Bandura (1986). Self-efficacy is the confidence

that an individual has to carry out the out the intended behavior successfully and deal with the barriers that arise along the way (Bandura, 2000). Research has shown that self-efficacy is especially important in the initiation, modification, and maintenance of complex behaviors such as healthful eating and physical activity (Contento 2007, Anderson, 2007). Self-efficacy can be strengthened by gaining knowledge, skills, observing peer modeling, and receiving social encouragement (Bandura, 2000).

The Knowledge, Attitudes and Beliefs (KAB) theory is very similar to the personal factor of SCT. The KAB model identifies knowledge as the primary motivator to attitude and behavior change. This model proposes that as people acquire knowledge, their attitudes change, and changes in attitudes lead to changes in behavior (Contento 2007). It is thought that scientific-based information that explains “why-to” make a particular change in behavior, may be more motivating than simply explaining “how-to” make a behavior change (Contento, 2007). That is because it provides a reason; such as, eat more calcium-rich food to develop stronger bones which is important for growth and physical activity, two factors important to children.

As part of the reciprocal influence, SCT suggests that knowledge and skills influence the behavior factor of an individual (Bandura 1986). Knowledge could be gained by learning both factual and procedural knowledge. An example of factual knowledge is, knowing calcium rich foods help build strong bones. Procedural knowledge is, understanding how to use the Nutrition Facts label to select calcium rich foods. Combined they increase behavioral capabilities and self-efficacy, thus leading to a behavior change.

Environmental factors are external to the individual and include both the physical and social environment (Bandura 1986). SCT describes the environment as taking three different forms: imposed, selected, and created (Bandura, 1997). The imposed environment is often difficult for an individual to control. An example is the availability of fruits and vegetables in the home or school environment, in that if fruits and vegetables are not available, then children are not able to choose them at meals or snacks. In contrast, selected environments can be controlled by an individual depending on how they respond to the environmental situation. For instance, if the family decides to eat at a fast food restaurant, the child can respond to the situation using their knowledge and skills and select healthier options from the menu, like milk instead of soda. The created environment is formed by the individual based on how they influence their environment. An example of this would be if a child requested that their parent buy more fruits and vegetables.

Cognitive Abilities of School-Age Children: The SCT is an appropriate approach to behavior change interventions targeting school-aged children, especially those who are in the fourth through sixth grade (Brown, 2005). At this age children are becoming “concrete thinkers” in that they can focus on several aspects of a situation and have more rational cause-effect reasoning (Brown, 2005). As such, they can use their knowledge from previous experiences to identify options and make a choice based on desired outcomes. These learning experiences help to build self-efficacy (Brown, 2005). They are also becoming increasingly independent in that they are developing an identity separate from the family and building strong relationships with peers. In short, their selected environment is expanding. As a result, school-age children, compared with

younger children, have more access to food outside of the home and more control over their own eating habits (Dwyer, 2001). Therefore, it is important to equip this age group with accurate nutrition information and skills so that when placed in a selected environmental situation, they have both the motivation and capability to make health-promoting food choices.

### **Nutrition Education Interventions**

Providing nutrition education to school-age children is an effective way to influence health-promoting behaviors (ADA, 2009). Children spend a majority of their waking hours in the school environment. Since they eat one to two of their meals at school, have the opportunity, or not, to participate in physical activity, and are in an educational environment where they can learn about and practice healthy behaviors, schools present an excellent opportunity to help children form dietary and physical activity behaviors that will remain with them through adulthood. Research has indicated that school-based nutrition education interventions that combine healthful eating and physical activity may provide the best opportunity to improve health and thus prevent children from developing chronic diseases later in life (Flodmark, 2006). Many of these studies and interventions are theory based and include SCT (Baranowski, 1999).

The Smart Bodies school wellness program was a twelve-week intervention program that included an interactive wellness exhibit and classroom curriculum. It was based on the constructs of SCT, building upon the idea that individuals are influenced by their social environment. The Smart Bodies curriculum encouraged change in the social environment around the child while providing information about the health benefits of eating fruits and vegetables. Children who participated in the program showed greater

nutrition knowledge and exhibited more confidence that they would consume the recommended number of fruits and vegetables per day when compared to a control group (Tuuri, et.al, 2009). Children in the intervention reported a greater increase from pre-to post-test in nutrition knowledge ( $F_{(1, 553)} = 6.99, P < 0.01$ ); and increased self-efficacy to consume fruit, drink juice, eat fruit instead of dessert/cookies/candy, and consume the recommended number of fruits and vegetables each day (Factor 1;  $F_{(1, 417)} = 14.36, P < 0.01$ ) (Turri, et al, 2009).

The Coordinated Approach to Child Health (CATCH), originally called the Child and Adolescent Trial for Cardiovascular Health (CATCH), is a well recognized series of studies that demonstrated a positive effect on dietary behavior can be achieved in school based interventions (Lytle, 1996; Nader, 1999). The intervention was based on SCT and included both school and individual-level interventions strategies. CATCH targeted children in third through fifth grades. It included a classroom curriculum, a physical education curriculum, a school foodservice program, a complementary family component, and tobacco-free school policy recommendations (Luepker, 1996). In both the initial results and in the three-year follow-up, students' self-reported daily energy intake from fat was significantly lower among the intervention group compared to the control group (Lytle 1996; Nader, 1999). The CATCH three year follow-up study indicated that the self-reported dietary and physical activity behavioral changes initiated during elementary school continued through early adolescents without further intervention (Nader, 1999).

## **Summary**

The health of Oklahoma children is poor, as evidenced by increased rates of obesity, CVD, T2DM, respiratory problems, and osteoarthritis. There are numerous contributing behaviors linked to these major health conditions, including insufficient consumption of nutrient-dense foods, excessive consumption of energy-dense foods, and low levels of physical activity. According to SCT, these behaviors are reciprocally influenced by both personal and environmental factors surrounding a child. It is also well understood that the behaviors established during childhood often continue into adulthood, impacting health later in life. Fortunately, research has shown that theory-based nutrition education interventions can be successful at improving the dietary behaviors of children.

## CHAPTER III

### METHODOLOGY

The evaluation utilized a repeated measures, case-control design using the existing HOY program pre/post questionnaire to measure changes in frequency of food and physical activity behaviors. To evaluate the added impact of the *Farm to You* exhibit a second post evaluation was conducted one to two weeks after the students participated in the exhibit, using the same HOY questionnaire. The questionnaire is available in Appendix A.

Both the control and intervention classrooms of fourth and fifth grade students were a convenience sample selected by seven Oklahoma Cooperative Extension Service (OCES) county educators who agreed to help with the project. Students in fourth through sixth grade were chosen to be evaluated due to their level of cognitive ability to make healthy food choices (Brown et.al, 2005). Students enrolled in control schools completed the pre HOY questionnaire, were taught the HOY lesson series and completed the post one questionnaire. The intervention sites received the same treatment in addition to participating in the *Farm to You* exhibit. A second post HOY questionnaire (referred to as post two) was administered one to two weeks after the exhibit experience. To minimize variability in teaching styles the same OCES county educator taught the HOY nutrition lesson series in both the control and an intervention classroom.

Programming was conducted and data was collected in Oklahoma schools from January 2009 through May 2009. Data were collected at two control schools (approximately 124 students), and three intervention schools (approximately 212 students). One control and one intervention school was located in an urban population, and one control and two intervention schools were located in a rural area, as defined by the U.S. Census Bureau (2008). The evaluation protocol of the HOY educational program and *Farm to You* exhibit was approved by the Oklahoma State University Institutional Review Board as non-human/non-research. A copy of the IRB approval is included in Appendix B.

### **Description of Intervention**

The *Farm to You* program was based on the constructs of SCT and builds upon the concept that increasing nutritional awareness and knowledge in a manner that develops valued outcomes expectancies will result in desired dietary behavior changes. To address the environmental component of SCT, both programs utilize parent newsletters to support parents/caregivers in creating selective environments within the home enabling students to make healthy food choices. The *Farm to You* exhibit can also serve as a way to increase community awareness of the importance of teaching children healthy dietary behaviors. In addition, *Farm to You* provides clings with symbols of each of the five food groups for the school cafeteria. The clings reinforce cognitive learning by identifying healthy food choices within the school cafeteria, thus providing another selective environment in which students can take responsibility for making healthy choices. An example of the cafeteria clings is available in Appendix C.



The exhibit is a 40' x 40' enclosed walk-through structure with nine stations. The floor plan is shown in Appendix D. At each station students participated in age appropriate activities and learned about the relationship between agriculture, food and health. To insure consistent messages were delivered to students, community or school volunteers used a written script to present an approximate six minute combined message and activity related to the specific station. Two sets of similar scripts were developed to insure age appropriateness of the message and activity, with one set designed for first through third grade students and the second designed for fourth through sixth grade students.

Students were divided into small groups of six to eight students to progress through the exhibit. The exhibit began at the *Cheeseburger Farm* where students learned that farms provide foods that are important to their health. Students matched the different food ingredients in the cheeseburger to the farm animal or plant from which the food ingredient originated. They also matched each component of the cheeseburger with the appropriate MyPyramid food group. Then each student received one of five “food group” stickers to represent transportation of food from the farm to the market. Examples of the food group stickers are available in Appendix C. At *The Market*, students followed the path of milk from the farm to the store. Students in grades first through third learned about the processing and packaging of food while students in grades fourth through sixth learned to use food label information to make food choices. Station three, the *Healthy Cool Café*, demonstrated that school cafeterias offer a variety of foods from each of the food groups and it is the student’s personal responsibility to make healthful food choices. To reinforce the message, students selected foods for a

lunch meal and evaluated it using the MyPyramid (MyPyramid, 2009) food groups and food color as criteria. Then at *The Mouth*, students observed the consequences of poor dental hygiene and learned the importance of keeping a healthy mouth so they can eat food. The fifth station was *The Stomach*, where students used their previous experience with balloons to better understand fullness and hunger cues, which is essential in regulating food intake. Students also used illustrations of MyPyramid and a caricature of the human body, showing muscles, bones, and skin, to investigate the stomach's role in the digestive system where foods are digested into nutrients. The sixth station was *The Small Intestines* where students walked through a short maze under "villi" suspended from the ceiling. They participated in scientific inquiry by predicting what happens when a paper towel is dipped into water and observed a demonstration of the same. The purpose of which was to illustrate how villi absorb nutrients into the blood so that they can be transported to other parts of the body. They also learned the left over fiber from plant foods is important to intestinal health. In *The Muscle* station, students used resistant exercise bands to engage in strength and flexibility exercises and discussed the role of protein-rich foods in growing muscle tissue and carbohydrate-rich foods in providing the muscle with energy. At the eighth station, *The Bone*, students learned the importance of dairy foods and exercise to help build strong bones. They found a bone filled with holes and helped repair it with calcium-rich foods. The final station was *The Skin*. Students learned that frequent hand washing is important to good health. They used Glo-Germ gel (Glo-Germ, Moab, Utah) to experience how germs are spread, and learned how to protect their skin from excessive sun exposure, cuts, scrapes and bruises. They also learned that

the vitamins and minerals in food help the skin heal from scratches, bruises, cuts, and burns.

### **Description of Questionnaire**

The pre, post one, and post two evaluation questionnaires were identical and consisted of ten items assessing the frequency of nutrition and physical activity behaviors using a five-point Likert response scale, where five = every day/Always and one = never. The ten behavior items included: *I eat whole grain breads and cereals, I eat fruits and vegetables, I drink milk or eat cheese or yogurt, I eat low-fat meats, I am physically active 60 minutes, I eat foods from 2 or 3 of the MyPyramid food groups for breakfast, I snack only when I am hungry, I use the Nutrition Facts label to make food and beverage choices, when I eat high fat food I eat small amounts, when I drink sugar-sweetened beverages I drink small amounts.* The questionnaire was adopted and modified from an Oklahoma Cooperative Extension pre/post questionnaire previously tested for reliability with children in third through fifth grade,  $r = 0.94$  (Brown & Hermann, 2004). The pre/post evaluation used for this evaluation study was tested for reliability among thirty-nine fourth through sixth graders, resulting in a reliability correlation of  $r = 0.80$ . To assure confidentiality, the questionnaire only required the students' initials and grade for the purpose of matching each student's pre and post surveys. The OCES educators distributed and collected the questionnaires, then matched them and mailed them to the PI for data analysis. Surveys that were not matched with a pre/post1 or a pre/post one/post two were not included in the data analysis. To ensure that the students understood each question on the evaluation correctly an evaluation

protocol was developed for the OCES educator to read to the students while they filled out the evaluation. The evaluation protocol is available in Appendix E.

### **Statistical Analysis**

Data were analyzed using the Statistical Program for Social Sciences (SPSS) version 17.0 for Windows (SPSS Inc, Chicago IL, 2009). A frequency analysis was conducted to analyze the data for any abnormal values or entry errors. Descriptive statistics were used to describe the demographic characteristics of the control and intervention groups. A repeated measure t-test was used to evaluate differences in pre and post questionnaire items among the control group and among the intervention group. New variables revealing the level (or amount) of behavior change for each questionnaire item were calculated by subtracting pre scores from post one scores for the control group and pre scores from post two scores for the intervention group. Frequencies were run to identify the percent of students within each group who reported a positive behavior change for each questionnaire item. Analysis of variance (ANOVA) was used to identify significant differences in the amount of behavior change between students who experienced the *Farm to You* exhibit and those that did not. The significance level for all analyses was set at  $P < 0.05$ .

## CHAPTER IV

### FINDINGS

Seven OCES educators were recruited to teach the HOY lesson series at a control school as well as teach the lesson series and coordinate the *Farm to You* exhibit at the intervention school sites. Of these, the evaluation was successfully completed in two control sites and three intervention sites. Various situations preventing evaluation completion at the remaining schools included unforeseen scheduling conflicts related in part to the overwhelming demand for the exhibit and irreconcilable cancellations of the exhibit due to school site personnel issues.

#### **Demographics**

Demographic characteristics of the control and intervention groups are summarized in Table 1 (page 32). Of the 101 students in the control group, fifty-one-percent (n = 52) were males and forty-nine-percent (n = 49) were females. All of the students were in the fourth grade. In the intervention group there were a total of 181 students, with forty-one-percent males (n = 74) and fifty-nine-percent females (n = 107), approximately two-thirds (n = 113) were fourth grade students and one-third (n = 68) were fifth grade students. Control and intervention data were collected in both rural and urban areas as defined by the U.S. Census Bureau (2008). Sixty-six-percent (n = 67) of the students in the control group lived in rural areas of the state, and thirty-four-percent (n = 34) lived in urban areas. These percentages of rural and urban participation were

the same in the intervention group (n = 120, n = 61 respectively).

**Table 1 Demographic Characteristics of Control and Intervention Groups**

| Demographic                 | Control<br>N = 101 |     | Intervention<br>N = 181 |     |
|-----------------------------|--------------------|-----|-------------------------|-----|
|                             | n                  | %   | n                       | %   |
| <b>Gender</b>               |                    |     |                         |     |
| Boy                         | 52                 | 51  | 74                      | 41  |
| Girl                        | 49                 | 49  | 107                     | 59  |
| Total                       | 101                | 100 | 181                     | 100 |
| <b>Grade</b>                |                    |     |                         |     |
| Fourth                      | 101                | 100 | 113                     | 62  |
| Fifth                       | 0                  | 0   | 68                      | 38  |
| Total                       | 101                | 100 | 181                     | 100 |
| <b>Residential Location</b> |                    |     |                         |     |
| Rural                       | 67                 | 66  | 120                     | 66  |
| Urban                       | 34                 | 34  | 61                      | 34  |
| Total                       | 101                | 100 | 181                     | 100 |

### **Behavior Change within Control Group**

A paired samples t-test was used to determine behavior changes within the control group measured before and after students received the HOY lesson series. These changes are reported in Table 2 (page 33). Students reported increased frequency of eight of the ten questionnaire items after completing the lesson series. Of the eight behaviors with an increase in mean from pre to post one, four were significantly different. These included how often they consumed fruits and vegetables ( $P = 0.021$ ), and how often they ate foods from two or three of the MyPyramid food groups for breakfast ( $P = 0.029$ ), how often they used the Nutrition Facts label to make food and beverage choices ( $P = 0.019$ ), and how often they chose a smaller serving when eating high fat foods ( $P = 0.033$ ).

**Table 2. Control Group (HOY lesson series): Average Means of Pre and Post Questionnaire Item Scores for Frequency of Performing Evaluated Behaviors**

| Questionnaire Item  | N   | Mean <sup>a</sup>     | P-Value <sup>b</sup> |
|---|-----|-----------------------|----------------------|
| I eat whole grains breads and cereals.                              | 101 | Pre 3.85<br>Post 3.93 | 0.482                |
| I eat fruits and vegetables.  | 101 | Pre 4.02<br>Post 4.26 | 0.021 <sup>b</sup>   |
| I drink milk or eat cheese or yogurt.                               | 100 | Pre 3.99<br>Post 4.02 | 0.798                |
| I eat low-fat meats.  | 96  | Pre 3.24<br>Post 3.17 | 0.607                |
| I am physically active 60 minutes.                                  | 101 | Pre 4.39<br>Post 4.39 | 1.00                 |
| I eat foods from 2 or 3 of the MyPyramid food groups for breakfast. | 99  | Pre 3.76<br>Post 4.04 | 0.029 <sup>b</sup>   |
| I snack only when I am hungry.                                      | 101 | Pre 3.80<br>Post 3.70 | 0.449                |
| I use the Nutrition Facts label to make food and beverage choices.  | 101 | Pre 2.92<br>Post 3.02 | 0.019 <sup>b</sup>   |
| When I eat high fat foods, I eat small amounts.                     | 100 | Pre 3.02<br>Post 3.32 | 0.033 <sup>b</sup>   |
| When I drink sugar-sweetened beverages, I drink small amounts.      | 101 | Pre 2.83<br>Post 3.06 | 0.146                |

<sup>a</sup>5 Point Likert Scale

1 = Never

2 = Almost Never

3 = Some Days/Sometimes

4 = Most Days/Almost Always

5 = Every Day/Always

<sup>b</sup>Mean difference significant at  $\alpha = 0.05$

### **Behavior Change within Intervention Group**

Within the intervention group (HOY lesson series plus the *Farm to You* exhibit) the paired samples t-test revealed higher means at post intervention compared to pre-intervention for eight of the ten evaluated behaviors. The statistical results are summarized in Table 3 (page 35). Of the eight behaviors with increased mean post two scores, six were significantly raised. Students reported a significant increase in the how

often they consumed whole grain breads and cereals ( $P = 0.001$ ), how often they ate fruits and vegetables ( $P = 0.002$ ), and how often they drank milk or ate cheese or yogurt ( $P = 0.031$ ). They also reported a significant increase in, how often they used the Nutrition Facts label to make food and beverage choices ( $P = 0.001$ ), how often they chose a smaller serving when eating high fat foods ( $P = 0.046$ ), and how often they chose a smaller amount when drinking sugar-sweetened beverages ( $P = 0.017$ ). For one behavior the statistical analysis revealed a significant decrease in mean from pre to post two evaluation, that being “I snack only when I’m hungry.”



**Table 3. Intervention Group (HOY lessons series plus *Farm to You* exhibit):  
Average Means of Pre and Post 2 Questionnaire Item Scores for Frequency  
of Performing Evaluated Behaviors**

| <b>Questionnaire Item</b>   | <b>N</b> | <b>Mean<sup>a</sup></b> | <b>P-Value<sup>b</sup></b> |
|---|----------|-------------------------|----------------------------|
| I eat whole grains breads and cereals.                              | 181      | Pre 3.56<br>Post 4.04   | 0.001 <sup>b</sup>         |
| I eat fruits and vegetables.  | 181      | Pre 3.83<br>Post 4.00   | 0.002 <sup>b</sup>         |
| I drink milk or eat cheese or yogurt.                               | 181      | Pre 3.92<br>Post 4.11   | 0.031 <sup>b</sup>         |
| I eat low-fat meats.  | 179      | Pre 3.11<br>Post 3.00   | 0.268                      |
| I am physically active 60 minutes.                                  | 179      | Pre 4.40<br>Post 4.41   | 0.830                      |
| I eat foods from 2 or 3 of the MyPyramid food groups for breakfast. | 179      | Pre 3.89<br>Post 3.98   | 0.367                      |
| I snack only when I am hungry.                                      | 177      | Pre 3.91<br>Post 3.71   | 0.037 <sup>b</sup>         |
| I use the Nutrition Facts label to make food and beverage choices.  | 177      | Pre 2.43<br>Post 2.99   | 0.001 <sup>b</sup>         |
| When I eat high fat foods, I eat small amounts,                     | 177      | Pre 3.08<br>Post 3.31   | 0.046 <sup>b</sup>         |
| When I drink sugar-sweetened beverages, I drink small amounts.      | 179      | Pre 2.71<br>Post 3.02   | 0.017 <sup>b</sup>         |

<sup>a</sup>5 Point Likert Scale

1 = Never

2 = Almost Never

3 = Some Days/Sometimes

4 = Most Days/Almost Always

5 = Every Day/Always

<sup>b</sup>Mean difference significant at  $\alpha = 0.05$

### **Comparisons of Behavior Change between Control and Intervention Groups**

For seven of the ten questionnaire items, the frequencies analysis identified a greater percent of students in the intervention group reporting increased frequency for performing the evaluated behaviors when compared to the control group. This data is summarized in Table 4 (page 37). In the intervention group forty-six-percent of students reported an increase in how often they ate whole grain breads and cereals from the pre

questionnaire to the post two questionnaire, compared to thirty-four-percent of students in the control group. A greater number of students in the intervention group also reported an increase in how often they ate fruits and vegetables, thirty-five-percent compared to thirty-four-percent in the control group. A stately number of students in the intervention group increased how often they read the Nutrition Facts label, forty-seven-percent compared to thirty-seven-percent, and how often students choose dairy products, thirty-five-percent compared to twenty-four-percent. There were also a slightly greater number of intervention students compared to control students who reported an increase in how often they eat low fat meats, thirty-one-percent compared to twenty-seven-percent, how often they are physically active, twenty-six-percent compared to twenty-two-percent, and how often they drank smaller amounts when choosing sugar-sweetened beverages, forty-two-percent compared to thirty-eight-percent. While a larger percentage of students in the intervention group reported increased practice of seven of the evaluated behaviors compared to the control group, the analysis of variance of the mean level (or amount) of behavior change acquired by students in the intervention group was significantly different for only one item, that being increased consumption of whole grain breads and cereals. The data are summarized in Table 5, page 38.

**Table 4. Percentage of Students in Control and Intervention Groups Reporting Increased Frequency for Performing Evaluated Behaviors**

| <b>Questionnaire Item</b>   | <b>Control<sup>a</sup><br/>HOY lesson series</b> | <b>Intervention<sup>b</sup><br/>HOY lesson<br/>series plus <i>Farm<br/>to You</i></b> |
|---|--|---|
| I eat whole grains breads and cereals.                              | 34%  | 46%   |
| I eat fruits and vegetables.  | 35%  | 35%   |
| I drink milk or eat cheese or yogurt.                               | 29%  | 35%   |
| I eat low-fat meats.  | 22%  | 31%   |
| I am physically active 60 minutes.                                  | 23%  | 26%   |
| I eat foods from 2 or 3 of the MyPyramid food groups for breakfast. | 33%  | 33%   |
| I snack only when I am hungry.                                      | 23%  | 24%   |
| I use the Nutrition Facts label to make food and beverage choices.  | 38%  | 47%   |
| When I eat high fat foods, I eat small amounts.                     | 45%  | 37%   |
| When I drink sugar-sweetened beverages, I drink small amounts.      | 42%  | 42%   |

<sup>a</sup> Percent of students with positive score (1- 4) resulting from Post 1 questionnaire item score minus pre questionnaire item score.

<sup>b</sup> Percent of students with positive score (1- 4) resulting from Post 2 questionnaire item score minus pre questionnaire item score.

**Table 5. Mean Amount of Change for Control and Intervention Groups for each Evaluated Behavior**

| <b>Questionnaire Item</b>   | <b>Control<br/>HOY lesson<br/>series</b> | <b>Intervention<br/>HOY lesson series<br/>plus <i>Farm to You</i></b> | <b><i>P</i> Value <sup>a</sup></b> |
|---|--|---|------------------------------------|
| I eat whole grains breads and cereals.                              | 0.08 ± 1.13                              | 0.48 ± 0.97   | 0.002 <sup>a</sup>                 |
| I eat fruits and vegetables.  | 0.22 ± 1.14                              | 0.23 ± 0.98   | 0.95                               |
| I drink milk or eat cheese or yogurt.                               | 0.15 ± 1.02                              | 0.19 ± 1.20   | 0.76                               |
| I eat low-fat meats.  | -0.12 ± 1.29                             | -0.11 ± 1.34  | 0.95                               |
| I am physically active 60 minutes.                                  | 0.03 ± 1.31                              | 0.02 ± 1.04   | 0.93                               |
| I eat foods from 2 or 3 of the MyPyramid food groups for breakfast. | 0.08 ± 1.26                              | 0.08 ± 1.24   | 0.98                               |
| I snack only when I am hungry.                                      | -0.09 ± 1.30                             | -0.20 ± 1.28  | 0.49                               |
| I use the Nutrition Facts label to make food and beverage choices.  | 0.30 ± 1.28                              | 0.56 ± 1.70   | 0.18                               |
| When I eat high fat foods, I eat small amounts.                     | 0.47 ± 1.50                              | 0.22 ± 1.49   | 0.19                               |
| When I drink sugar-sweetened beverages,<br>I drink small amounts.   | 0.24 ± 1.42                              | 0.30 ± 1.70   | 0.73                               |

<sup>a</sup> Mean difference significant at  $\alpha = 0.05$

## CHAPTER V

### DISCUSSION AND CONCLUSION

The purpose of the study was to evaluate if the *Farm to You* exhibit was an effective nutrition education tool; specifically we determined if participation in the educational exhibit enhanced behavior change in fourth and fifth grade students beyond that seen after students participated in the Healthy Oklahoma Youth (HOY) nutrition curriculum program. Using the constructs of SCT and the KAB model, *Farm to You* aimed to increase knowledge and outcome expectancies associated with the relationship between food choices and health. The goal was to communicate the relationships between food and health in such a way that the new attitude/beliefs related to agriculture, food choices and health were of value to the students, thus creating motivation to positively change behavior (Bandura, 1986). Anticipated behavior changes included increased consumption of whole grain breads and cereals, fruits and vegetables, dairy products, and low-fat meats. Additional anticipated behavior changes included increased physical activity, and choosing foods from two or three of the MyPyramid food groups for breakfast. The *Farm to You* exhibit also aimed to intervene on children's dietary behaviors to snack only when hungry, use the Nutrition Facts label to make food and beverage choices, eat small amounts of high fat foods, and drink small amounts of sugar-sweetened beverages. Intervening on these behaviors will likely improve the current and future health of the students who participated in the study. This is imperative to reducing

the rate of overweight and obesity (Ogden, 2008) and other health related concerns, including T2DM, CVD, respiratory problems, and osteoarthritis, among children (OSDH, 2007).

### **Discussion**

The findings show that nutrition behaviors improved among students both in the control and intervention groups; however, students exposed to the lesson series plus the *Farm to You* exhibit reported a greater number of healthy dietary behaviors at post intervention compared to students who were only exposed to the HOY nutrition lesson series. Students in both groups reported significant increases in the frequency of consuming fruits and vegetables, using the Nutrition Facts label to make healthy food choices and eating smaller amounts of high fat foods. Students in the intervention group reported a positive and significant behavior change from pre to post intervention in three additional behaviors – increased frequency of consuming of whole grain breads and cereals, drinking milk or eating cheese and yogurt, and drinking smaller amounts when consuming sugar-sweetened beverages. Thus, the intervention was effective at increasing the number of healthy dietary behaviors reported by fourth and fifth grade students.

Based on the SCT, we posit that the findings are related to students' positive attitudes and outcome expectancies for the improved behaviors (Bandura, 1986). While these constructs were not implicitly measured, it seems logical that they were modified at some degree for each behavior where significant improvement was identified in the intervention group but not the control group. Through experiential learning the students participated in hands-on activities and were exposed to visual examples of the physiology related to food choices and health that were relevant to their age-specific health interests.

As such, they had a deeper understanding of why the various healthy behaviors are important, thus creating greater value in the outcome expectancies. For example, while students in the control group discussed consuming milk instead of sugar-sweetened beverages and identified the amount of calcium in various calcium-rich foods, students in the intervention group observed a “bone with holes” and participated in selecting calcium-rich foods to fill in the holes. In addition students observed a model of an osteoporotic bone compared to a healthy bone. While students in the control group gained knowledge of foods rich in calcium, they may not have fully understood why or how drinking milk gives them stronger bones. In contrast, students in the intervention group observed a weakened bone structure and related the fragility to limited growth and activity, both of which are important to this age group. In turn, the age relevant experience deepened understanding and improved attitudes and outcome expectancy of drinking milk, in turn improving their healthy behavior.

The KAB model described by Contento (2007) also supports change in behavior related to greater knowledge and understanding of “why-to” make a particular food choice or dietary change. As the students gained more knowledge about healthy behaviors their attitude was changed; leading to changes in behavior. “Why-to” knowledge is an important basis of motivation because it provides a reason why an individual should make a behavior change (Contento, 2007). As students gained more understanding of why they should eat more calcium rich foods, they made changes in their behavior.

The increase in healthy nutrition behaviors is similar to that seen in the evaluation of *Smart Bodies*, a randomized controlled, multi-component, school-based intervention

conducted in Louisiana, which concluded that students were more likely to make better nutrition choices after conclusion of the intervention. The *Smart Bodies* study reported students in the intervention group had greater nutrition knowledge and self-efficacy for consuming fruits and vegetables (Tuuri, 2009).

The frequency analysis used to determine the percentage of students in each group reporting an increase in the frequency of practicing the evaluated behaviors revealed a larger number of students performing six of the ten behaviors who were exposed to the *Farm to You* compared to the control group. The difference may be related to the dosage effect of participating in both the HOY lesson series and the exhibit. A study conducted by Hildebrand and Cragun (2008) found that an increased number of exposures led to increased behavior change among Community Nutrition Education Program (CNEP) participants. In that study significant change was measured after nine to twelve nutrition lessons. While the *Farm to You* participants were not exposed nine to twelve times to the nutrition messages, the intervention group received additional exposure above that seen by the control group. The phenomena of increased exposure may also help to explain the greater mean amount of change for frequency of consuming whole grain breads and cereals in the intervention group compared to the control group. In addition to the amount of exposure to whole grains both in the HOY lesson series and throughout the *Farm to You* exhibit, students receive numerous marketing messages related whole grain products on television advertisements and on food packaging.

Students exposed to the *Farm to You* intervention group appeared to be more aware of portions sizes and using the information to make healthier food decisions. Before the intervention students reported “Almost Never” (mean 2.71) consuming small



amounts when drinking sugar-sweetened beverages. After the intervention students reported “Sometimes” (mean 3.02) for consuming smaller amounts when drinking sugar-sweetened beverages. The result may also be supported by the fact that students in both the control and intervention groups reported a significant increase in the frequency of reading the Nutrition Facts labels when making food and beverage choices. This desirable practice would help inform students of portion sizes, and thus improve their behavioral capability for drinking smaller amounts of sugar-sweetened beverages. This is collaborated by a study conducted by Hawthorne and colleagues (2006) that found students’ understanding of the Nutrition Facts label significantly improved after completing an educational intervention. Another plausible explanation for the reported frequency of smaller sugar sweetened beverage servings is again related to the phenomena of repeated messages (Hildebrand, 2009) and the value placed in the outcome expectancy. In the mouth station students observed a model of decayed teeth and periodontal disease resulting from frequent consumption of foods high in sugar coupled with poor dental hygiene. The impact of soft-drinks instead of milk is also addressed in the bone station, where students experienced the soft drink cannot fit the hole in the bone. Most important, the prospect of students consuming smaller servings of sugar-sweetened beverages may lead to a decrease of approximately 224 calories a daily (Wang, 2008).

### **Limitations**

Some limitations to the study should be considered in the interpretation of findings. One limitation is that all the data was self-reported. This may have influenced the accuracy of the data; however a study by Lytle and colleagues (1998) found a moderate correlation between observed and recalled intakes among fourth grade students.

Also, the questionnaire used in this study was tested and found to be highly reliable ( $r=.80$ ).

Other limitations were found after examining the follow-up questionnaire from the OCES educators. Some educators reported not using the evaluation protocol that was developed to help maintain consistency in the way the questionnaire was explained to each group of students. It was also reported that in one of the intervention groups, one of the HOY lessons was not presented. This may have reduced the possible changes in behavior. In future research, it would be beneficial to the investigator to complete a one-on-one follow up with the educators that agree to help with the study to alleviate any confusion, avoid deviation from the study design, and prevent incompleteness of the evaluation.

### **Conclusions**

In conclusion, the *Farm to You* exhibit, when coupled with the HOY lesson series, resulted in fourth and fifth grade students practicing an increased number of the evaluated healthy behaviors. Such interactive exhibits may prove useful in increasing educational message exposures for future nutrition and health interventions.

### **Implications for Future Research**

Future research should be conducted to identify the level of self-efficacy and outcome expectancy in relationship to the self-reported behavior changes. This would help confirm that the personal factor of SCT was indeed the basis of behavior change. Further research could also measure if the behavior changes initiated during the intervention were sustained in the months following the intervention. Research from the CATCH study confirmed that the behavior changes initiated by the intervention were still

practiced by the participants at a three year follow-up study (Nader, 1999). While it is not expected that the exhibit alone without the lessons series would bring about changes in behavior, it would be valuable to ascertain, as the *Farm to You* exhibit is being used often with students who have not completed the HOY lesson series prior to seeing the intervention.

After process evaluation with the educators who assisted with this project, there are some recommendations for improvements to the wording of the questionnaire. It was determined that the question “I eat foods from 2 or 3 of the MyPyramid food groups for breakfast” was confusing to some of the students, especially when filling out the pre evaluation questionnaire, because they had not yet learned about MyPyramid. Students did, however, understand what the food groups were; thus it is recommended that MyPyramid be removed from the question. Additionally, students were confused about the meaning of low-fat meat. It is recommended that this question be removed from questionnaire because children of this age have little control over selecting and preparing meat products. The selection and preparation of meat is usually an imposed environmental factor, according to SCT (Bandura, 1997), determined by their parents. This is likely why no behavior change for “I eat low-fat meat” was observed in the control or intervention group. Furthermore, the *Healthy Cool Café* station in the exhibit could be modified to focus on breakfast as opposed to lunch. This would reinforce the *Break Fast with Breakfast* lesson in the HOY series, while still encouraging students to choose a variety of food from MyPyramid food groups.

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## APPENDICES

## Appendix A

### Healthy Oklahoma Youth Questionnaire



#### Youth Questionnaire

My initials are: \_\_\_\_ \_\_\_\_ \_\_\_\_

|  |  |                   |
|--|--|-------------------|
| <b>For OCES County Educator Use:</b><br>Please circle one: Pre   Post 1   Post 2 | I am a: <input type="checkbox"/> Boy <input type="checkbox"/> Girl | My grade is: ____ |
|--|--|-------------------|

**In the boxes below mark what you do:**

|   | Every Day     | Most Days            | Some Days        | Almost Never        | Never        |
|---|---------------|----------------------|------------------|---------------------|--------------|
| I eat whole grain breads and cereals.   |               |                      |                  |                     |              |
| I eat fruits and vegetables.  |               |                      |                  |                     |              |
| I drink milk or eat cheese or yogurt.   |               |                      |                  |                     |              |
| I eat low-fat meats.  |               |                      |                  |                     |              |
| I am physically active 60 minutes.<br>(walk, run, swim, bike, skate, active games, stretch, etc.) |               |                      |                  |                     |              |
| I eat foods from 2 or 3 of the MyPyramid food groups for breakfast.                               |               |                      |                  |                     |              |
|   | <b>Always</b> | <b>Almost Always</b> | <b>Sometimes</b> | <b>Almost Never</b> | <b>Never</b> |
| I snack only when I am hungry.  |               |                      |                  |                     |              |
| I use the nutrition facts label to make food and beverage choices.                                |               |                      |                  |                     |              |
| When I eat high fat foods, I eat small amounts.   |               |                      |                  |                     |              |
| When I drink sugar-sweetened beverages, I drink small amounts.                                    |               |                      |                  |                     |              |

Oklahoma Cooperative Extension Service offers its programs to all eligible persons regardless of race, color, national origin, religion, gender, age, disability or status as a Vietnam/era veteran and is an Equal Opportunity Employer. Revised 10/2008

## Appendix B

### Institutional Review Board Approval

Oklahoma State University Institutional Review Board  
**Request for Determination of Non-Human Subject or Non-Research**

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"?  
X No  Yes
- C. Does the study involve access to identifiable private information?  
X No  Yes
- D. Are data/specimens received by the Investigator with identifiable private information?  
X 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?  
X No  Yes  
If "Yes," is there a written agreement that prohibits the PI and his/her staff access to the link?  
 No  Yes

#### 6. Signatures

Signature of PI Ally J. Stover Date 11-25-08

Signature of Faculty Advisor Deana Hildebrand Date 11-25-08  
(If PI is a student)



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.**

Sheila Kennison  
Dr. Sheila Kennison, IRB Chair

12-1-08  
Date

## Appendix C

### Food Group Clings and Stickers





## Appendix E

### Protocol for the Healthy Oklahoma Youth (HOY) Nutrition Education Evaluation

# HEALTHY OKLAHOMA

## Protocol for Healthy Oklahoma (HO) Youth Nutrition Education Evaluation

### **Background:**

The Healthy Oklahoma youth curriculum consists of 6 lessons and is the intervention being evaluated for impact. The target audience is upper elementary grades (4<sup>th</sup> – 6<sup>th</sup> grades). **Each HO team member is asked to complete 2, 6-lesson series to the target audience and conduct the evaluation as described below under Evaluation Protocol.** Lessons can be accessed at <http://oces.okstate.edu/healthyok> under Curriculum ~ Youth. Group sizes may vary depending on the county.

Each lesson contains background information for the instructor. Lesson format follows a learning task model developed by Dr. Joye Norris. The *anchor* task grounds the topic in the learners' lives; *add* tasks provide new information; *apply* tasks have learners do something with the information; and the *away* tasks allow learners to move the information into the future.

The emphasis for each lesson addresses one or more of the topics identified as covered most often by the 2006 TIP Grant journaling activity. (NOTE: As of October 2008, HO educators are no longer required to complete the journaling pages.) In addition, the topics are consistent with research identifying determinants contributing to overweight and obesity in youth populations.

The lessons are:

- *Keeping Balance with MyPyramid*
- *Mix it Up for Fitness*
- *Snack Wise*
- *Beverage Buzz*
- *Fast Break with Breakfast*
- *Making Fast Food Fit*

It is recommended *Keeping Balance with MyPyramid* and *Mix it Up for Fitness* be the first two lessons taught. Thereafter, lesson order can vary to meet needs. Consider using the exercise resistant bands (used in the *Mix it Up for Fitness* lesson) in subsequent lessons to help reinforce the benefit of regular physical activity.

The lessons have been tied to the Oklahoma Department of Education Priority Academic Skills and Ag in the Classroom lessons. It is recommended that the HO educator share the list of Ag in the Classroom lessons with the classroom teacher.

### **Evaluation Protocol:**

NOTE: For sound evaluation purposes, it is **imperative** that all 6 lessons be taught and that the **evaluation questionnaire not be altered**. The time frame over which the lessons are taught is dependent on the school and educator's schedule.

1. Prior to teaching the first lesson, have students complete the Pre Health Oklahoma Youth Questionnaire. It can be accessed at <http://oces.okstate.edu/healthyok> under Pre Post Form.
  - a. Circle "Pre" before making copies.
  - b. Give each student a copy.
  - c. Ask students to write their initials in the upper right hand corner; check the box in front of the appropriate gender; and write the grade they are in.
  - d. Briefly explain the frequency variables as follows:
    - i. "Every day" means you do that activity every day.
    - ii. "Most days" means that you almost always do the activity, but not every day.
    - iii. "Some days" means that the activity is not a habit but might do it on some days.
    - iv. "Almost never" means that you very rarely do this activity, like once a month or less.
    - v. "Never" means you would do not perform the activity.
  - e. Read each sentence aloud. Ask students to decide how often they do the activity and mark an "X" in the appropriate box. Use the following descriptions to explain what is being asked.



## Appendix E Continued

### Healthy Oklahoma Youth Evaluation Instructions

- i. "I eat whole grain breads and cereals." Examples of a whole grain are: brown rice, oatmeal, popcorn, whole wheat cereal flakes, whole wheat bread, whole wheat crackers, whole wheat pasta, whole wheat sandwich buns and rolls, whole wheat tortillas, and wild rice.
  - ii. "I eat low-fat meats." Low-fat meats usually don't have breading and have not been fried. Examples of *high-fat* meats are chicken nuggets, fried chicken, chicken fried steak, steak fingers, bologna, hot dogs etc.
  - iii. "I am physically active 60 minutes." Being physically active means participating in an activity that makes students breathe hard and/or perspire. Examples of physical activity include walking, running, swimming, bike riding, and active games. Students do not have to be physically active for 60 minutes at one time; smaller bouts throughout the day add up. For example playing tag at recess for 20 minutes, walking the dog for 20 minutes, and riding a bike for 20 minutes.
  - iv. "I snack only when I am hungry." This means not snacking because you are bored, tired, sad, or up-set.
  - v. "I use the nutrition facts label to make food and beverage choices." Students look on the food package to find out how big a serving is or the amount of calories, fat, or sugar that is in a serving.
  - vi. "When I eat high fat foods, I eat small amounts." Students may think of high-fat foods as "junk food" like chips, donuts, or candy bars. Fried foods like French fries and fried vegetables would also be included.
  - vii. "When I drink sugar-sweetened beverages, I drink small amounts." Sugar-sweetened beverages include soft drinks, lemonade, sports drinks, energy drinks, fruit drinks, and sweet-tea.
- f. Collect the questionnaires from the students. Maintain in an office file.
2. Teach the series of 6 lessons.
  3. After the 6<sup>th</sup> lesson, ask students to complete a Post 1 questionnaire.
    - a. Circle Post 1 before making copies.
    - b. Follow the protocol in 1c through 1e above.
    - c. Collect the questionnaires from the students.
    - d. **Using the students' initials, match each student's pre questionnaire to their post questionnaire. Staple the two questionnaires together.**
  4. Submit the matched questionnaires to:

Janice Hermann  
305 HES Building  
Oklahoma State University  
Stillwater, OK 74078-6141

To be included in data analysis for 2009 impact team reporting, **all matched questionnaires must be postmarked by November 20, 2009.**

#### Evaluation of the Farm to You interactive exhibit:

If you are participating in the evaluation of the Farm to You interactive exhibit follow the above protocol. In addition, approximately 1 week after students visit the exhibit, have students in a 4<sup>th</sup> or 5<sup>th</sup> grade class complete a Post 2 HO Youth questionnaire. Circle Post 2 on the questionnaire before making copies. Follow the protocol outlined above in 1c through 3.

Using each student's initials match their pre, post 1 and post 2 questionnaires; staple the three questionnaires together. Submit by April 30, 2009 to Abby Stover, 305 HES Building, Oklahoma State University, Stillwater, OK 74078-6141

NOTE: These efforts will count toward the HO team requirement of teaching the 2, 6-lesson series. The data will be submitted to Janice Hermann for inclusion in data analysis and impact reporting.

## VITA

Abby Fischer Stover

Candidate for the Degree of

Master of Science

Thesis: EVALUATION OF THE FARM TO YOU NUTRITION EDUCATION  
INTERACTIVE EXHIBIT

Major Field: Nutritional Sciences

Biographical:

Education: Graduated from Chattanooga High School in May 2002; attended Oklahoma State University from August 2002 to May 2007 earning a Bachelor of Science degree in Nutritional Sciences in May 2007; completed Oklahoma State Dietetic Internship program at Oklahoma State University in June 2008 and passed the National Examination for Registered Dietitians in August 2008; completed the requirements for the Master of Science in Nutritional Sciences at Oklahoma State University, Stillwater, Oklahoma in July 2009.

Experience: Child Nutrition Educator for Families and Schools for Health (FISH) from November 2006-May 2007; Graduate Assistant at Seretean Wellness Center from August 2007-December 2007; Dietetic Intern January 2008- June 2008; Graduate Research Assistant from August 2008 to May 2009; Nutrition Coordinator at the Otoe-Missouria Tribe from August 2008-present.

Professional Memberships: American Dietetic Association, Oklahoma Dietetic Association, North Central District Dietetic Association (Secretary, 2009)

Name: Abby Fischer Stover

Date of Degree: July 2009

Institution: Oklahoma State University

Location: Stillwater, Oklahoma

Title of Study: EVALUATION OF THE FARM TO YOU INTERACTIVE NUTRITION  
EDUCATION EXHIBIT

Pages in Study: 59

Candidate for the Degree of Master of Science

Major Field: Nutritional Sciences

Scope and Method of Study: The objective of this study was to evaluate the *Farm to You* exhibit, and determine if participation in the educational intervention enhanced behavior change in fourth and fifth grade students beyond that seen after students participated in the Healthy Oklahoma Youth (HOY) nutrition education program. The information learned from the evaluation will help guide future development of similar interventions in Oklahoma and contribute to the existing body of literature related to the efficacy of Social Cognitive Theory based interventions in school and community settings. The evaluation utilized repeated measures, case-control design to measure changes in frequency of food and physical activity behaviors. A repeated measure t-test was used to evaluate differences in pre and post questionnaire items among the control and intervention group. Analysis of variance (ANOVA) was used to identify significant differences in the amount of behavior change between students who experienced the *Farm to You* exhibit and those that did not.

Findings and Conclusions: The paired samples t-test identified significant changes in behavior within the control group in four of the ten items on the questionnaire. Within the intervention group, the paired samples t-test revealed six behaviors in which means significantly raised from pre to post intervention. The frequencies analysis identified a greater percent of students in the intervention group reporting increased frequency for performing the evaluated behaviors when compared to the control group for seven of the ten questionnaire items. Thus, the *Farm to You* exhibit in combination with the HOY lesson series, enhanced nutrition behavior change in fourth and fifth grade students beyond that achieved by students exposed only to the nutrition lesson series.

ADVISER'S APPROVAL: Dr. Deana Hildebrand

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