BASELINE STUDY OF STUDENTS' CONSUMPTION OF SCHOOL LUNCH MEAL COMPONENTS PRIOR TO IMPLEMENTATION OF THE *COOKING FOR KIDS: CULINARY TRAINING FOR OKLAHOMA SCHOOL NUTRITION PROFESSIONALS*

By

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Abstract: Since implementation of the Healthy Hunger-Free Kids Act (HHFKA), 2010, school cafeterias are seeing a decline in students' school meal consumption. *Cooking for Kids* is a 5-year program that aims to train and provide food service consulting to Oklahoma school districts participating in the School Breakfast Program and National School Lunch Program to improve the quality and student consumption of school meals following the new revisions developed by the USDA Food and Nutrition Service in response to the HHFKA. This study's purpose was to 1) establish a baseline measure of Oklahoma students' consumption of lunch meal components (i.e., entrée, grain, vegetable, and fruit) prior to the implementation of the pilot culinary training program, and 2) compare trends between geographic location (urban versus rural), grade level (elementary versus secondary), and meal preparation system (central/satellite versus on-site kitchen). A consumption analysis was conducted in six school sites from Oklahoma school districts in spring 2014. Of the 1524 observations, students ate ¾ of the entrée, half the grain serving, and less-than-half of the vegetable and fruit servings. Students attending urban schools, compared to rural, consumed significantly more of the entrée (0.77±0.01, 0.70±0.02 respectively) and vegetable (0.48±0.01, 0.39±0.02 respectively) ($P \leq 0.001$). Middle/high school students, compared to elementary school students, ate significantly more entrée (0.81±0.01, 0.68±0.01 respectively), grain (0.70±0.03, 0.48±0.02 respectively), and vegetable servings (0.51±0.02, 0.38±0.01 respectively) ($P \leq 0.001$). Controlling for grade level, the meal preparation system did not make a difference in consumption. Culinary-training efforts should focus on fruits, vegetables and whole grains and address preparation methods of these food items as well as menu planning approaches to increase variety of items offered. Additionally, identifying differences in menus served in urban versus rural schools and to elementary versus secondary school age students may identify strategies that contribute to increased consumption.

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CHAPTER I

INTRODUCTION

The National School Lunch Program (NSLP) and School Breakfast Program (SBP) were first authorized by federal law in 1946 to maintain the health and well-being of America's youth, many of whom did not have access to nutritious foods (USDA, 2014). Most recently, the Healthy Hunger-Free Kids Act (HHFKA), passed in 2010, required the United States Department of Agriculture Food and Nutrition Service (USDA FNS) to revise the NSLP and SBP meal patterns to better reflect the 2010 Dietary Guidelines for Americans (DGAs). In part, the goal was to help decrease the prevalence of childhood obesity and food insecurity (USDA FNS, 2012). Since these new updates, schools are reporting barriers to implementation and negative feedback from the students and community stakeholders, resulting in students consuming less of the school meals (Byker, Pinard, Yaroch, & Serrano, 2013). In addition, when schools started implementing the new standards, participation dropped which could have a negative effect on the intended outcomes (GAO, 2014).

The Academy of Nutrition and Dietetics (AND) has recommended that chef-based training be conducted to improve the palatability of meals (Byker et al., 2013). There is current literature describing the outcomes of a comprehensive culinary training program on students' consumption of school meals that meet the most current USDA school meal pattern requirements (Cohen et al., 2012). Since the revisions, training in Oklahoma had been focused on school nutrition administrators and the regulatory items of the updated meal patterns. There had been no comprehensive culinary training program in Oklahoma aimed towards school food service authorities to prepare meals that meet the regulations and appeal to students. To address this critical need in October 2013, the Oklahoma State Department of Education Child Nutrition Programs contracted with Oklahoma State University Department of Nutritional Sciences to develop a chef-based culinary training program for school kitchen managers and staff with the vision of changing the paradigm of school nutrition in Oklahoma.

The training program, referred to as the *Cooking for Kids: Culinary Training for Oklahoma School Nutrition Professionals*, is a 5-year program, developed by a multi-disciplinary team including industry chefs, that is aiming to build basic culinary skills and provide on-site consultation service to Oklahoma school districts participating in the NSLP and SBP. The overall purpose of this program is to improve the quality and student consumption of foods served as part of the reimbursable meals that meet the meal pattern and nutrition standard requirements of the USDA FNS response to the HHFKA. A pilot training program was developed and piloted in summer 2014 in six school districts across Oklahoma. Based on findings using the Community Readiness Model (Edwards, Jumper-Thurman, Plested, Oetting, & Swanson, 2000), a second level of training will be provided

to the pilot schools including on-site chef consultation to address revision of local recipes and menus to meet local student preferences and marketing strategies to address participation.

These types of programs are crucial to introduce young children to the importance of eating healthy to prevent them from developing chronic disease. School cafeterias are ideal locations for public health nutrition programs because children consume at least one to two meals a day at their school. Using schools as a place for an intervention program has potential to help school age children develop a foundation of a healthy lifestyle and food security, thus improving their opportunity to identify and consume nutrient dense foods and reach higher levels of academic achievement.

Purpose

The purpose of this study was to establish a baseline measure of students' consumption of school lunch meal components (i.e., entrée, grain, vegetable, and fruit) prior to implementation of a school nutrition culinary pilot training program.

Research Question

The research questions were: 1) How much of the lunch meal components are Oklahoma students consuming prior to *Cooking for Kids*? 2) Are there differences in students' consumption of school lunch meal components based on geographic setting, grade level, and meal preparation system?

Objectives

Objective 1: Conduct a meal consumption analysis to establish a baseline measure for each of the lunch meal components (i.e. entrée, grain, vegetable, and fruit) in the six pilot schools.

Objective 2: Compare students' consumption of school lunch meal components by school characteristics: geographic setting (i.e., rural and urban), grade level (i.e., elementary and secondary) and meal preparation system (i.e., central/satellite and on-site).

Assumptions

This study assumes that when the meal component was not on the tray at the end of the meal, the student ate the food item. A second assumption was that the school meals served and student participation on the observation days were typical of usual meal service.

Limitations

There were potential limitations that may have posed threats to the internal and external validity of this study. The first limitation to consider is the meal component consumption analysis was conducted for two days at the six pilot schools, which limits the types of food to be measured. Three days to observe meal consumption would have been ideal, but due to time constraints and limiting burden to the school, researchers visited on two nonconsecutive days offering different menus. However, conducting the

meal component consumption analysis on nonconsecutive days allowed for better representation of the school meals.

Observation days may have influenced consumption due to the time of year or other school activities that might have influenced the number of students eating in the cafeteria. This study was conducted in the spring semester of 2014; different findings may have been observed during the fall semester. Additionally, the presence of the research assistants in the lunchroom may have affected the students' consumption of the meals. Although the students were aware of tray photograph collections, they did not know the study aims. Some students might have felt the need to consume all of their meal or none of it since they were being observed. If students asked why research assistants were taking photos of their trays before and after they ate, they were told that the assistants were observing how much the students like the meals and what types of food they eat.

A nutrient analysis of the school meals to ensure they were following the updated meal patterns and nutrition standards was planned at the beginning of the study. This analysis was not conducted due to inadequate menu and lunch meal information provided by the schools. Some schools did not have access to a nutrient analysis program or did not use standardized menus, while other schools did. Therefore, there was not enough consistent information available to compare the school meals between the different schools.

Another important limitation to consider for this study is the presence of competitive foods at the school cafeterias. Some of the school sites had a la carte lines,

vending machines, or off-campus meal choices that may have influenced the students' decision to participate in the school lunch meal during the days of observation.

Abbreviations, Terms, & Definitions

AND- Academy of Nutrition and Dietetics. The AND is the world's largest organization of registered dietitian nutritionists, dietetic technicians, and other food and nutrition professionals dedicated to improving the public's health and advancing the profession of dietetics through research, education, and advocacy (AND, 2015).

CDC- Centers for Disease Control and Prevention

Central/satellite kitchen- Also known as commissary food service system. Food is produced in one centralized location and then transported to external receiving (satellite) kitchens where is it served to students (Unklesbay, Maxcy, Knickrehm, Stevenson, Cremer, & Matthews, 1977).

Childhood obesity- A BMI at or above the 95th percentile on the CDC growth charts for children of the same age and sex (USDA, 2012).

Childhood overweight- A BMI at or above the 85th percentile and lower than the 95th percentile on the CDC growth charts for children of the same age and sex (USDA, 2012).

Dietary Guidelines for Americans, 2010- Updated every 5 years by the USDA and Department of Health and Human Services. It provides advice about proper calorie consumption, food choices, and physical activity to Americans aged 2 years and over to prevent disease and promote overall health (USDA & HHS, 2010).

Food insecurity- Household-level economic and social condition of limited or uncertain access to adequate food (USDA ERS, 2014).

Food security- People have constant access to enough food for a healthy and active lifestyle (USDA ERS, 2014).

HHFKA- Healthy Hunger-Free Kids Act. This act was passed in 2010 and required the USDA to update meal pattern and nutrition standards for meals reimbursed under the Child Nutrition Programs to align with the Dietary Guidelines, 2010 (USDA & HHS, 2010). The purpose of the updates is to address both the growing prevalence of childhood obesity and food insecurity.

Hunger- Individual-level physiological condition that may result from food insecurity (USDA ERS, 2014).

NSLP- National School Lunch Program

OVS- Offer versus serve. Provision in NSLP and SBP that allows a student to decline some of the food offered (USDA FNS, 2014a). The purpose is to reduce plate waste.

On-site kitchen- Commonly referred to a conventional food service system. Ingredients are assembled and food is produced onsite and served to students (Unklesbay et al., 1977).

Reimbursable meal- refers to meals served under the federally reimbursed Child Nutrition Program. This meal must contain a specified quantity by age for the following food components: meat/meat alternative, vegetable or fruit, grains/bread, and milk (USDA FNS, 2014b).

SBP-School Breakfast Program

USDA- United States Department of Agriculture

USDA ERS- United States Department of Agriculture Economic Research Service. The ERS conducts Federal research on food security and measures food security in American households and communities (USDA ERS, 2014).

USDA FNS- United States Department of Agriculture Food and Nutrition Service. The FNS works towards ending hunger and obesity through federal nutrition assistance programs including school meals (USDA FNS, 2014c).

Very low food security- Multiple indications of disrupted eating patterns and reduced food intake (USDA ERS, 2014).

YRBSS- Youth Risk Behavior Surveillance System. Monitors health-risk behaviors and measures the prevalence of obesity among youth and young adults. It also includes national school-based surveys and local surveys (CDC, 2014a).

CHAPTER II

REVIEW OF LITERATURE

Childhood Obesity

Overweight and obesity have become common health conditions in today's society, with an increasing number of people growing heavier. The terms "overweight" and "obese" are used to describe individuals with ranges of weight associated with high risk for poor health outcomes (CDC, 2012). These unhealthy ranges of weight can be determined by calculating body mass index (BMI), by dividing weight, in kg, by height, in m^2 (CDC, 2012). BMI estimates an individual's body fat but it must be used carefully because it does not measure body fat directly (Dehghan, Akhtar-Danesh, & Merchant, 2005). Regardless, BMI is an appropriate method to estimate the prevalence of overweight and obesity in population groups.

Childhood obesity in particular has increased in prevalence, especially in the United States, putting more children at the risk of developing a chronic disease. The percentage of obese children six to eleven years of age increased from 7% in 1980 to 18% in 2012 and the percentage of obese adolescents twelve to nineteen years of age

increased from 5% to nearly 21% in the same time period (CDC, 2014b). Childhood overweight and obesity can be measured by BMI by calculating a child's weight and height, similarly to calculating adult BMI, however classification is different. A child is classified as overweight if their BMI is between the 85th percentile and 95th percentile and obese if their BMI is at or above the 95th percentile, when compared to children of the same age and sex (CDC, 2009).

Based on the Youth Risk Behavior Surveillance Survey, 15.3% of Oklahoma high school students were reported as overweight and 11.8% were reported as obese (CDC, 2013). Similar to adult obesity, childhood obesity is associated with major health complications and increases the onset of chronic disease in children and adolescents. Overweight and obesity have been associated with "hyperlipidemia, hypertension, abnormal glucose tolerance, and infertility" and has also been associated with psychological impairments such as depression (Dehghan et al., 2005, p.2).

Weight gain occurs "when energy intake exceeds energy expenditure" (Dehghan et al., 2005, p.3). This imbalance in energy is influenced by multiple factors, including genetics. However, lifestyle preferences and environmental settings are the factors which have changed most in the time period over which obesity rates have dramatically increased (Deghan et al., 2005).

There are many factors in the environment that contribute to the childhood obesity epidemic. Such factors include "the urban context, […] in relation to public transportation, stressful lifestyle, commuting and availability of green space" (Donatiello et al., 2013, p.762). Researchers have examined the differential effect on adiposity in

children living in rural or urban areas and have found that adiposity was higher in children living in urban areas compared to those living in suburban and rural areas (Donatiello et al., 2013). This relationship could be partly explained by geographical factors or land structures that may influence sedentary choices associated with overweight in children. For instance, children living in urban areas may have inadequate access to safe outdoor areas to be active during the day and are more inclined to participate in structured, indoor physical activity compared to children living in rural areas (Donatiello et al., 2013).

Childhood Hunger

There is a strong association between childhood obesity and childhood hunger. Hunger is predominantly caused by poverty and children living in households where they are unable to access enough nutritious food for healthy and normal growth (Raphel, 2014). In 2012, 16.1 million children lived in poverty in the United States and 15.9 million children reported living in food insecure households (Feeding America, 2014). Food insecurity refers to a limited or uncertain availability of nutritionally adequate and safe foods, or limited or uncertain ability to access acceptable food in a socially acceptable way (USDA ERS, 2014). Oklahoma ranks as one of the top 5 states in people who are hungry and one quarter of this population group are children who are at risk of food insecurity (Food Bank of Oklahoma, 2013).

Food insecurity is an issue of the quantity (under-consumption) and quality (mal-consumption including over-consumption of nutritionally inadequate foods) of foods (Ashe & Sonnino, 2012). Food insecurity has been known to be adversely associated with

the health of an individual and an association lies between income and diet quality (Nackers & Appelhans, 2013). This is especially true for inadequate intakes of nutrient-rich vegetables, fruit, and dairy products, resulting in lower intakes of vitamins and minerals necessary for growth and to maintain health (Hanson & Connor, 2014). Food insecure families must make different food purchasing decisions than food secure families due to the higher price per calorie of nutrient-dense foods compared to energy-dense, obesogenic foods (sugar-sweetened beverages, salty and sugary snacks, packaged and frozen foods) (Nackers & Appelhans, 2013). These findings suggest that children living in food insecure homes are more inclined to become overweight and at risk for other adverse outcomes because of the increased exposure to these obesogenic foods (Nackers & Appelhans, 2013).

A study conducted by Weinreb et al. (2002) found a positive relationship in school-aged children between severe child hunger and an increased number of chronic adverse health conditions. The study also found a negative impact of hunger on children's mental health (Weinreb et al., 2002). Without the proper nutrition, children are not able to grow to the best of their ability and this can greatly affect them in the school setting. Even short episodes of hunger can affect a child's health negatively, increasing risk of cognitive, behavioral, emotional, and physical problems (Raphel, 2014). Preventing childhood hunger is possible and can lead to an increase in high school graduations and ultimately increase the employment of healthy young adults (Raphel, 2014). It is crucial for communities to take measures aimed at reducing the prevalence of childhood hunger and poverty and this can be done through the school systems.

School Food Environment

School food environments were recognized as an appropriate setting to promote children's health and reduce childhood obesity in the Child Nutrition and WIC Reauthorization Act of 2004 (Public Law, 108-265). The school environment has the most continuous and intensive contact with children, where children attend school for six hours or more per day, 180 days per year, between the ages of five and seventeen years (Fox, Dodd, Wilson, & Gleason, 2009). On an average school day, about 60% of children eat the school lunch and about 37% eat the school breakfast in schools that offer lunch and breakfast meals (Story, Kaphingst & French, 2006).

Fox et al., (2009) examined the association between school food environments and practices to children's BMI. In this study, data was obtained from the third School Nutrition Dietary Assessment Study (SNDA-III) and on-site observations and interviews with school principals, while children were also weighed and measured for BMI scores. The researchers hypothesized that school food environments and practices that promoted the availability of low-nutrient, energy-dense foods would be associated with higher BMI scores (Fox et al., 2009). They found that in the elementary schools where French fries were offered more than once per week in the school lunches, the children were more likely to be obese compared to those eating school lunches that served French fries only once per week (Fox et al., 2009). In the middle school setting, the availability of vending machines that sold low-nutrient, energy-dense foods in or near the cafeteria was associated with higher BMI scores (Fox et al., 2009). Conversely, the researchers found that the frequency of French fries and desserts served in the school lunches were not associated with BMI or the likelihood of obesity at the middle or high school level (Fox

et al., 2009). The findings from this study suggest that limiting school-aged children's access to low nutrient, energy-dense foods at school may be a successful method for reducing children's total calorie intake, while improving their BMI and the nutritional quality of children's diets (Fox et al., 2009). This study was conducted previous to any changes in the school food environments and practices.

School food authorities (SFAs) use varying types of kitchen systems for food production and service. There are four main types of foodservice systems available for school meal production and many variations to them, depending on the needs of the SFAs (Unklesbay et al., 1977). The conventional system is the most common where it consists of assembling ingredients and producing food onsite (Unklesbay et al., 1977). The food is then held, chilled or heated, and served in the cafeteria at the same location of food production (Unklesbay et al., 1977). Due to shortages in labor, these conventional systems typically use more food products that are processed and ready-to-heat or ready-to-serve (Unklesbay et al., 1977). This study uses this type of foodservice system as part of the meal preparation school characteristic consumption analysis and refers to it as an "on-site kitchen" system.

The centralized, or commissary, foodservice system involves producing food at a central kitchen, where the food is stored frozen, chilled, or heated, then transported to nearby satellite, or receiving, kitchens where it is served to students (Unklesbay et al., 1977). Important factors to consider for this type of system are temperature and packaging of the food that is transported to the satellite kitchens (Unklesbay et al., 1977). Additionally, the foods purchased for a centralized foodservice system are often less processed and more fresh since food preparation is done in the central kitchen

(Unklesbay et al., 1977). This study also uses this type of foodservice system as part of the meal preparation analysis and refers to it as a "central/satellite kitchen" system.

The remaining types of foodservice systems are ready-prepared and assembly-serve. A ready-prepared system is when "food is produced onsite, held chilled or frozen, reheated, and served to customer on site" (Unklesbay et al., 1977, p.12). This type of system differs from the conventional system because for this system, food production occurs at any time of the day since the food is stored until it needs to be reheated and served (Unklesbay et al., 1977). Assembly-serve foodservice systems include purchasing food semi-processed and storing it as frozen or chilled until it needs to be portioned, reheated, and served to customers (Unklesbay et al., 1977).

The foodservice system is important to consider when designing culinary training programs in school kitchens. Some school districts have combination systems that have "characteristics of more than one of the foodservice systems" (Unklesbay et al., 1977, p.16). For example, a school district has a central production facility where the majority of food is prepared at that kitchen but some food items are prepared in the satellite kitchens (Unklesbay et al., 1977). Another example includes a school district that centralizes the production of baked products in one location and transports them to surrounding schools (Unklesbay et al., 1977). The type of foodservice system at each school district cafeteria will determine the types of food that can be purchased and served at the school sites and may affect students' acceptance of meals.

School Nutrition Programs

The National School Lunch Program (NSLP) is a federally funded meal program that has been implemented in over 100,000 public and non-profit private schools that served over 5 billion lunches in the United States in the 2012-2013 school year (USDA FNS, 2013 & USDA FNS, 2014d). Out of these 5 billion lunches, 62.1% were free lunches and 8.3% were reduced-price (USDA FNS, 2013). Free meals are available for children from families with incomes at or below 130% of the poverty level and reduced-price meals are available for children from families with incomes between 130% and 185% of the poverty level (USDA FNS, 2013). Children eligible for reduced-price meals cannot be charged more than 40 cents for their lunches. The School Breakfast Program (SBP) is similar to the NSLP in that it is available to public or nonprofit private schools of high school grade or less (USDA FNS, 2014e). The After-School Snack Program also allows SFAs to be reimbursed for snacks served to children through 18 years of age in afterschool educational or enrichment programs (USDA FNS, 2013). Schools that take part in these programs receive cash subsidies from the USDA for each meal, whether it is breakfast or lunch (USDA FNS, 2013). In return for the subsidies, the meals must meet Federal requirements, and the schools must offer free or reduced price meals to eligible children (USDA FNS, 2013). At the state level, both the NSLP and SBP are most often, but not always, administered through state education agencies. The local SFAs are responsible for operating them in the schools (USDA FNS, 2013).

Healthy Hunger-Free Kids Act

To address the increasing rates of childhood obesity and childhood hunger, efforts have been developed by Congress to improve child nutrition programs. These programs are implemented to directly and immediately decrease child hunger while reducing the cases of overweight or obese children. The Healthy Hunger-Free Kids Act (HHFKA) was signed by Congress in 2010 and called for the Food and Nutrition Service of the USDA to update the NSLP and SBP. These updates changed the nutritional standards and meal patterns of school meal programs to align with the 2010 Dietary Guidelines for Americans (DGAs) (Byker et al., 2013 & USDA HHS, 2010). The aim of the final rule of the updated regulations (Appendix A) was to "meet the nutrition needs of school children" and "enhance the diet and health of school children, and help mitigate the childhood obesity trend" (USDA FNS, 2012, p.4088).

One component of the new NSLP guidelines was to address the school food authorities (SFAs) because of their immense responsibility in directing school meal programs (Byker et al., 2013). The guidelines require SFAs to serve meals that offer at least five meal components daily, including milk, a meat or meat alternative, whole grains, fruits, and vegetables (USDA FNS, 2012). The offer vs serve (OVS) provision allows students to decline two of the five meal components. The revised meal pattern now requires that at least one of the items selected be ½ cup fruit or vegetable (FV) or ¼ cup fruit and ¼ cup vegetable (USDA, 2012). OVS is optional in elementary and middle schools but required in high schools and was developed to reduce food waste, especially of the FV components (USDA, 2012). This method of service enables students an

opportunity to choose meal components to better meet their preference and has the potential to lessen the amount of food wasted (Byker et al., 2013).

The serving sizes of the five meal components mentioned previously are based on the following groups: kindergarten through grade 5, grades 6 through 8, and 9 through 12th grade (USDA FNS, 2012). Based on these age groups, a range of minimum and maximum calories averaged over a one week period is now required, when the previous regulation only required a minimum number of calories (USDA FNS, 2012). The new calorie requirements correlate with the 2010 DGAs to promote quality nutrients and limit excess calories, as a means to reduce childhood obesity (USDA HHS, 2010).

A major difference between the previous and 2010 requirements is that fruits and vegetables (FV) are offered as two separate meal components rather than SFAs offering a fruit *or* vegetable with no specifications on the type of vegetable served (USDA FNS, 2012 & Byker et al., 2013). The purpose of this update is to "increase exposure to and availability of a variety of FVs" and to increase daily FV consumption (Byker et al., 2013, p.684). In addition to the amount of FV that must be offered to a corresponding age group, there are now requirements on the type of vegetable component served during a week period. To increase the variety of vegetables served, the new guidelines state there must be weekly specifications for dark green, red/orange, beans/peas (legumes), starches, and other vegetables as defined in the 2010 DGAs (USDA FNS, 2012 & USDA HHS, 2010). The new guidelines continue to allow tomato sauce to be counted as a vegetable on pizza and French fries to be served in limited amounts per week (Byker et al., 2013). To address the fruit component, the new guidelines allow up to half of the fruit requirement to be met with 100% fruit juice (USDA FNS, 2012). However, this

requirement provides more calories and is not nutritionally comparable to whole fruits (Byker et al., 2013).

Initially, the new requirements developed a minimum and maximum range of meat or meat alternative, appropriate to age group, when the previous requirement had no maximum weekly amount (USDA FNS, 2012). The maximum limit was removed during the first year of implementation in response to public dissatisfaction. To better address the preferences of students following a vegetarian food pattern, tofu was added as a meat alternate (USDA FNS, 2012). This change exposes students to a variety of different foods and "offers a new opportunity to introduce more nonmeat proteins into school lunch menus" (Byker et al., 2013, p.685).

The previous recommendations for the grain component required a minimum and maximum weekly range of grains, whereas previously there were no maximum requirements (Byker et al., 2013). This new rule was challenging for SFAs to follow since a large amount of their grains were incorporated into the meals and difficult to measure. Because of the various challenges perceived, the policy was changed to require only daily and weekly minimums to be met for grains (Byker et al., 2013). In addition to the minimum requirement of grains, the new recommendations require at least half of the grains be whole grain-rich. In order for a grain to count as whole grain-rich, it must contain at least 51 percent whole grains with the remaining percent being enriched grain (USDA FNS, 2012). These recommendations were established in an effort to balance calories and reduce the consumption refined grains as stated in the 2010 DGAs while also providing children with nutrients found in whole grains such as iron, B vitamins, and dietary fiber (USDA HHS, 2010 & USDA FNS, 2012).

Milk requirements were changed from reduced fat and whole milk options with no flavor restrictions to fat-free (unflavored or flavored) or 1% low-fat (unflavored) milk (USDA FNS, 2012). The quantity did not change from 1 cup offered at lunch and breakfast. This new standard was developed to create a balance between added sugars from flavoring in milk and the amount of fat present in the milk (Byker et al., 2013).

Saturated fat and trans fat were particularly addressed in the new requirements. The new recommendations have no limit on total fat intake, however, the total meal has to contain 10% or less of saturated fat and 0 grams of trans fat per serving (USDA FNS, 2012). This allows SFAs to incorporate more mono- and polyunsaturated fats in the school meals without adding any additional saturated or trans fats (Byker et al., 2013).

Sodium intake was also addressed in the new requirements but allowed for a gradual reduction in the amount served in school meals to occur over a span of ten years. Schools are required to meet the final target sodium levels of 1,900 mg (ages 4-8), 2,200 mg (ages 9-13), and 2,300 mg (ages 14-18) by July 1, 2022 (USDA FNS, 2012). These amounts serve as the sodium Tolerable Upper Intake Limits (ULs) established by the Dietary Reference Intakes (DRI) (USDA FNS, 2012). It has been proposed that SFAs would have great difficulty in planning and preparing palatable meals, hence leading to a decrease in NSLP participation (USDA FNS, 2012). Schools are encouraged to incorporate new low-sodium products into their menu as well as use alternative sodium-free seasonings to increase the palatability of the meals. *Cooking for Kids* emphasizes the importance of using herbs and spices to enhance the flavor of the school meals.

Barriers of Implementation

Since the new regulations have been implemented, members of the community including students, parents, school food service staff, and policy makers have expressed concern that these new standards are too restrictive (Byker et al., 2013). A recent study by the Government Accountability Office (GAO) reported a 3.7% decrease in student participation in the NSLP from 2010-2011 to 2012-2013, which may have been a result of increased meal prices and/or decreased student acceptance of the new lunches (GAO, 2014). This decrease in participation mainly occurred among full-price-paying students (GAO, 2014). Nonetheless, some communities and school districts have shown support for the changes and understand that the HHFKA and new regulations are to benefit children and their health (Byker et al., 2013).

Some SFAs are having difficulty planning meals to fit within the new calorie range while other SFAs are finding that the calorie range implementation has not changed their meals (Byker et al., 2013). The reduction in calories ultimately affects every meal component in the school lunch. SFAs that previously served well over the minimum nutrient requirement have the most difficulty in adjusting to the new requirements (Byker et al., 2013). Also, the new calorie requirements may not be adequate for some students, especially those with higher energy needs (Byker et al., 2013). In these situations, access to vending machines or other competitive foods on campus may cause students to substitute the school meals for more energy-dense foods (Byker et al., 2013).

The updated recommendations have created challenges in all areas of the school lunch meal. For example, the requirement for certain types of vegetables served per week

may require additional training and equipment in order to improve cooking and preparation knowledge among SFAs to prepare the vegetables in ways that follow the new guidelines and are appealing to students (Byker et al., 2013). The change in meat/meat alternative component was difficult to implement due to inadequate products for the new requirements provided by a majority of food suppliers (Byker et al., 2013). Additional training may be necessary for preparing meals that contain meat alternatives. There is also the issue that more food waste has occurred since the new guidelines were implemented, since the availability of FVs is not reciprocated by student consumption (Byker et al., 2013).

A key concern about the new NSLP requirements is that students are not consuming adequate amounts of the meals served, resulting in their nutrient and calorie intake being relatively low. Smith and Cunningham-Sabo (2013) evaluated consumption and food choices made by elementary- and middle-school students and also compared students' nutrient intake from the previous NSLP meal requirements to the updated requirements. A plate waste study was conducted over a five-day period and lunch menus were obtained from both schools that corresponded with the days of the plate waste experiment and were nutritionally analyzed for energy, protein, fiber, sodium, vitamins A and C, calcium, iron, total and saturated fat. The authors found that elementary school students wasted more than a third of the individual grain, canned fruit, fresh fruit and hot and fresh vegetable menu items (Smith & Cunningham-Sabo, 2013). Middle-school students wasted about half of fresh fruit, over a third of canned fruit and about a third of vegetables (Smith & Cunningham-Sabo, 2013). This study also found that elementary school students were consuming less than half of the recommended amounts of iron and

vitamins A and C, with the mean energy intake of these students being less than both the previous and updated NSLP requirements (Smith & Cunningham-Sabo, 2013). Additionally, very few middle school students met the previous requirements for energy intake, although there was a higher amount that met the new energy requirements. These students also exceeded the sodium intake limit and did not meet requirements (old or new NSLP recommendations) for fiber (Smith & Cunningham-Sabo, 2013). Based on this information, Smith and Cunningham-Sabo (2013) concluded that school-aged children are not consuming the recommended amount of vegetable intake and are consuming inadequate amounts of key nutrients. Millburg (2014) found similar findings in a plate waste analysis. They found that elementary school students were consuming inadequate amounts of the recommended amounts of fiber, calcium, and calories (Millburg, 2014). Researchers suggest that schools need to implement nutrition education and marketing programs utilizing behavioral economic strategies to encourage students to make the most healthful lunch choices (Smith & Cunningham-Sabo, 2013).

In a recent study, administrators and food service staff were surveyed to assess their perceptions regarding student reactions to the 2012 changes in school lunches and how the perceptions varied across schools (Turner & Chaloupka, 2014). Researchers found that half of the respondents agreed that students complained about the meals at first, but 70% agreed that students liked the new lunches (Turner & Chaloupka, 2014). Data from this study suggest that more students are accepting the school lunches following the new recommendations and efforts such as behavioral economics (changing the environment of the lunchroom), can be made to sustain and potentially increase student acceptance of the new school meals (Turner & Chaloupka, 2014).

Intervention in Schools

There is a generous amount of research available that discusses the nutritional inadequacy of school meals, before the new regulations were put into place; however, there is limited research that has addressed implementing culinary training to school cafeteria staff to increase the nutritional content and consumption of the school meals. One study evaluated a cafeteria staff training program, Chef Initiative, designed to teach food preparation techniques with the intention of improving the palatability and nutritional content of meals served in schools (Cohen et al., 2012). To evaluate Chef Initiative, Boston Public School sites were selected to serve as either a control school or to host the chef trainings. A chef was placed in the two schools selected over a two-year period to develop recipes, plan menus, and train the staff to establish healthier, more palatable meals (Cohen et al., 2012). Throughout the two years of the training program, the planned menus from all of the schools (including both control and chef intervention) were analyzed based on production records, food labels, and nutrient content. The researchers conducted a plate waste study to assess the amount of food wasted and found that the Chef Initiative students ate 0.36 more servings of vegetables per day ($P=0.01$) and ate 45% more of their side dishes ($P\leq0.0001$) than control students (Cohen et al., 2012). The authors also found that the Chef Initiative school meals had 3.6g more fiber and 284mg less sodium ($P\leq0.0001$) compared to the control school meals (Cohen et al., 2012). Based on these results, the authors suggest that incorporating chefs with cafeteria staff in the process of menu planning and food preparation has the potential to enhance school menu nutrient quality and student meal consumption, ultimately improving the health of the students (Cohen et al., 2012).

Plate waste studies have been conducted in the past, but none have been completed since the new guidelines were implemented. Byker et al. (2013) suggest that plate waste evaluations will aid SFAs in tracking consumption of their meals so they can make improvements. They also suggest that assistance from nutrition educators, local chefs and food specialists, and other community members would be beneficial in providing staff training in food preparation to promote palatability and student consumption through inventive cooking techniques (Byker et al., 2013).

CHAPTER III

METHODS

The sampling population was public schools in Oklahoma participating in the federally funded Child Nutrition Programs administered by the Oklahoma State Department of Education (OSDE CN). The OSDE CN field consultants recommended 28 districts for the project and a sample of six school districts were selected for the pilot project based on geographic location across the state and school enrollment size. Four districts were located in urban areas of Oklahoma and two in rural areas. Each school's geographic location was determined using the Metropolitan Statistical Area of the United States Census Bureau Population Estimates (OSDE, 2014). The study was conducted in three elementary school sites and three secondary (middle or high) school sites. Three school districts prepared meals using a central/satellite meal preparation system, while three districts used an on-site meal preparation system. OSDE CN consultants invited the selected schools to participate in the pilot project using a Statement of Agreement prepared by the researchers and approved by OSDE CN. Once agreeing to serve as a pilot site for the school nutrition culinary training project, the school food service authority (SFA) was asked to sign a consent form and was provided with a parent information flyer

to inform parents the study was being conducted (Appendix B). An announcement for the school website and parent information flyers were provided indicating the dates of observation, description and purpose of the study (Appendix B). The passive parent consent method was used and students were eligible to partake in the analysis if they attended a lunch period on the observation days. Parents not wanting their child to participate instructed their children to respond "no" when asked if a photograph could be taken of their lunch tray. The study was reviewed and processed as exempt from oversight by the Oklahoma State University Institutional Review Board (Appendix B).

Meal Component Consumption Analysis

A protocol similar to a quarter-method plate waste study was used to measure students' consumption of the school lunch meal components (Hanks, Wansink, & Just, 2014). While the plate waste study observed and recorded to the nearest ¼ portion of the amount of each food component discarded, the consumption study observed and recorded to the nearest ¼ portion of the amount of each food component consumed. The goal was to collect 300 matched meal consumption observations (or 30% of school enrollment, whichever was least) at each site. The study was conducted over a nonconsecutive 2-day period at each school site in spring 2014. Study days were selected with the approval of the school site principal and no follow-up procedures were planned.

As students exited the meal service line they were asked if a photo could be taken of their lunch tray. If the student responded "no" they were thanked and allowed to proceed with their lunch as usual. If the student agreed, the research assistant placed a numbered card on their tray and took a digital photograph. The numbered card was used

as an identifier to match the pre- and post-meal observations. There were six different card colors to indicate each different school site. The cards were numbered “001” to “200” and “201” to “400” for Day 1 and Day 2 of the meal consumption observation respectively.

No part of the student’s body was in the photo, nor was the student’s name associated with the photo. Once the photo was taken, the students were instructed to assure to have a photo taken after they consumed the meal, and then they proceeded with their lunch. Upon dismissal from lunch, students with numbered cards were asked to raise their hand when they were finished eating or leave their plate at a designated place (e.g., table near the tray disposal window). A photo of each plate was taken with the number visible so that consumption could be determined (See Figure 1).

Figure 1: Example Photographs of Pre- and Post-Consumption Tray

Pre-Consumption

Post-Consumption

The study did not obtain any data through individual interaction with students other than asking permission to take the photo. No information that could be traced to a student or regarding the individual student was collected. No identifiers were matched with the student. Photographs of the trays with the numbered cards were the only data

maintained by the researchers. The observations took place in a regular school cafeteria using regular school nutrition data.

Data Analysis

To analyze the amount of food consumed, the pre- and post-meal pictures for each numbered tray were compared. The quarter-waste method was used to determine the amount of each individual food item (entrée, grain, vegetable, and fruit) consumed by each student that participated in the meal component consumption analysis. Milk was not included in the analyses because it was not prepared at the school. Two researchers compared pre- and post-meal photographs to determine the amount of each component consumed: where 0.00 equaled none, 0.25, 0.50, 0.75, and 1.0 equaled all of the component (Hanks, Wansink, & Just, 2014). When the grain component was an integral part of the entrée (e.g., breaded meats, sandwiches) grain consumption was not analyzed as a separate meal component, it was included in the entrée consumption measure.

Inter-rater reliability between two research assistants was assessed by item percent agreement for each of the four meal components (Richter et al., 2012). Ten trays were randomly selected per day from each school site for a total of 120 pairs of matched trays (a total of 240 pictures, pre- and post-meal). High correlation between researchers' observations was achieved (Cohen's kappa score of 0.965; $P \leq 0.001$). Once inter-rater reliability was established, each research assistant analyzed a total of 321 pairs of matched trays to determine consumption of each individual food component.

Statistical Analysis

Statistical analyses was performed using the Statistical Package for Social Sciences (SPSS) software version 22.0 (Chicago, IL) with statistical significance set at $P<0.05$. Frequency analysis was used to describe the consumption patterns of lunch meal components by students. Independent *t*-tests were used to compare the differences between the mean consumption of each lunch meal component (entrée, grain, vegetable, and fruit) by school characteristic (geographic location, grade level, and meal preparation method). Because there were significant differences in consumption by grade level, an ANCOVA (analysis of covariance) was conducted to compare differences in the mean consumption of each lunch meal component between the two different types of meal preparation systems controlling for grade. Chi-square analyses were used to compare the proportion of students consuming none (0.00), some (0.25 – 0.75) or all (1.00) of the meal components based on the school characteristics mentioned previously. The consumption variables were recoded into the "none", "some", and "all" categories prior to performing the chi-square analyses.

CHAPTER IV

FINDINGS

A total of six pilot school sites representing six school districts were selected for the *Cooking for Kids* pilot program. Four of the school districts were located in urban areas of Oklahoma while the remaining two districts were located in rural areas. Three elementary school sites and three secondary school sites were selected for this study. Also, three of the school sites received meals from a central/satellite kitchen and the remaining three school sites prepared meals on-site. The enrollment for the elementary school sites ranged from 305 to 395 students. In contrast, the enrollment for the secondary school sites varied from 44 to 664 students. All but one of the school sites had at least 50% or more students eligible for free or reduced-price meals. The majority of students at all six of the school sites were reported as non-Hispanic white. Table 1 summarizes the six school sites selected for the study and their demographic information used in this study.

Table 1: Demographic Information of Pilot School Sites

	Chickasha	Coweta	Enid	Lomega	Midwest City	Sterling
Pilot School Site	Chickasha Middle School	Coweta High School	Hayes Elementary	Lomega Middle/High School	Del City Elementary	Sterling Elementary
Enrollment[a]	340	664	361	55	395	305
Urban/Rural Designation[b]	Urban	Urban	Rural	Rural	Urban	Urban
Meal Preparation System	Central/ Satellite	Central/ Satellite	Central/ Satellite	On-site	On-site	On-site
Grade Level[c]	Secondary (6 – 8)	Secondary (10 – 12)	Elementary (Pre-K – 5)	Secondary (9 – 12)	Elementary (Pre-K – 5)	Elementary (Pre-K – 8)
% Free/ Reduced Meal Eligibility[a,d]	72.7%	35.7%	58.2%	68.2%	78.0%	53.8%
Racial Ethnic Groups[c]						
American Indian	7.5%	27.2%	3.6%	1.8%	16.5%	16.1%
Asian	0.8%	1.2%	7.1%	-	1.7%	-
Black	12.6%	5.4%	5.5%	-	18.0%	1.0%
Hispanic	9.4%	1.2%	7.4%	7.3%	6.5%	4.0%
Non-Hispanic White	69.7%	65.0%	76.4%	90.9%	57.4%	78.9%

[a] Based on Low Income Report (OSDE, 2013)
[b] Based on Metropolitan Statistical Area of the US Census Bureau Population Estimates (OSDE, 2014)
[c] (Oklahoma Schools, 2014)
[d] % free/reduced eligibility > 50% is considered a low-income school

Meal Component Consumption Analysis

The total number of valid matched meal observations was 1524, with a total number of 1492 entrées, 667 grains, 1376 vegetables, and 1416 fruits. Not all meals contained all of the components due to the offer versus serve option implemented at the school sites.

Mean Amount of Food Components Consumed

The mean amount consumed of the entrée, grain, vegetable, and fruit meal component servings were 0.75, 0.56, 0.45, and 0.41 respectively. Table 2 represents the

number of observations and mean consumption for each meal component, separated into the six pilot schools selected for this study.

Table 2: Mean Consumption of Lunch Meal Component Servings at the Pilot School Sites

	Chickasha MS *Mean*[a] *N (%)*[b]	**Coweta HS** *Mean*[a] *N (%)*[b]	**Hayes Elem.** *Mean*[a] *N (%)*[b]	**Lomega MS/HS** *Mean*[a] *N (%)*[b]	**Del City Elem.** *Mean*[a] *N (%)*[b]	**Sterling Elem.** *Mean*[a] *N (%)*[b]	**Total Observations** *Mean*[a] *N*
Entrée	0.82 ± 0.03 137 (9.2)	0.88 ± 0.01 209 (14.0)	0.64 ± 0.02 356 (23.9)	0.89 ± 0.02 116 (7.8)	0.71 ± 0.02 349 (23.4)	0.74 ± 0.02 325 (21.8)	0.75 ± 0.01 1492
Grain	0.95 ± 0.02 81 (12.1)	- 0	0.54 ± 0.03 184 (27.6)	- 0	0.43 ± 0.03 240 (36.0)	0.58 ± 0.04 162 (24.3)	0.56 ± 0.02 667
Vegetable	0.29 ± 0.03 135 (9.8)	0.84 ± 0.02 208 (15.1)	0.30 ± 0.02 356 (25.9)	0.73 ± 0.03 95 (6.9)	0.50 ± 0.02 256 (18.6)	0.32 ± 0.02 326 (23.7)	0.45 ± 0.01 1376
Fruit	0.37 ± 0.04 130 (9.2)	0.37 ± 0.04 165 (11.7)	0.49 ± 0.02 356 (25.1)	0.66 ± 0.04 102 (7.2)	0.38 ± 0.2 349 (24.6)	0.03 ± 0.02 314 (22.2)	0.41 ± 0.01 1416
Total Meals Observed (%)[b]	137 (9.0)	211 (13.8)	356 (23.4)	116 (7.6)	349 (22.9)	326 (21.4)	1524

[a] Mean ± Standard Error, consumption values are measured on a scale of 0 (none of the serving) to 1.00 (all of the serving)
[b] N = matched meal observations, percentages are totaled across each row

Among the total valid number of entrée meal observations (N=1492), a little over half (55.2%) of students consumed the entire entrée serving and 7.8% of students did not consume any part of the entrée. Of the total valid number of grain meal observations (N=667), 44.4% of students consumed the entire grain serving and 28.5% of students did not consume any part of the grain. One-fourth (24.9%) of students ate all of the vegetable serving while a slightly larger proportion (30.9%) of students did not consume any part of the vegetable meal component. Fruit had the lowest consumption. Of the total valid number of fruit observations (N=1416), 28.7% of students consumed the entire fruit serving and 45.6% of students did not consume any part of the fruit. The consumption frequencies are further broken down into each individual school site and summarized in Table 3.

Table 3: Baseline Consumption Amounts of Lunch Meal Component Servings at School Sites

Amount Consumed[a]	Chickasha N (%)[c]	Coweta N (%)[c]	Hayes N (%)[c]	Lomega N (%)[c]	Del City N (%)[c]	Sterling N (%)[c]	Total Observations N (%)[c]
Entrée							
0.00	5 (3.6)	1 (0.5)	55 (15.4)	2 (1.7)	20 (5.7)	34 (10.5)	117 (7.8)
0.25	14 (10.2)	7 (3.3)	41 (11.5)	6 (5.2)	62 (17.8)	30 (9.2)	160 (10.7)
0.50	10 (7.3)	17 (8.1)	56 (15.7)	6 (5.2)	41 (11.7)	30 (9.2)	160 (10.7)
0.75	15 (10.9)	38 (18.2)	54 (15.2)	15 (12.9)	53 (15.2)	57 (17.5)	232 (15.5)
1.00	93 (67.9)	146 (69.9)	150 (42.1)	87 (75.0)	173 (49.6)	174 (53.5)	823 (55.2)
Total Observations	*137*	*209*	*356*	*116*	*349*	*325*	*1492*
Grain[b]							
0.00	2 (2.5)	-	53 (28.8)	-	85 (35.4)	50 (30.9)	190 (28.5)
0.25	2 (2.5)	-	30 (16.3)	-	52 (21.7)	15 (9.3)	99 (14.8)
0.50	0 (0.0)	-	11 (6.0)	-	15 (6.2)	10 (6.2)	36 (5.4)
0.75	2 (2.5)	-	18 (9.8)	-	17 (7.1)	9 (5.6)	46 (6.9)
1.00	75 (92.6)	-	72 (39.1)	-	71 (29.6)	78 (48.1)	296 (44.4)
Total Observations	*81*	*-*	*184*	*-*	*240*	*162*	*667*
Vegetable							
0.00	62 (45.9)	9 (4.3)	137 (38.5)	8 (8.4)	45 (17.6)	164 (50.3)	425 (30.9)
0.25	24 (17.8)	11 (5.3)	97 (27.2)	9 (9.5)	66 (25.8)	48 (14.7)	255 (18.5)
0.50	24 (17.8)	14 (6.7)	68 (19.1)	11 (11.6)	45 (17.6)	35 (10.7)	197 (14.3)
0.75	13 (9.6)	33 (15.9)	27 (7.6)	23 (24.2)	40 (15.6)	21 (6.4)	157 (11.4)
1.00	12 (8.9)	141 (67.8)	27 (7.6)	44 (46.3)	60 (23.4)	58 (17.8)	342 (24.9)
Total Observations	*135*	*208*	*356*	*95*	*256*	*326*	*1376*
Fruit							
0.00	70 (53.8)	96 (58.2)	130 (36.5)	21 (20.6)	149 (42.7)	180 (57.3)	646 (45.6)
0.25	8 (6.2)	3 (1.8)	44 (12.4)	10 (9.8)	55 (15.8)	33 (10.5)	153 (10.8)
0.50	6 (4.6)	7 (4.2)	27 (7.6)	6 (5.9)	39 (11.2)	20 (6.4)	105 (7.4)
0.75	12 (9.2)	11 (6.7)	22 (6.2)	11 (10.8)	27 (7.7)	23 (7.3)	106 (7.5)
1.00	34 (26.2)	48 (29.1)	133 (37.4)	54 (52.9)	79 (22.6)	58 (18.5)	406 (28.7)
Total Observations	*130*	*165*	*356*	*102*	*349*	*314*	*1416*
TOTAL[d]							**1524**

[a] 0 = student consumed none of the meal component serving; 1 = student consumed all of the meal component serving

[b] the grain component was an integral part of the entrée (e.g., sandwich, spaghetti, pizza)

[c] N = matched meal observations, percentages are totaled down each column

[d] Students were not required to take all of the meal components due to the offer versus serve provision

Independent T-test for Geographic Setting

Table 4 represents the differences between the mean consumption of each lunch meal component (entrée, grain, vegetable, and fruit) by the geographic setting (i.e., urban versus rural) of the pilot schools. There were significant differences in the mean consumption of the entrée, vegetable, and fruit meal component servings between urban and rural school students. The mean consumption of the entrée and vegetable lunch components were significantly greater among students attending urban schools (0.77 ± 0.01, 0.48 ± 0.01 respectively; P≤0.001) compared to students attending rural schools (0.70 ± 0.02, 0.39 ± 0.02 respectively; P≤0.001). In contrast, the mean consumption of the fruit lunch component was significantly greater among students attending rural schools (0.53 ± 0.02, P≤0.001) compared to students attending urban schools (0.35 ± 0.01, P≤0.001). There were no significant differences in the mean consumption of the grain lunch meal component between urban and rural school students.

Table 4: Differences in Students' Mean Consumption of Lunch Meal Component Servings Based on Geographic Setting

	Geographic Setting	N[a]	Mean ± SE	P-value
Entrée	Urban	1020	0.77 ± 0.01	≤ 0.001[b]
	Rural	472	0.70 ± 0.02	
Grain	Urban	483	0.57 ± 0.02	0.373
	Rural	184	0.54 ± 0.03	
Vegetable	Urban	925	0.48 ± 0.01	≤ 0.001[b]
	Rural	451	0.39 ± 0.02	
Fruit	Urban	958	0.35 ± 0.01	≤ 0.001[b]
	Rural	458	0.53 ± 0.02	

[a] N = matched meal observations
[b] Statistical significance set at P < 0.05

Independent T-test for Grade Level

There were significant differences in the mean consumption of the entrée, grain, vegetable, and fruit meal component servings between elementary and middle/high school students. The middle/high school students' mean consumptions of the entrée (0.81 ± 0.01; P≤0.001), grain (0.70 ± 0.03; P≤0.001), and vegetable (0.51 ± 0.02; P≤0.001) lunch meal components were significantly greater than the elementary school students' consumption (0.68 ± 0.01, 0.48 ± 0.02, 0.38 ± 0.01 respectively). In contrast, elementary school students' mean consumption of the fruit lunch meal component was significantly greater than the middle/high school students' consumption (0.43 ± 0.02, 0.38 ± 0.02 respectively; P=0.016). These findings can be found in Table 5.

Table 5: Differences in Students' Mean Consumption of Lunch Meal Component Servings Based on Grade Level

	Grade Level	N[a]	Mean ± SE	P-value
Entrée	Elementary	705	0.68 ± 0.01	≤ 0.001[b]
	Middle/High	787	0.81 ± 0.01	
Grain	Elementary	424	0.48 ± 0.02	≤ 0.001[b]
	Middle/High	243	0.70 ± 0.03	
Vegetable	Elementary	612	0.38 ± 0.01	≤ 0.001[b]
	Middle/High	764	0.51 ± 0.02	
Fruit	Elementary	705	0.43 ± 0.02	0.016[b]
	Middle/High	711	0.38 ± 0.02	

[a] N = matched meal observations
[b] Statistical significance set at P < 0.05

Independent T-test for Meal Preparation System

Table 6 indicates the differences between the mean consumption of the lunch meal component servings (entrée, grain, vegetable, and fruit) by the meal preparation system (i.e., central/satellite and on-site). Students' mean consumptions of the grain

(P=0.032) and fruit (P≤0.001) lunch meal components were significantly greater at schools using the central/satellite system (0.66 ± 0.03, 0.43 ± 0.02 respectively) compared to an on-site system (0.49 ± 0.02, 0.38 ± 0.02 respectively). There were no significant differences in the mean consumptions of the entrée and vegetable lunch meal components between central/satellite kitchen and on-site systems.

Table 6: Differences in Students' Mean Consumption of Lunch Meal Component Servings Based on Preparation Method

	Preparation Method	N[a]	Mean ± SE	P-value
Entrée	Central/Satellite	702	0.75 ± 0.01	0.915
	On-site	790	0.75 ± 0.01	
Grain	Central/Satellite	265	0.66 ± 0.03	≤ 0.001[b]
	On-site	402	0.49 ± 0.02	
Vegetable	Central/Satellite	699	0.46 ± 0.01	0.514
	On-site	677	0.45 ± 0.02	
Fruit	Central/Satellite	651	0.43 ± 0.02	0.032[b]
	On-site	765	0.38 ± 0.02	

[a] N = matched meal observations
[b] Statistical significance set at P < 0.05

ANCOVA for Meal Preparation System Analysis

After an ANCOVA test was conducted to control for grade level, the previous significant findings of the grain and fruit meal components between different preparation methods became insignificant (P=0.239, P=0.121 respectively). The estimated marginal mean consumptions for the grain and fruit servings can be found in Table 7.

Table 7: Estimated Marginal Mean Consumption of the Grain and Fruit Servings Based on Preparation Method after Adjusting for Grade Level

	Preparation Method	N[a]	Mean ± SE	P-value[b]
Grain	Central/Satellite	265	0.59 ± 0.03	0.239
	On-site	402	0.54 ± 0.02	
Fruit	Central/Satellite	651	0.43 ± 0.02	0.121
	On-site	765	0.39 ± 0.02	

[a] N = matched meal observations
[b] Statistical significance set at $P < 0.05$

Chi-Square Analysis for School Characteristics

The proportion of students consuming "none" (0.00), "some" (0.25 – 0.75), or "all" (1.00) of the entrée, grain, vegetable, and fruit servings based on the school characteristics mentioned previously can be found in Table 8.

Geographic Setting

With the exception of grains, there were significant differences in the proportion of students consuming "none," "some," and "all" of the lunch meal components ($P \leq 0.001$).

Regardless of the geographic setting, at least half of the students (55.2% of entrée observations) consumed "all' of the entrée. However, when "none" of the entrée was eaten it was more likely to be students attending rural schools (12.1%, 5.9% respectively).

More students in both geographic settings ate "some" of the vegetable (44.3% of vegetable observations) compared to those eating "none" or "all." In comparison of

geographic areas urban area students, compared to rural, were more likely to eat "all" of the vegetable serving (29.3%, 15.7% respectively).

Across geographic areas, almost half (45.6% of fruit observations) of the students ate "none" of the fruit component. However, of the students eating "all" of the fruit, students in rural schools were more likely to fall into the category than those attending urban schools (40.8%, 22.9% respectively).

Grade Level

By grade level, significant differences were found in the proportion of students consuming "none," "some," and "all" of all four meal component servings (entrée, grain, vegetable, and fruit) ($P \leq 0.001$).

More than half of students (55.2% of entrée observations) across grade levels ate "all" of the entrée. Middle/high school students (70.6%) were more likely to consume "all" of the entrée, while elementary school students (41.2%) were more likely to eat "some."

As with the entrée, across grade levels students were more likely to eat "all" of the grain compared to "some" or "none" (44.4%, 27.1%, and 28.5% respectively). Again, middle/high school students were more likely to consume "all" of the grain compared to elementary school students (92.6%, 37.7% respectively). Similar proportions of the elementary school students ate "none," "some," and "all" of the grain (32.1%, 30.2%, and 37.7% respectively).

For vegetables, overall students were more likely to eat "some" (44.3% of vegetable observations). However, when comparing middle/high school to elementary, the middle/high school students were more likely to eat "all" compared to elementary students (45.0%, 15.5%, respectively).

Overall, students more often ate "none" of the fruit (45.6%). By grade level, 45.0% of elementary age students and 47.1% of middle/high school age students ate no fruit. When the observation was recorded as "some" it was more likely to be an elementary student (28.5%) compared to a middle/high school student (18.6%). Conversely, when the observation was recorded as "all" it was more likely to be a middle/high school student (34.3%) compared to an elementary student (26.5%).

Meal Preparation System

There were significant differences in the proportion of students consuming "none," "some," and "all" of the grain and fruit servings based on meal preparation system ($P \leq 0.001$), but no differences for entrée and vegetable servings.

Students eating meals prepared in a central/satellite (sat) system were more likely to consume "all" of the grain compared to schools with an on-site kitchen (55.5%, 37.1% respectively).

Similar to the findings based on grade level, there was a large majority of students (45.6%) that consumed "none" of the fruit, with similar proportions for each meal preparation system (45.5% central/satellite, 45.8% on-site).

Table 8: Proportion of Students Consuming None, Some, All of Lunch Meal Components Based on School Characteristics

	None (0.00)[a]	Some (0.25 – 0.75)[a]	All(1.00)[a]	Total	P-value
Geographic Setting					
Entrée					
Urban	60 (5.9)	374 (36.7)	586 (57.5)	1020	
Rural	57 (12.1)	178 (37.7)	237 (50.2)	472	≤ 0.001[b]
Total	117 (7.8)	552 (37.0)	823 (55.2)	1492	
Grain					
Urban	137 (28.4)	122 (25.3)	224 (46.4)	483	
Rural	53 (28.8)	59 (32.1)	72 (39.1)	184	0.145
Total	190 (28.5)	181 (27.1)	296 (44.4)	667	
Vegetable					
Urban	280 (30.3)	374 (40.4)	271 (29.3)	925	
Rural	145 (32.2)	235 (52.1)	71 (15.7)	451	≤ 0.001[b]
Total	425 (30.9)	609 (44.3)	342 (24.9)	1376	
Fruit					
Urban	495 (51.7)	244 (25.5)	219 (22.9)	958	
Rural	151 (33.0)	120 (26.2)	187 (40.8)	458	≤ 0.001[b]
Total	646 (45.6)	364 (25.7)	406 (28.7)	1416	
Grade Level					
Entrée					
Elementary	109 (10.6)	424 (41.2)	497 (48.3)	1030	
Middle/High	8 (1.7)	128 (27.7)	326 (70.6)	462	≤ 0.001[b]
Total	117 (7.8)	552 (37.0)	823 (55.2)	1492	
Grain					
Elementary	188 (32.1)	177 (30.2)	221 (37.7)	586	
Middle/High	2 (2.5)	4 (4.9)	75 (92.6)	81	≤ 0.001[b]
Total	190 (28.5)	181 (27.1)	296 (44.4)	667	
Vegetable					
Elementary	346 (36.9)	447 (47.7)	145 (15.5)	938	
Middle/High	79 (18.0)	162 (37.0)	197 (45.0)	438	≤ 0.001[b]
Total	425 (30.9)	609 (44.3)	342 (24.9)	1376	
Fruit					
Elementary	459 (45.0)	290 (28.5)	270 (26.5)	1019	
Middle/High	187 (47.1)	74 (18.6)	136 (34.3)	397	≤ 0.001[b]
Total	646 (45.6)	364 (25.7)	406 (28.7)	1416	
Meal Preparation System					
Entrée					
Central/Sat	61 (8.7)	252 (35.9)	389 (55.4)	702	
On-site	56 (7.1)	300 (38.0)	434 (54.9)	790	0.435
Total	117 (7.8)	552 (37.0)	823 (55.2)	1492	
Grain					
Central/Sat	55 (20.8)	63 (23.8)	147 (55.5)	265	
On-site	135 (33.6)	118 (29.4)	149 (37.1)	402	≤ 0.001[b]
Total	190 (28.5)	181 (27.1)	296 (44.4)	667	
Vegetable					
Central/Sat	208 (29.8)	311 (44.5)	180 (25.8)	699	
On-site	217 (32.1)	298 (44.0)	162 (23.9)	677	0.587
Total	425 (30.9)	609 (44.3)	342 (24.9)	1376	
Fruit					
Central/Sat	296 (45.5)	140 (21.5)	215 (33.0)	651	
On-site	350 (45.8)	224 (29.3)	191 (25.0)	765	≤ 0.001[b]
Total	646 (45.6)	364 (25.7)	406 (28.7)	1416	

[a] Values are represented as N = matched meal observations (%); percentages are totaled across each row
[b] Statistical significance set at $P < 0.05$

CHAPTER V

DISCUSSION & CONCLUSIONS

The purpose of this study was to establish baseline consumption measures of four lunch meal component servings (entrée, grain, vegetable, and fruit) at six pilot Oklahoma schools selected for the *Cooking for Kids* culinary training program. The findings will be used to help guide further development of the training program and measure effectiveness of the program after schools have received school specific chef consultations. The school sites were organized into the following characteristics: geographic setting (urban vs. rural), grade level (elementary vs. secondary), and meal preparation system (central/satellite vs. on-site kitchen) to determine if these factors influence students' consumption of the school lunch meal.

Meal Component Consumption Analysis

A total of 1524 plate observations were collected and analyzed. Of these total plate observations, there were a total of 1492 entrées, 667 grains, 1376 vegetables, and 1416 fruits. There were fewer grains compared to the other components because in some meals the grain was an integral part of the entrée (e.g., breaded meats, sandwiches).

Overall, the majority of students ate about three-fourths of the entrée servings. This held true across demographic characteristics of the schools (i.e., geographic setting, grade level, meal preparation system). As would be expected, middle/high school students ate more than the elementary students, and students in urban schools were slightly more likely to eat more of the entrée compared to students in rural schools. Similar proportions of students ate "some" or "all" of the entrée regardless of meal preparation system.

On average, students were eating about half of the grain servings, with slightly less than half of the students (2 of every 5 students) eating "all" of the grain serving. Again, middle/high school students were eating more of the grain (almost ¾ of the item) than elementary age students (about ½ of the item). A large majority of the older students (92.6%) ate "all" of the grain serving compared to just more than one-third (37.7%) of younger students. The observed trend among elementary age students is that they were just as likely to eat about half of the grain item (i.e., "some") as they were "all" or "none." Of interest is that students eating meals prepared in a central/satellite system were more likely to eat all of the grain compared to meals prepared at the school site. One disadvantage of the central/satellite system is that students are not able to smell the foods being prepared, especially breads, triggering hunger, and that foods are more often served at cooler temperatures (Unklesbay, et al., 1977). Further investigation revealed that more of the middle/high school observations were conducted in cafeterias receiving meals from a central/satellite kitchen. For this reason, an ANCOVA was conducted to control for grade level, resulting in no differences in the amount of the grain component consumed when comparing meal preparations systems.

The updated meal patterns require that grain food items be whole-grain rich, meaning that half of the grain weight be whole-grain (USDA FNS, 2012). Changing from refined to whole grains requires different formulations for bread recipes as well as time for taste preferences to change. Providing schools with tested recipes and offering whole-grain foods (i.e., quinoa, brown rice) to students in taste tasting may help to increase consumption of these items.

The majority of students ate less than half of the vegetable serving, and about one-third ate "none" of the vegetable. Middle/high school students ate more of the vegetable (about ½ of the item) than elementary school students (about 1/3 of the item). When "all" of the vegetable was eaten it was more likely a middle/high school student.

Overall, the fruit was the least consumed amongst all of the lunch meal components and almost half of students (45.6%) did not consume any part of the fruit across the school demographic characteristics (geographic setting, grade level, meal preparation system). In contrast to other components, elementary age students ate more of the fruit (slightly less than half) than the older students (about one-third of the fruit item). Similarly, students attending rural schools were found to eat at least half of the fruit serving compared to students attending urban schools who consumed about one-third of the item.

An explanation for increased consumption of the entrée in urban settings is the concept of choice. Behavioral economic strategies, when applied to school nutrition, has shown that offering students options and letting them choose between equally nutrient-dense foods increases food consumption (Hanks, Just, & Wansink, 2013). Further review

of urban schools' menus in this study (Appendix C) reflects choices of entrées, especially in the middle/high school settings.

In the high schools where the study was conducted, the high school students had other options for lunch including vending machines, off-campus, and a la carte. In contrast, elementary school students' options were limited to the school meal or a sack-lunch from home. Thus, in keeping with behavioral economics theory, it is logical that high school students choosing to eat in the school cafeteria rather than selecting other options would most likely eat more of the entrée, grain and vegetable, helping to explain grade differences in meal component consumption (Hanks, Just & Wansink, 2013). Condon and colleagues (2009) compared the consumption of school meals by children (ranging from grade 1 to 12) who did and did not participate in the NSLP meals. They found that the students participating in the school meals were significantly more likely to consume the grains and vegetables and significantly less likely to consume desserts and snack items than nonparticipants.

The differences in total consumption of the lunch meal components between the younger and older students could partly be explained by differences in their growth and pubertal development. Puberty is a dynamic period of growth that involves biological, physical, and psychological changes (Soliman, De Sanctis, & Elalaily, 2014). During this critical period of rapid growth, nutritional needs increases dramatically, such as calories, protein, iron, and calcium (Soliman, De Sanctis, & Elalaily, 2014). As children progress through puberty, their hormone levels become altered and leads to an increase in their appetite. In this study, the middle and high school students may have consumed more of the entrée, grain, and vegetable lunch components because they were hungrier than the

elementary students. The older students also may have been involved in extracurricular activities, such as sports, that may have also increased their appetite, resulting in them consuming more of their lunch meal.

Similar to findings in this study, the literature supports that students are not eating much of the fruits and vegetables offered in the school meal. A recent study of middle school students found that students participating in the NSLP meals consumed about half of the fruit serving (Cullen, Watson, & Dave, 2011). Additionally, Byker et al. (2013) found an increase in food waste, especially fruits and vegetables, following the implementation of the new NSLP guidelines. This is of concern because students are not getting important nutrients. Millburg's (2014) findings revealed that students were not eating enough of the fruits and vegetables to meet the meal's fiber recommendations. This is similar to Smith and Cunningham-Sabo's study (2013) reporting students were not consuming the recommended amounts of the school meals, more specifically the fruits and vegetables, which suggests they were consuming inadequate amounts of key nutrients.

In this study, findings indicate that three-fourths of students threw away all to about half of the fruit and vegetable servings served in their school meals. A recent study compared fruit and vegetable intake of elementary students in a serve-only and an offer versus serve (OVS) school (Goggans, Lambert, & Chang, 2011). The researchers found that students at the schools using OVS were more likely to consume a greater amount of the fruits and vegetables that they chose to eat off of the tray line. They also found that students at the serve-only school wasted significantly more fruit and vegetables than students at the OVS school; however, OVS students still wasted at least 44% of fruits and

vegetables (Goggans, Lambert, & Chang, 2011). These findings stress the importance of providing a variety of vegetables and fruits. Offering more options and planning menus accordingly has the potential to increase students' acceptance of the vegetable and fruit and may lessen the amount of food wasted.

Implications for Practice & Future Research

Previous studies have suggested implementation of nutrition education and marketing programs, such as behavioral economics, in schools, assists students in making healthful lunch choices (Smith & Cunningham-Sabo, 2013). Efforts to also educate children on making appropriate food choices among food groups would be beneficial to influence students' consumption of healthful food items (Condon, Crepinsek, & Fox, 2009). This information would be beneficial to a culinary training program by involving the students and producing an overall positive attitude towards the new and improved school lunches.

Based on the findings in this study, the grade level, and to a lesser extent geographic setting, of schools significantly affect students' consumption of the school lunch meal. The findings also support the need to provide training to SFAs in planning menus that offer choices. Further, on-site consultations should include an assessment of equipment and scheduling to ease production of additional food items (Byker et al., 2013). Oklahoma students are not eating much of the fruits and vegetables, and whole grains served in their school lunches, consistent with previous plate waste studies (Byker et al., 2013). Future culinary training efforts should address preparation methods of these food items, menu planning approaches to increase variety of items offered, taste testing

and use of behavioral economic marketing strategies to nudge students toward making the healthy food choices.

Future research is necessary to evaluate the effectiveness of the *Cooking for Kids* culinary training program on students' consumption of school meals. Conducting meal consumption analyses following chef consultations in the schools will provide insight on the students' acceptance of the new foods provided. This information will also aid in the development of the training program by pinpointing areas of focus, such as producing more appealing fruits and vegetables.

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APPENDICES

Appendix A: Final Rule Nutrition Standards in the SBP and NSLP

	Breakfast Meal Pattern			Lunch Meal Pattern		
	Grades K-5[a]	Grades 6-8[a]	Grades 9-12[a]	Grades K-5	Grades 6-8	Grades 9-12
Meal Pattern	Amount of Food[b] Per Week (Minimum Per Day)					
Fruits (cups)[c,d]	5 (1) [e]	5 (1) [e]	5 (1) [e]	2½ (½)	2½ (½)	5 (1)
Vegetables (cups)[c,d]	0	0	0	3¾ (¾)	3¾ (¾)	5 (1)
Dark green [f]	0	0	0	½	½	½
Red/Orange [f]	0	0	0	¾	¾	1¼
Beans/Peas (Legumes) [f]	0	0	0	½	½	½
Starchy [f]	0	0	0	½	½	½
Other [f,g]	0	0	0	½	½	¾
Additional Veg to Reach Total[h]	0	0	0	1	1	1½
Grains (oz eq) [i]	7-10 (1) [j]	8-10 (1) [j]	9-10 (1) [j]	8-9 (1)	8-10 (1)	10-12 (2)
Meats/Meat Alternates (oz eq)	0 [k]	0 [k]	0 [k]	8-10 (1)	9-10 (1)	10-12 (2)
Fluid milk (cups)[l]	5 (1)	5 (1)	5 (1)	5 (1)	5 (1)	5 (1)
Other Specifications: Daily Amount Based on the Average for a 5-Day Week						
Min-max calories (kcal)[m,n,o]	350-500	400-550	450-600	550-650	600-700	750-850
Saturated fat (% of total calories)[n,o]	< 10	< 10	< 10	< 10	< 10	< 10
Sodium (mg)[n, p]	≤ 430	≤ 470	≤ 500	≤ 640	≤ 710	≤ 740
Trans fat[n,o]	Nutrition label or manufacturer specifications must indicate zero grams of trans fat per serving.					

[a] In the SBP, the above age-grade groups are required beginning July 1, 2013 (SY 2013-14). In SY 2012-2013 only, schools may continue to use the meal pattern for grades K-12 (see § 220.23).

[b] Food items included in each food group and subgroup and amount equivalents. Minimum creditable serving is ⅛ cup.

[c] One quarter-cup of dried fruit counts as ½ cup of fruit; 1 cup of leafy greens counts as ½ cup of vegetables. No more than half of the fruit or vegetable offerings may be in the form of juice. All juice must be 100% full-strength.

[d] For breakfast, vegetables may be substituted for fruits, but the first two cups per week of any such substitution must be from the dark green, red/orange, beans and peas (legumes) or "Other vegetables" subgroups as defined in §210.10(c)(2)(iii).

[e] The fruit quantity requirement for the SBP (5 cups/week and a minimum of 1 cup/day) is effective July 1, 2014 (SY 2014-2015).

[f] Larger amounts of these vegetables may be served.

[g] This category consists of "Other vegetables" as defined in §210.10(c)(2)(iii)(E). For the purposes of the NSLP, "Other vegetables" requirement may be met with any additional amounts from the dark green, red/orange, and beans/peas (legumes) vegetable subgroups as defined in §210.10(c)(2)(iii).

[h] Any vegetable subgroup may be offered to meet the total weekly vegetable requirement.

[i] At least half of the grains offered must be whole grain-rich in the NSLP beginning July 1, 2012 (SY 2012-2013), and in the SBP beginning July 1, 2013 (SY 2013-2014). All grains must be whole grain-rich in both the NSLP and the SBP beginning July 1, 2014 (SY 2014-15).

[j] In the SBP, the grain ranges must be offered beginning July 1, 2013 (SY 2013-2014).

[k] There is no separate meat/meat alternate component in the SBP. Beginning July 1, 2013 (SY 2013-2014), schools may substitute 1 oz. eq. of meat/meat alternate for 1 oz. eq. of grains after the minimum daily grains requirement is met.

[l] Fluid milk must be low-fat (1 percent milk fat or less, unflavored) or fat-free (unflavored or flavored).

[m] The average daily amount of calories for a 5-day school week must be within the range (at least the minimum and no more than the maximum values).

[n] Discretionary sources of calories (solid fats and added sugars) may be added to the meal pattern if within the specifications for calories, saturated fat, trans fat, and sodium. Foods of minimal nutritional value and fluid milk with fat content greater than 1 percent milk fat are not allowed.

[o] In the SBP, calories and trans fat specifications take effect beginning July 1, 2013 (SY 2013-2014).

[p] Final sodium specifications are to be reached by SY 2022-2023 or July 1, 2022. Intermediate sodium specifications are established for SY 2014-2015 and 2017-2018. See required intermediate specifications in § 210.10(f)(3) for lunches and § 220.8(f)(3) for breakfast

Appendix B: Oklahoma State University IRB Approval

Oklahoma State University Institutional Review Board

Date:	Thursday, January 23, 2014
IRB Application No	HE145
Proposal Title:	Evaluation of Oklahoma School Nutrition Culinary Training Program: Impact on Student Consumption and Food and Labor Costs
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 1/22/2017

Principal Investigator(s):

Lilian Carl
301 HS
Stillwater, OK 74078

Deana Hildebrand
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The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

X The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval. Protocol modifications requiring approval may include changes to the title, PI advisor, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms
2. Submit a request for continuation if the study extends beyond the approval period. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of the research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Dawnett Watkins 219 Cordell North (phone: 405-744-5700, dawnett.watkins@okstate.edu).

Sincerely,

Shelia K. Kennison

Shelia Kennison, Chair
Institutional Review Board

ADULT CONSENT FORM
OKLAHOMA STATE UNIVERSITY

PROJECT TITLE: Evaluation of Oklahoma School Nutrition Culinary Training Program: Impact on student consumption and food and labor costs

INVESTIGATORS:

Deana Hildebrand, PhD, RD, SNS
Oklahoma State University

Lillian Carl
Graduate Research Assistant
Oklahoma State University

PURPOSE:
The purpose of the evaluation is to assess the impact of the school nutrition culinary training on 1) students' acceptance and consumption of the school meal and 2) food and labor costs.
The information will be used to help chefs and researchers develop a training program to meet the needs of school cafeteria staff.

PROCEDURES

Plate waste analysis
Digital photographs of students' meal trays will be taken as they leave the meal service line and then again prior to returning or discarding the tray at the end of the lunch period. Numbered cards placed on the trays prior to taking the pre-meal photo will be used to match the pre and post trays.

No more than 300 sets (or 30% of the school enrollment, whichever is least) will be taken. The procedure will be conducted over a two to three day period to assure that menu preference does not influence meal consumption.

The procedure will be conducted twice, once in Spring 2014 and again in Fall 2014.

Food and labor analysis
School food service documents of monthly food and labor cost will be collected from the food service director for analysis. This information will be collected for the Fall 2013 and Fall 2014 semesters. Collecting data from the beginning of each fiscal year will yield more comparable food and labor costs since the schools order the majority of their supplies at the beginning of the year. No individual employee's payroll documents will be used in the analysis, only aggregated school food service labor costs will be used.

RISKS OF PARTICIPATION:
There are no known risks associated with this project which are greater than those ordinarily encountered in daily life.

BENEFITS OF PARTICIPATION:
Benefits of participation in the program will help chefs develop and conduct a training program that best meets the needs of school cafeteria staff. Benefits to the society at large is an increased accessibility to affordable healthy foods to a large proportion of school age youth.

CONFIDENTIALITY:
The digital photos used in the plate waste analysis will be of the meal tray, no part of the student or the student's name will be in the photos.

Labor costs analyses will include only aggregated school food service records, individual employees names will not be obtained by the researchers.

Research records will be stored on a password protected computer in a locked office and only researchers and individuals responsible for research oversight will have access to the records.

COMPENSATION:
The school district will receive $500 to be used at the school's discretion.

CONTACTS:
You may contact any of the researchers at the following addresses and phone numbers, should you desire to discuss your participation in the study and/or request information about the results of the study:

Deana Hildebrand, PhD, RD, SNS
Department of Nutrition Sciences
Oklahoma State University, Stillwater, OK 74078
Deana.hildebrand@okstate.edu
405-744-5059

Lillian Carl
Graduate Research Assistant
Department of Nutritional Sciences
Oklahoma State University
Stillwater, OK 74078
Lillian.carl@okstate.edu

If you have questions about your rights as a research volunteer, you may contact

Dr. Shelia Kennison,
IRB Chair,
219 Cordell North, Stillwater, OK 74078,
irb@okstate.edu
405-744-3377

PARTICIPANT RIGHTS:
I understand that my participation is voluntary, that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation in this project at any time, without penalty.

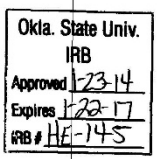
CONSENT DOCUMENTATION:
I have been fully informed about the procedures listed here. I am aware of what I will be asked to do and of the benefits of my participation. I also understand the following statements:
I affirm that I am 18 years of age or older.

I have read and fully understand this consent form. I sign it freely and voluntarily. A copy of this form will be given to me. I hereby give permission for my participation in this study.

Signature of Participant _____ Date _____

I certify that I have personally explained this document before requesting the participant to sign.

Signature of Researcher _____ Date _____



EXTENSION

[redacted]

_____ Public Schools is collaborating with the Oklahoma State Department of Education and Oklahoma State University to pilot a school nutrition culinary training program with school food service staff. To be sure the new foods are acceptable to students researchers will be conducting a plate waste study during the 2014 Spring and Fall Semesters.

What will the researchers do?

- Researchers will ask students if they can take a picture of their meal tray as they leave the meal service line.
  - No picture will be taken if a student responds 'no.'
  - For students who respond 'yes', a numbered card will be placed on the tray and a picture of **only the meal tray will be taken.** When the student is dismissed from lunch, a second picture of the tray will be taken.
  - At no time will the child be included in the picture or asked for his or her name.

How do the school & students benefit?

- School administrators will be able to schedule an optimum amount of time for students to eat.
- Students who have adequate time to eat school meals have better nutrition. Students who have better nutrition do

Who can participate?

- Students enrolled at _____ Public Schools.

Will my child be at risk?

- No. The procedures create no risks, discomforts or harm to the child.

What if I don't want my child to participate?

- Participation is voluntary. Instruct your child to tell the researcher 'no thank you' if he or she, or you do not want them to participate.
- Refusal to participate will not result in loss of benefits or privileges.

For more information

Contact:
deana.hildebrand@okstate.edu
405-744-5059
Deana Hildebrand, PhD, RD, SNS, LD
Oklahoma State University

Okla. State Univ. IRB
Approved 1-23-14
Expires 1-22-17
IRB # HE-14-5

Appendix C: Menu Items Served at Pilot School Sites during Days of Meal Consumption Analysis

	Day 1	**Day 2**
Chickasha Middle School	Cheese pizza Broccoli w/ranch Carrots w/ranch Cinnamon apples	Spaghetti w/meat sauce Garlic breadstick Green beans Canned pears
Coweta High School	Pepperoni pizza Chicken tenders Cheeseburger Potato wedges Salad bar Strawberry cups Apple	Pepperoni pizza Chicken sandwich Cheeseburger Potato wedges Salad bar Baked beans Apple Orange
Hayes Elementary School	Sloppy Joe sandwich Broccoli Sweet potato waffle fries Mandarin oranges	Fish nuggets Macaroni and cheese Salad greens w/zucchini and broccoli Fruit cocktail
Lomega High School	Chicken and rice Green beans Salad bar Fruit salad (banana, strawberry, pineapple) Banana	Philly cheese steak sandwich Baked beans Salad bar Canned pineapple Banana
Del City Elementary School	Bean and cheese burrito Cheese quesadilla Mexican rice Canned corn Veggie cups w/ranch Apple Banana Orange	Chicken nuggets Ham and cheese sandwich Sun Chips Dinner roll Veggie cups w/ranch Cucumber slices w/ranch Potatoes w/gravy Green beans Peach cups
Sterling Elementary School	Nachos w/cheese and chili Chicken breast Mixed greens salad Pinto beans Salad bar Fruit cocktail	BBQ wieners Hot roll Mashed potatoes Broccoli and cheese Salad bar Applesauce

VITA

Lillian Carl

Candidate for the Degree of

Master of Science

Thesis: BASELINE STUDY OF STUDENTS' CONSUMPTION OF SCHOOL LUNCH MEAL COMPONENTS PRIOR TO IMPLEMENTATION OF THE *COOKING FOR KIDS: CULINARY TRAINING FOR OKLAHOMA SCHOOL NUTRITION PROFESSIONALS*

Major Field: Nutritional Sciences

Biographical:

Education:

Completed the requirements for the Master of Science in Nutritional Sciences at Oklahoma State University, Stillwater, Oklahoma in May, 2015.

Completed the requirements for the Bachelor of Science in Nutrition & Dietetics at University of New Mexico, Albuquerque, New Mexico in 2013.

Experience:

Graduate Research Assistant under the supervision of Dr. Deana Hildebrand including the assistance of the *Cooking for Kids* program

Professional Memberships:

Academy of Nutrition and Dietetics
Oklahoma Academy of Nutrition and Dietetics