FRUIT AND VEGETABLE SERVINGS IN LOCAL FARM-SOURCED AND STANDARD LUNCHES OFFERED TO CHILDREN IN A HEAD START PROGRAM

by

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Abstract

The objective of this project was to compare servings of fruits and vegetables consumed in locally-sourced or farm-to-school lunches to that in conventional lunches served to students attending a Head Start preschool. The students took part in the “Fine Dining Friday” program sponsored by a local chef. The sample used in this study was the entire student population enrolled in the Head Start preschool. No subject identifiers were obtained besides gender. Students between 2 and 5 years old were observed eating lunch twice a week for 25 weeks to coincide with a local chef’s “Fine Dining Friday” program for a total of 732 observations. In this observational study, research staff were trained to visually determine amounts of each food item placed on the subjects’ plates and the amount consumed, as a percentage of the original amount. Amounts were recorded and analyzed for mean servings of food groups, macro-, and micro-nutrients for all conventional lunches and locally-sourced lunches. Independent-samples t-tests were performed using SPSS version 17.0 software package. There were no significant differences in either fruit or vegetable consumption between conventional lunches and locally-sourced lunches served to the subjects. Tomatoes, other vegetables (such as lettuce, cucumbers and green beans), and fried potatoes were main contributors to total vegetable intake in conventional lunches and tomatoes, other vegetables and deep-yellow vegetables contributed to total intake in locally-sourced lunches. Dark-green vegetables had the same contribution to total vegetable intake in both lunches. There were no differences in total

energy, fat, saturated fat, total carbohydrates, total protein, vitamin C, calcium, iron, or potassium between the conventional lunches and locally-sourced lunches. Vitamin D and sodium were higher in conventional lunches whereas dietary fiber was higher in locally-sourced lunches. Even though there was more variety of fruit and vegetable offerings in the locally-sourced lunches, the consumption of those possibly unfamiliar foods to the sample may have been limited by the phenomenon of food neophobia. Future studies should focus on offering locally-sourced foods on a repeated basis, possibly in the form of a rotating cycle menu.

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Chapter 1

Introduction

Childhood obesity is a well-documented phenomenon. In fact, 13.9% of all American children ages 2-5 are overweight or obese (1). Preschool children who are obese may have a greater risk of being obese adults. Since obesity is known to contribute to several diseases such as type 2 diabetes mellitus, hypertension, cardiovascular disease and certain cancers, most nutritionists recommend a sensible diet that is moderate in energy, low in fat and rich in fruits and vegetables. A diet that is rich in fruits and vegetables is recommended because they have a low energy density due to their high water and fiber content, but at the same time they are rich in various vitamins and minerals. The typical American diet is generally one that is plentiful in simple carbohydrates and fat but low in fruits and vegetables. Research indicates that, when fruit juice and French fries are not included in the calculations, preschool-aged children are not meeting the recommended servings of fruits and vegetables (2, 3). Preschools and Head Start programs (federally sponsored preschools for children in low-income families) have a significant influence on their students' nutrition status with the meals they serve. Even though Head Start programs must follow the United States Department of Agriculture (USDA) recommendations for school lunches as outlined in the National School Lunch Program (NSLP), they may be composed of more processed food and canned fruits and vegetables as opposed to fresh, minimally processed food. Processed foods are likely to

contain higher sodium and fat and less fiber than whole, fresh foods such as fruits and vegetables. Research indicates that preschool meals contain more saturated fat than current recommendations (4). Farm-to-school programs address this issue by partnering schools with local farms and agriculture to 1) provide children with fresh, local, and minimally processed foods and 2) support local agriculture and strengthen local food systems. A local chef provides meals to schools using a farm-to-school program and collaborates with local farmers whenever possible to provide students minimally processed foods while at the same time supporting the local economy. Local foods, especially fresh fruits and vegetables, can make a positive contribution to the nutrition of children and may encourage choices of more nutrient dense foods outside of school. Recent research studying the effects of school gardens has shown to improve consumption of fruits and vegetables in children, albeit temporarily (5). One recent report that reviewed evaluations of several farm-to-school programs around the nation shows promise in that they may positively impact children's knowledge of local produce and healthy eating and change behaviors that result in more fruit and vegetable consumption (6).

Statement of Purpose

Due to the novelty of the farm-to-school concept published scientific research has been extremely limited. There have not been any studies identified that compare preschool-aged children's fruit and vegetable

consumption in farm-to-school meals to that in conventional school meals. The major objective of this thesis project was to compare the servings of fruits and vegetables consumed in a meal sourced by local farmers and producers with a standard meal served to preschool students enrolled in a local Head Start preschool.

Research Question

Do students in a local Head Start preschool eat more servings of fruits and vegetables when served local, farm-sourced lunches compared to their conventional school lunches?

Chapter 2

Review of Literature

Background on Childhood Obesity

America is facing a crisis in childhood obesity, especially for preschool-aged children. Obesity is known to contribute to several diseases such as type 2 diabetes mellitus, hypertension, cardiovascular disease and certain cancers. Results from the 2003-2004 National Health and Nutrition Examination Survey (NHANES) estimate that 13.9% of all children ages 2-5 are currently overweight (1). In fact, the rate has been increasing since the 1976-1980 data were collected when prevalence was 5%, to 7.2% in 1988-1994, to 10.3% in 1999-2000 (1). The prevalence of overweight in that age group has doubled in the past 10 years.

Preschool-aged children in low-income families have an even higher prevalence of overweight. A recent report published by the Centers for Disease Control and Prevention (CDC) finds that 14.6% of all preschool-aged children in families who are assisted by federally-funded programs for eligible families, such as WIC, are obese (7). For low-income preschool-aged children living in Missouri the rate of obesity is 13.9%, equal to that of the national rate for that age group, regardless of income status (7).

Obesity is one of the top 10 health priorities of Healthy People 2010. Objective 19-3c calls to “Reduce the proportion of children and adolescents who are overweight or obese” to achieve the overall goals of increasing

quality of life and decreasing health disparities (8). A sensible diet that is moderate in energy, low in fat and rich in fruits and vegetables is considered optimal for nutrition as described in the Dietary Guidelines for Americans (9).

Impact of Fruits and Vegetables on Various Diseases

Fruits and vegetables may have a protective effect against some of the most prevalent diseases in America. Perhaps the strongest evidence that fruits and vegetables may be protective against certain diseases is in the case of coronary heart disease. In a meta-analysis of cohort studies studying the association of fruit and vegetable intake and coronary heart disease, individuals who ate more than 5 servings of fruits and vegetables per day had a 17% reduced risk of coronary heart disease ($p<0.0001$) compared with those individuals who ate less than 3 servings per day. Persons who ate between 3 and 5 servings of fruits and vegetables per day had a smaller and not statistically significant decrease in coronary heart disease risk of 7% compared with those who ate less than 3 servings per day (10).

A similar meta-analysis was conducted to review the evidence that fruit and vegetable intake is associated with reduced stroke risk (11). In their meta-analysis, He et al. (2006) concluded that individuals who ate more than 5 servings of fruits and vegetables per day had a 26% decrease in risk of stroke ($p<0.0001$) compared to those who ate less than 3 servings per day while those who ate between 3 and 5 servings of fruits and vegetables per

day had a reduction in risk of stroke of 11% (p=0.005) compared to those who ate less than 3 servings per day (11).

The Therapeutic Lifestyle Changes (TLC) diet and the Dietary Approaches to Stop Hypertension (DASH) diet, both supported by the National Heart Lung and Blood Institute recommend at least 5 servings of fruits and vegetables every day (12, 13). Fruits and vegetables may also play a protective roll in certain cancers. In a meta-analysis to determine the association of fruits and vegetables and protection against gastric cancer, it was concluded that higher fruit or vegetable intake was indeed associated with decreased risk of several types of gastric cancers (14). The World Cancer Research Fund and American Institute for Cancer Research concluded in a 2007 expert report that there is convincing evidence that increased amounts of fruits and non-starchy vegetables in the diet may also reduce the risk of mouth, larynx, pharynx, and esophagus cancers (15).

Recommendations and Intakes of Fruits and Vegetables in Children

The most recent publication of the Dietary Guidelines for Americans recommends at least one cup each of fruits and vegetables, in a variety of colors for persons in the lowest energy category of 1,000 calories per day. Most preschool-aged children fall into this category (9). The Centers for Disease Control and Prevention further categorizes recommendations by age groups and physical activity. They recommend one cup each of fruits and

vegetables for children ages 2-3 regardless of activity level. For children 4-8 years of age, they recommend one cup fruits and 1½ cups vegetables for those less active and 1½ cups each of fruits and vegetables for more active children (16).

How close are preschool-aged children to meeting these recommendations? A study by Munoz et al. (1997) concluded that, at that time, 2-5 year old boys met the recommendation of 3 servings of vegetables and fruits only 17.8% and 33.8% of the time, respectively. Girls met the recommendations for vegetables and fruits only 20.4% and 30.2% of the time, respectively (3). More recent data show that children aged 2-5 are consuming an average of 1.29 cups per day of fruits and 0.76 cups per day of vegetables. It should be pointed out, however, that about 40% of the fruit intake was from juice and 11% of the vegetable intake was from French fries (2). Although many children of preschool ages are likely to receive most of their food at home, most children who attend Head Start programs receive the majority of their daily food intake at school. Food consumed in preschool can impact preschool-aged children's nutritional intake and status.

Impact of School Meals on Children's Nutrition

Since school-age children spend a considerable amount of time in school, the effect of the meals they receive in the school setting on their nutritional status is a subject of scrutiny. Frequently schools rely heavily on

processed food for their students because it is both quick and economical. However, commercially-prepared foods are more likely to contain higher sodium and fat and less fiber than whole, fresh foods such as fruits and vegetables (17). Head Start programs must follow the USDA recommendations for school lunches as outlined in the National School Lunch Program (18). The National School Lunch Program (NSLP) recommendations are based on the 1995 Dietary Guidelines for Americans.

Recent research reveals that schools may be doing a poor job at reducing certain nutrients that are associated with various disease states. In particular, total fat, saturated fat and sodium. According to the latest School Nutrition Dietary Assessment Study (SNDA III), less than one third of all schools meet the requirements for total fat and saturated fat (19). Sodium and fiber are not standardized by the USDA for the NSLP but recommendations do exist. Crepinsek et al. (2007) found that the mean sodium content offered in school lunches is 1442mg which is more than the recommended level (17). Bollella et al. (1999) concluded that children who attend all-day head start programs consume 12.1% of their total energy intake in the form of saturated fat from the meals served at school, exceeding the recommendation that no more than 10% of total daily energy intake be in the form of saturated fat (4).

Most nutritionists agree that dietary fiber is an important component of a sensible diet. Yet fewer than 8% of schools offered lunches containing at

least one third of daily fiber intakes recommended by the 2005 Dietary Guidelines (19). On a positive note, the SNDAA III did find that most schools are meeting the USDA standard for protein, vitamin A, vitamin C, calcium and iron (18).

To meet the updated dietary recommendations and at the request of the USDA, the Institutes of Medicine (IOM) has published recommendations to revise the current standards of the NSLP and the National Breakfast Program (NBP). Those recommendations include increasing the number of fruits, vegetables and whole grains offered at school meals, setting both minimums and maximum calorie levels of meals, and a focus on reducing saturated fat and sodium content of the meals (20).

Food Neophobia

Food neophobia is generally defined as a "reluctance to eat and/or avoidance of novel foods" (21). This phenomenon has been researched extensively and the general consensus is that food neophobia is based on both genetic and environmental factors (22). Food neophobia has been associated with decreased consumption of fruits and vegetables in children. Cooke et al. (2006) found that 4-5 year old children who scored high on the Child Food Neophobia Scale consumed 35% less fruits and vegetables ($p<0.05$) in test meals served at school than those children who had low neophobia scores (23). Similar findings have been found in children aged 2-6

years using the Child Food Neophobia Scale and a food frequency questionnaire (24). Galloway et al. (2003) found that young girls about 7 years of age who were categorized as “high pickiness-high neophobia” had significantly lower vegetable intake scores than those categorized as “low pickiness-low neophobia” ($p<0.01$) (25).

Repeated exposure to certain foods can decrease neophobia and increase acceptance of novel foods, according to research. Wardle, et al. (2003) found that repeated exposure to red pepper increased consumption from about one piece to about 9 pieces in 5-7 year old children ($p<0.005$) in the school setting (26). The positive effect of repeated exposure was also seen in the home setting, where parents were the main influence. Children aged 2-6 years significantly increased their voluntary consumption of a target vegetable from 47% to 77% ($p<0.01$) after 14 exposures to that vegetable. (27).

Farm-to-School Programs

Farm to school programs are a way to incorporate fresh foods into students’ diets while supporting local farmers. Even though the published studies on the farm-to-school concept are limited, garden-based nutrition programs show promise to increase fruit and vegetable intake in children. A pilot intervention to promote fruit and vegetable intake on 4^{th}-6^{th} grade students attending a YMCA summer camp found that subjects increased their

preference for vegetables and increased requests for fruits and vegetables at home (5). McAleese et al. (2007) found that their garden-based nutrition intervention in 6th graders effectively increased the subjects' total fruit and vegetable consumption from 1.93 servings to 4.5 servings per day (28).

A recent report that reviewed evaluations of several farm-to-school programs around the nation revealed numerous positive impacts of farm-to-school programs on children. Positive outcomes include increased knowledge of local produce and healthy eating and increased fruit and vegetable consumption (6). The farm-to-school concept has even caught the attention of the federal government. Kathleen Merrigan, Agriculture Deputy Secretary, recently announced the proposed creation of "Farm to School Tactical Teams" to help schools obtain locally-sourced foods for their students (29). At this time there is limited research on the effectiveness of the farm-to-school programs. Further, we have not found any previous studies that compare preschool-aged children's fruit and vegetable consumption in farm-to-school meals to that in conventional school meals.

Chapter 3

Methods

Overview

The purpose of this thesis was to compare the servings of fruits and vegetables consumed in a meal sourced by local farmers and producers with a standard meal served to preschool students enrolled in a local Head Start preschool. It was an observational study. The students were between the ages of 2 and 5 years of age and enrolled in a Head Start preschool in western Kansas City, Missouri. The students took part in the "Fine Dining Friday" program sponsored by a local chef. Trained staff from the University of Kansas Medical Center (KUMC) visually observed a random sample of meals being consumed by students eating lunch. Observations were conducted on a randomly chosen day between Monday and Thursday, when standard lunch was served and on Friday, when the meal was served for a total of two days per week. KUMC staff observed and documented the intake of all food and beverage items served to the sample of students on each day. Students were identified only by their classroom and gender; no student-specific identifiers were obtained. Data were collected for 25 weeks to coincide with the local chef's "Fine Dining Friday" program, which operated from June 19, 2009 to December 18, 2009. Data collected were entered into and analyzed by the Nutrition Data System for Research (NDSR) (version 2008, University of Minnesota, Minneapolis, MN).

Setting and Program Characteristics

The Head Start preschool was located in western Kansas City, Missouri. Data were collected for 25 weeks to coincide with a local chef's "Fine Dining Friday" program, which operated from June 19, 2009 to December 18, 2009. The "Fine Dining Friday" program, managed by a local chef, was a farm-to-school program which aimed to provide students with meals made from food bought from local farmers. The food served as part of the "Fine Dining Friday" program was locally-sourced, mostly organic, and homemade. At lunch time the tables were decorated with tablecloths and local flowers served as centerpieces. There was also an education component integrated into the program in which some of the farmers were brought into the classroom to educate the students on the foods they would be eating during the program and the food's origination on the farm.

Sample

The subjects in this study were children aged 2 to 5 years who were enrolled in a local Head Start preschool in Kansas City, Missouri. The Head Start preschool took part in the "Fine Dining Friday" program administered by a local chef. All students were offered lunch each day and, therefore, all participated in the "Fine Dining Friday" program. The school had an enrollment of 85 students when the study began. There were five classrooms in the school and classes were observed a reasonably equal number of times

throughout the study period. There was no identification of students other than their gender and classroom. The classrooms are named Butterflies, Dolphins, Eagles, Grasshoppers and Little Ducks.

Ethics

This thesis was covered under an existing approved protocol to evaluate the "Fine Dining Friday" program, in which Cheryl Gibson, Ph.D. was principal investigator.

Procedures and Materials

In this observational study, KUMC staff were trained to visually determine amounts of each food item placed on the subjects' plates and the amount consumed, as a percentage of the original amount. Staff recorded each child's food record on an intake sheet based on their gender and a temporary identifier for that day, such as color of clothing they were wearing (see Appendix A for a copy of the intake sheet). The intake sheet included areas to record the main entrée, grain item, vegetable, fruit, beverage, condiment, and dessert. A modified version of the Comstock's method was employed to measure and document student consumption (30). The KUMC staff visually observed a random sample (approximately 20-25%) of students eating lunch at each occurrence. Observations were conducted on a randomly chosen day between Monday and Thursday when standard lunch was served and on

Friday, when the locally-sourced lunch was served for a total of two days per week. KUMC staff observed and documented the intake of all food and beverage items served to the sample on each day. Measurements of food consumed were standardized according to home measures of cups, tablespoons, teaspoons, and fluid ounces. Data were collected for 25 weeks to coincide with a local chef's "Fine Dining Friday" program, which was in operation from June 19, 2009 to December 18, 2009. Data were then entered into the Nutrition Data System for Research (NDSR) (version 2008, University of Minnesota, Minneapolis, MN) by the same KUMC staff collecting the data. The NDSR software program was used to determine total number of servings consumed for fruits and vegetables for each observed meal occurrence and the overall nutrient intake for each observed meal occurrence.

Description of Serving Sizes

The National School Lunch Program (NSLP) defines serving sizes of food groups for children attending preschool (31). Therefore this project utilized the same serving sizes. One serving of fruit or vegetable is equal to ½ cup fruit or vegetable. One serving of grains is equal to one slice of bread or a biscuit or roll or ½ cup cooked rice, macaroni, or other pasta or cereal grain. One serving of meat is equal to 1½ oz. lean meat, poultry, fish, alternate protein, or cheese; ¾ of a large egg; 3/8 cup cooked dried beans or

peas; 3 Tbsp. peanut or other nut or seed butters; or 6 fl. oz. or ¾ cup yogurt of any kind. One serving of milk is equal to 6 fl.oz.

Analysis of Data

Independent-samples t-tests were performed using SPSS version 17.0 software package. Differences with a *p*-value of less than 0.05 were considered to be statistically significant for the primary planned comparisons. Adjustment for multiple comparisons when examining the micronutrient content of meals was performed using the Bonferroni correction.

Sample Characteristics

The sample included 85 students enrolled in a local Head Start preschool. The average age was 3.4 years. Sixty-eight percent of the subjects were of Hispanic or Latino ethnicity, 16% were African American, 8% were Caucasian and 8% were of mixed race. The average income of families with children attending the preschool was $13,064 per year. A total of 732 observations were made at 22 conventional lunches and 22 locally-sourced lunches. Table 1 depicts the characteristics of the sample.

Table 1: Sample Characteristics

Student Population	85
Ages	Average age: 3.4 years Age 2: n=10; Age 3: n=34; Age 4: n=38; Age 5: n=3
Ethnicity	White (not of Hispanic origin): 8%; Black or African American: 16%; Hispanic or Latino: 68%; Mixed race (all include Hispanic or Latino): 8%
Annual Income	Average: $13,064 Range: $3,000 - $32,000
Total Observations	732 22 Conventional lunches: n=350 22 Locally-sourced lunches: n=382

Food Group Servings

Table 2 depicts the food group serving results. There was no significant difference in consumption of fruit or vegetable servings between the conventional and locally-sourced lunches. Grains consumption was significantly higher in the locally-sourced lunches (p<0.001). Meat and fluid milk consumption was significantly higher in the conventional lunches (p=0.017 and p<0.001, respectively).

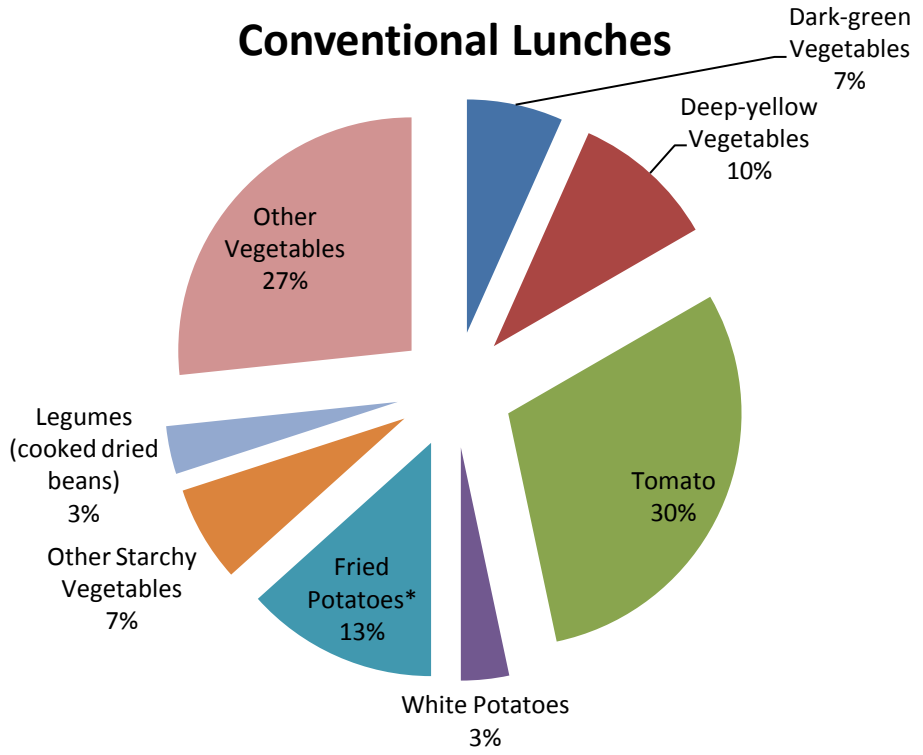
Table 2: Food Group Servings

Servings Category	Mean Servings		P-value
	Conventional Lunch n = 350	Locally-Sourced Lunch n = 382	
Fruits	0.53 ± 0.55	0.56 ± 0.51	0.477
Vegetables	0.29 ± 0.39	0.29 ± 0.34	0.821
Grains	1.03 ± 0.83	1.51 ± 1.98	<0.001
Meats	1.14 ± 1.15	0.94 ± 1.05	0.017
Milk	0.66 ± 0.46	0.54 ± 0.41	0.000

Vegetable Profiles of Lunches

Figure 1 presents a breakdown of the varieties of vegetables that contributed to total mean vegetable intake. Leading contributors to total vegetable intake in the conventional lunches were tomatoes, other vegetables (such as lettuce, cucumbers and mixed vegetables), and fried potatoes such as French fries. In the locally-sourced lunches main contributors of total vegetable intake were tomatoes, other vegetables and deep-yellow

vegetables. Dark-green vegetables had the same contribution to total vegetable intake in both the conventional and locally-sourced lunches. Fried potatoes contributed significantly more to the total intake in the conventional lunches compared to the locally-sourced lunches ($p<0.001$), while deep-yellow vegetables contributed significantly more to the total intake in the locally-sourced lunches compared to the conventional lunches ($p<0.001$).



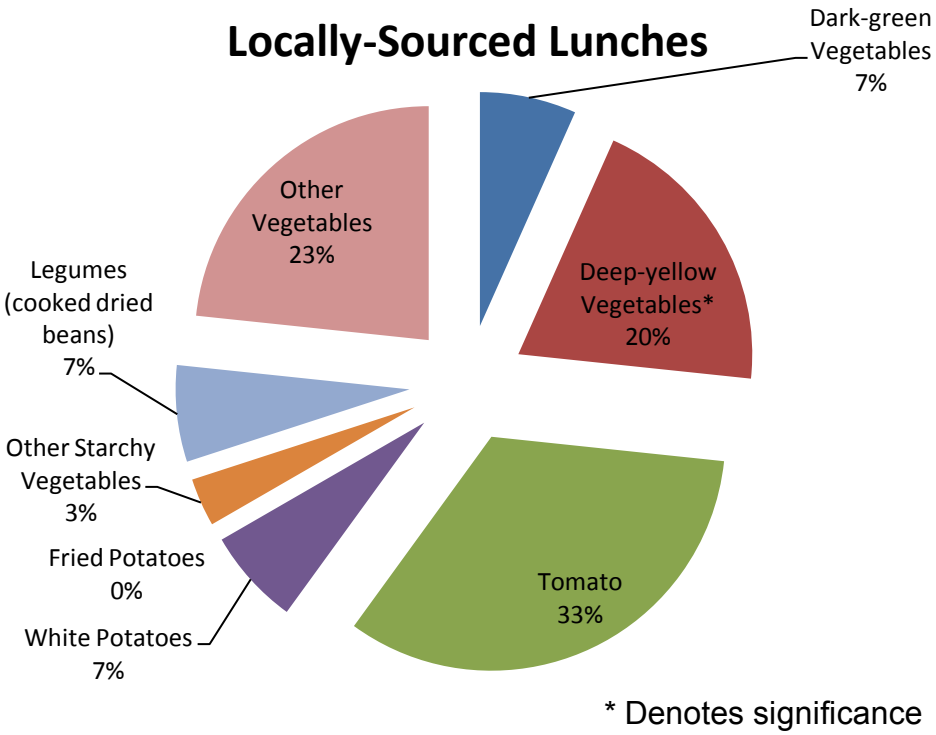


Figure 1: Vegetable Profiles of Lunches

Intake of Selected Nutrients

There were few differences in mean values of selected macro- and micro-nutrients between the conventional and locally-sourced lunches. Total energy, total fat, saturated fat, total carbohydrates, total protein, vitamin C, calcium, iron, and potassium were not significantly different in the conventional lunches compared to the locally-sourced lunches. Vitamin D and sodium were significantly higher in the conventional lunches compared to the locally-sourced lunches ($p<0.001$ and $p=0.029$, respectively). However, dietary fiber in the locally-sourced lunches was significantly greater compared to the conventional lunches ($p<0.001$). Table 3 illustrates the results for intake of selected nutrients.

Table 3: Mean Intake of Selected Nutrients

Nutrient	Mean Intakes		P-value
	Conventional Lunches n = 350	Locally-Sourced Lunches n = 382	
Energy (kcal)	333.56 ± 161.29	310.67 ± 213.85	0.105
Total Fat (g)	11.55 ± 7.82	10.31 ± 9.98	0.063
Total CHO (g)	41.67 ± 20.53	39.27 ± 28.54	0.196
Tot. Protein (g)	16.63 ± 9.23	16.99 ± 12.61	0.661
Total SFA (g)	3.74 ± 2.94	4.29 ± 5.00	0.077
Total Fiber (g)	2.44 ± 1.53	3.91 ± 4.18	<0.001
Vitamin D (mcg)	1.83 ± 1.20	1.54 ± 1.08	<0.001
Vitamin C (mg)	9.17 ± 10.39	10.71 ± 11.48	0.058
Calcium (mg)	269.15 ± 150.94	301.88 ± 277.45	0.051
Iron (mg)	1.98 ± 1.19	1.91 ± 1.79	0.524
Sodium (mg)	631.08 ± 372.18	558.45 ± 506.17	0.029*
Potassium (mg)	539.85 ± 253.18	535.43 ± 316.39	0.836

*Using the Bonferroni correction, this value is no longer considered statistically significant

Chapter 5

Discussion

This research appears to be the first of its kind to compare fruit and vegetable intake in a locally-sourced or farm-to-school meal to a conventional school meal in preschool-aged children. Because of the childhood obesity epidemic and the knowledge that fruit and vegetable intake can have a favorable impact on certain obesity-related diseases and some cancers, it is important to find out if farm to school programs can improve fruit and vegetable intakes among children. The published studies on this topic so far are limited in number.

Sample

The sample for this project had a mean age of 3.4 years. Students of Hispanic/Latino ethnicity made up the majority of the student body. This ethnic group, along with American Indian/Alaska Natives had the highest prevalence of childhood obesity in 2008, whereas non-Hispanic Whites and Black/African Americans had the lowest rates of childhood obesity (7). The average income of families with children who were enrolled in this Head Start preschool was $13,064, which was less than 100% of the Federal Poverty guideline for a family of 2 (31). Indeed, families with children who were enrolled in this Head Start preschool could be considered low-income.

Fruit and Vegetable Intakes

The objective of this project was to compare servings of fruits and vegetables consumed in locally-sourced or farm-to-school lunches to that in conventional lunches served to students attending a Head Start preschool. The results of this project did not find a significant difference in fruit or vegetable servings between the two lunch types. In fact, both lunch types yielded very similar intakes of both fruits and vegetables.

Both lunch types yielded consumptions of about ¼ cup of fruits and slightly more than one tablespoon of vegetables per meal. That is roughly 25% and 7%, respectively, of both the Dietary Guidelines for Americans and Centers for Disease Control and Prevention for this age group (9, 16). Even though this is only one meal, if it is theorized that these subjects consumed the same serving sizes at breakfast and dinner then total daily consumption would be 75% and 21% of fruits and vegetables, respectively. In terms of fruits, that is similar to Lorsen et al.'s findings (2) but below their findings for vegetables. These results are also in line with Munoz et al.'s findings that indicate many children are not meeting the current recommendations (3). These results further fall below the National School Lunch Program regulations that recommend students in this group have at least ½ cup each of fruits and vegetables at lunch (32).

Vegetable Profiles of Lunches

The profiles of the two lunch types were similar for tomatoes and other vegetables (including lettuce, cucumbers and mixed vegetables) but the locally-sourced lunches included significantly more deep-yellow vegetables (including carrots, yellow squash and sweet potatoes). The locally-sourced lunches offered more of a variety of fruits and vegetables than the conventional lunches and a more varied menu altogether, possibly introducing unfamiliar foods such as whipped sweet potatoes, squash and fresh basil to the sample. If these foods were indeed novel to some subjects then food neophobia may have affected consumption of those foods. (see Appendix B for weekly menus) On the other hand, the conventional lunches included significantly more fried potatoes than the locally-sourced lunches. The proportion of fried potatoes to the total intake in the conventional lunches is similar to previous research (2).

Intakes of Selected Nutrients

The total energy, iron and vitamin C were less than National School Lunch Program requirements for those nutrients in both lunch types (31). Saturated fat was above NSLP requirements in the locally-sourced lunch, which could be due to the fact that cheese was served more often in the locally-sourced lunches than in the conventional lunches. Both lunch types met the requirements for total fat, protein, and calcium (30). The findings that

sodium was higher in the conventional lunches and fiber was higher in the locally-sourced lunches supports the theory that farm-to-school programs offer minimally-processed foods rich in fruits and vegetables compared to that in conventional school meals. The results for total fat, saturated fat and sodium for the conventional lunches do not support the previous research that indicates schools are doing poorly in meeting standards and recommendations (4, 17, 19). This was a pilot study with a small sample size. If a Bonferroni correction would have been used the difference in sodium may not have been significant. A Bonferroni correction is a conservative adjustment to account for multiple comparisons. Future studies could increase power by having a larger sample size to determine if that remains a significant variable.

Limitations

One limitation of this study is that the "Fine Dining Friday" program was conducted through the summer and only about half of a normal school year. While the Head Start preschool is year-round, this project cannot be generalized to children attending schools with a traditional 9 month school year during the fall, winter and spring. Another limitation of the study is that while the chef administering the farm-to-school program was focused on providing children with minimally processed foods coming from local sources, nothing in the marketing literature stated intent to provide more fruits and

vegetables than a standard school lunch. And in fact, their meals did not create more consumption of fruits and vegetables among the sample of students in this project. Because the program was administered by a chef and not a dietitian, adequate knowledge to plan appropriate menus for this population may have been lacking. The fact that the students serve themselves as opposed to having the teachers place the food on their plates may affect their intake, as the students often choose not to take foods that they may not be familiar with at home. The tablecloths and flower centerpieces featured as part of the "Fine Dining Friday" program could have also affected the students' intakes, as they were a deviation from the students' normal routine of no table dressings during meal times. Refer to Appendix C for photograph examples of the difference in table dressings between conventional lunches and locally-sourced lunches.

Implications and Future Studies

One implication for this study is that farm-to-school meals give children the opportunity to consume a variety of locally produced foods, especially fruits and vegetables, in the school setting. For example, the locally-sourced lunches in this project offered yellow and orange colored watermelon in addition to the normal red color that is usually the only color available at supermarkets. Sweet potatoes were another common alternative to white potatoes served in the locally-sourced meal. Since sweet potatoes offer more

fiber and vitamin A than white potatoes, it is a good substitution to the starchy staple in most American's diets. Research shows that repeated exposure is the key for food acceptance, especially in young children. For this population, it may be necessary to offer repeated and continued exposures of the perceived novel or unfamiliar foods to gain acceptance and liking. Future studies should focus on offering locally-sourced foods on a repeated basis, possibly in the form of a rotating cycle menu. Further, trained nutrition professionals should be used for collaboration in planning meals.

Conclusion

There were no significant differences in either fruit or vegetable consumption between conventional lunches and locally-sourced lunches served to students in a Head Start preschool. Even though there was more variety of fruit and vegetable offerings in the locally-sourced lunches, the consumption of those possibly unfamiliar foods to the sample may have been limited by the phenomenon of food neophobia. Both lunch types were similar in macronutrient composition. The locally-sourced lunches did offer benefits such as higher dietary fiber likely due to higher whole grain content in the foods and less sodium compared to the conventional lunches.

Chapter 6

Summary

The purpose of this thesis project was to compare the servings of fruits and vegetables consumed in a meal sourced by local farmers and producers with a standard meal served to preschool students enrolled in a local Head Start preschool. The sample consisted of students between the ages of 2 and 5 years of age enrolled in a local Head Start preschool in Kansas City, Missouri. Visual observations were made by KUMC staff on random samples of students eating lunch on randomly chosen days between Monday and Thursday for the conventional lunches and on Fridays to observe the locally-sourced lunches. Data were collected for 25 weeks to coincide with a local chef's "Fine Dining Friday" program.

There was no significant difference in consumption of fruit between the conventional and locally-sourced lunches (0.53 ± 0.55 and 0.56 ± 0.51 servings, respectively). There was also no significant difference in vegetable consumption between the conventional lunches (0.29 ± 0.39 servings) and locally-sourced lunches (0.29 ± 0.34 servings). Both lunch types yielded consumptions of about ¼ cup of fruits and slightly more than one tablespoon of vegetables per meal. Those amounts are below the Dietary Guidelines for Americans, Centers for Disease Control and Prevention, and the National School Lunch Program guidelines for this age group. These findings support

previous research that shows many American children do not meet current recommendations for fruit and vegetable servings (2, 3).

Even though there was more variety of fruit and vegetable offerings in the locally-sourced lunches, the consumption of those possibly unfamiliar foods to the sample may have been limited by the phenomenon of food neophobia. Future studies should focus on offering locally-sourced foods on a repeated basis, possibly in the form of a rotating cycle menu.

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APPENDIX A

Data Collection Intake Sheet

KUMC - Pre-Kindergarten Program

DATE: _____

LUNCH CONSUMPTION MONITORING FORM

PLAZA DE NINOS / ROOM# _____

ENTRÉE		**GRAIN/OTHER**	
VEGGIE		**DESSERT**	
FRUIT		**CONDIMENTS**	
BEVERAGE			

Student	Food Items	Original Portion Size	None	<25 %	25 %	50 %	75 %	95 %	100 %	Amt. Eaten
S1 boy girl	Entrée									
	Grain/Other									
	Vegetable									
	Fruit									
	Beverage									
	Dessert									
	Condiment									

S2 boy girl	Entrée									
	Grain/Other									
	Vegetable									
	Fruit									
	Beverage									
	Dessert									
	Condiment									
S3 boy girl	Entrée									
	Grain/Other									
	Vegetable									
	Fruit									

	Beverage									
	Dessert									
	Condiment									

APPENDIX B

Weekly Menus

Weekly Menus

Week	Conventional Lunches	Locally-Sourced Lunches
1	Taco salad (chips, taco meat), lettuce, tomato, cheese, salsa, Spanish rice, refried beans, fruit (watermelon, pineapple)	Grilled cheese sand., salad w/cucumbers, carrots, tomato, ranch dressing, yogurt w/cinnamon and raisins, fruit (oranges, blueberries, watermelon)
2	Spaghetti w/meat sauce, lettuce salad, dressing, garlic toast, applesauce, Mandarin oranges	Data not collected
3	Hot dog w/bun (white), ketchup, Ruffles chips, steamed broccoli, pineapple	Cheeseburger (wheat bun, American cheese), lettuce, tomato, organic ketchup, sweet potato fries, cantaloupe, watermelon
4	Breaded baked fish, cornbread muffin, mixed veggies, applesauce, lemon	Bean/Cheese quesadilla, taco sauce, Spanish rice, yellow squash and zucchini, watermelon, peach slices
5	Lasagna, salad w/cucumbers and carrots, ranch dressing, garlic toast, pineapple, pears	Baked chicken strips, ketchup, Original 7-Grain Kashi™ crackers, corn soup, blackberries, blueberries, oranges
8	Data not collected	Cheese pizza, Parmesan cheese, cherry tomato salad w/basil and mozzarella, honey sticks, honeydew melon
9	Spaghetti w/meat sauce, Parmesan cheese, garlic toast, salad w/cucumbers and carrots, ranch dressing, corn, applesauce	Taco salad (chips, meat), lettuce, cheese, salsa, frijoles, watermelon slices
10	Hamburger pizza, steamed carrots, pear slices	Macaroni and cheese, whole wheat roll, cucumbers and tomatoes, ranch dressing, yellow watermelon slices

11	Sloppy Joes w/bun (white), potato wedges, ketchup, grapes	Bison chili, cornbread, green beans w/onions, orange watermelon wedges, honey sticks
12	Salisbury steak, cornbread muffin, mashed potatoes, green peas, grapes	Breaded fish fillets, zucchini/banana bread, baby carrots, sliced apples, strawberry applesauce
13	Sandwich (croissant, deli turkey, American cheese), mayo, Ruffles chips, steamed carrots, grapes	Breaded chicken strips, BBQ sauce, apple crisp, hummus, pita bread
14	Homemade meatloaf, wheat roll, scalloped potatoes, green peas, Mandarin oranges	Bison hotdog (whole grain bun), mustard, whipped sweet potatoes, raw broccoli, ranch dressing, watermelon slices
15	½ Cheeseburger (white bun, American cheese), seasoned fries, ketchup, mustard, spaghetti squash, Mandarin oranges	Pumpkin pancakes w/Maple syrup, scrambled eggs, whole wheat toast, yogurt parfait w/blackberries, strawberries, blueberries, granola
16	Toasted cheese sandwich (whole wheat bread), vegetable soup, grapes	Ham/pineapple flatbread, pumpkin bread, green beans, watermelon, apple wedges
17	Chili w/beans and tomatoes, saltine crackers, steamed broccoli, apple crisp	Sloppy Joes (whole wheat bun), harvest squash soup, Kashi™ crackers, grapes
18	Baked chicken leg, cornbread muffin, steamed spinach, Mandarin oranges	Tuna noodle casserole, carrots and celery sticks, ranch dressing, sweet potato puffs, pineapple
19	Fajitas (chicken, green pepper, onion, flour tortilla), lettuce, tomato, shredded cheese, salsa, Spanish rice, mixed tropical fruit	Chicken and noodles, frosted pumpkin muffins, salad w/celery and carrots, ranch or Italian dressing, banana and grapes
20	Breaded chicken patty, ketchup, wheat bread, broccoli Normandy, canned peach slices	Broccoli cheese mini quiche, squash/zucchini chocolate muffins, whole wheat breadstick, strawberry

		applesauce
21	Chicken nuggets, BBQ sauce, cornbread muffins, mixed veggies (peas, corn, green beans, carrots), mango slices, grapes	Bison meatloaf, mashed potatoes, green beans, pears
22	Pepperoni pizza pocket, tossed salad, ranch dressing, tropical mixed fruit (banana, pineapple, peach)	Sun butter and jelly cutout, broccoli and rice, string cheese, banana
23	Breaded chicken breast patty (white bun), ketchup, green beans, peaches	Spaghetti w/meat sauce, Parmesan cheese, wheat roll, mixed greens salad, ranch or Italian dressing, orange slices
24	Grilled cheese, potato soup, mixed veggies (peas, corn, green beans, carrots), grapes	Cheese pizza wheels, pasta salad, cottage cheese, grapes
25	Chicken strips, BBQ sauce, wheat bread, steamed carrots, applesauce	Beefy noodles, cinnamon raisin bread, raw carrots and celery, ranch dressing, fresh pear quarters

APPENDIX C

Photos of Selected Meals

Conventional Lunches

Locally-Sourced Lunches