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Patrick Ona
Eastern Illinois University

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Food Selection Trends and Requirements of Students

Participating in the National School Lunch Program

(TITLE)

BY

Patrick Ona

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

Master of Science

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

2010

YEAR

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Abstract

The purpose of this study was to determine if students that participated in the National School Lunch Program (NSLP) were receiving an excessive or inadequate amount of macronutrients and micronutrients set by SMI nutrient standards and 2005 Dietary Guidelines. There were four research objectives regarding food selection trends, School Meals Initiative (SMI), 2005 Dietary Guidelines, and competitive foods. The researcher hypothesized the food selections by school-aged children would not meet the SMI nutrient standards and 2005 Dietary Guidelines.

The study was a cross-section observational study that used a self-developed observation checklist. Quantitative data was gathered over the course of 5 days at a local elementary school in Illinois. The sample consisted of a stratified random sample of 881 students. The data was analyzed using frequencies and percentages.

The results indicated a high selection of milk (93% of students selected milk), lack of variety in the main entrees, and increased availability of fruits and vegetables as side items. The 5-day menu met the SMI nutrition standards and 2005 Dietary Guidelines for cholesterol (100% of days met requirement) and exceeded the requirements for sodium (60% of days met requirement). The student's food selections met the SMI nutrition standards and 2005 Dietary Guidelines for cholesterol (99% of students met requirement) and exceeded the requirements for sodium (55% of students met requirement). Furthermore, students that participated in the NSLP were less likely to select a competitive food (<50% of students selected competitive food).

Dedication

This thesis is dedicated to my parents, Nick and Lerma, my sister, Nicole, and my girlfriend, Laura, for their love and support.

Acknowledgements

I would like to thank the following individuals for their assistance during the research process:

Dr. Kennedy-Hagan, my thesis advisor, for her knowledge, expertise, commitment, and patience. Thank you for the time and energy you dedicated to this study. Your patience and flexibility allowed me to work on my own pace.

Dr. Honselman, for serving on my thesis committee with a passion for dietetics and public policy. Your enthusiasm in the classroom kept me motivated.

Dr. Taylor, for serving on my thesis committee with a great sense of humor and providing comic relief in class. Your knowledge in statistics made my data analysis process an easy experience.

The food service director at the elementary school for allowing me to collect data in your cafeteria.

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Chapter 1

Introduction

The National School Lunch Program (NSLP) and the School Breakfast Program (SBP) were created in 1946 under the US Department of Agriculture (USDA). Both programs are federally funded and administered through state child nutrition agencies and local school food districts. The NSLP and SBP provide subsidized meals to children in school. Children from low-income families obtain meals free or at a reduced price. In the 2004-2005 school year, the NSLP served 29.5 million meals on average per school day (Gordon, Cohen, Crepinsek, Fox, Hall, & Zeidman 2009).

Statement of Problem

In 1993, a study called the first School Nutrition Dietary Assessment Study (SNDA-I) focused attention on the nutritional quality of school meals. SNDA-I found meals offered to children in the school year of 1991-1992 were not consistent with goals specified in the Dietary Guidelines for Americans. In response, Congress passed the Healthy Meals for Healthy Americans Act of 1994. It required school meals to be consistent with the Dietary Guidelines for Americans. A year later the USDA implemented the 1995 School Meals Initiative (SMI). The SMI formalized and established new dietary standards for the school meal programs (Crepinsek, Gordon, McKinney, Condon, & Wilson, 2009).

Under SMI, schools participating in the NSLP and SBP have several options for planning menus that meet the program's nutrition requirements. More than two-thirds of schools follow the food-based menu planning approach (FBMP). In a FBMP approach, a minimum of five food components must be offered prior to the point-of-service to meet

SMI requirements: meat/meat alternative, two vegetable/fruit, grains/breads, and milk. School-aged children must select at least three of the five required food items to participate in the NSLP (Clark & Fox, 2009). To meet SMI requirements, the 5 food-components are nutritionally analyzed to approximate the average nutrient content of the meals as offered to school-aged children. Therefore, the problem is the minimum requirements set by the SMI and 2005 Dietary Guidelines for food component selections is 3, and the meals are nutritionally analyzed for 5 food component selections. A potential problem exists when the student's food selection is 3 to 4 food components, and it would not meet the requirements set by the SMI and 2005 Dietary Guidelines (USDA, 2007, e).

Purpose

The purpose of this study was to determine if student's participating in the NSLP were receiving an excessive or inadequate amount of macronutrients and micronutrients set by SMI nutrient standards and 2005 Dietary Guidelines.

Research Objectives

1. To examine the food selection trends of school-age children in a food-based menu-planning approach.
2. To determine if a one-week lunch menu meets SMI nutrition standards and 2005 Dietary Guidelines.
3. To determine if the student's daily food selection meets the SMI nutrition standards and 2005 Dietary Guidelines.
4. To examine the extent of the competitive foods available.

Hypothesis

The researcher hypothesized the food selections by school-aged children would not meet the SMI nutrient standards and 2005 Dietary Guidelines.

Definition of Terms

1. Food-based menu planning – A planning system designed to provide approximately one-third of the Recommended Dietary Allowance (RDA) for various age groups averaged over a period of time. Using this approach, a minimum of five food components must be offered prior to the point-of-service to meet SMI requirements: meat/meat alternative, two vegetable/fruit, grains/breads, and milk. School-aged children must select at least three of the five required food items to participate in the NSLP (USDA, 2007, e).

2. SMI - The School Meals Initiative (SMI) includes all of the NSLP and SBP regulations and policies that address the nutrition standards for school meals (USDA, 2007, c).

3. Dietary Guidelines – The federal government's main nutrition guidance for the general public. <10% of total calories from saturated fat, 20-35% of total calories from fat, 45-55% of total calories from carbohydrates, <2,300 mg of sodium (USDHHS, 2005).

4. Macronutrients – Protein, carbohydrates, fats, and calories.

5. Micronutrients – Vitamins and minerals

6. School-aged – Children in grade levels pre-kindergarten through 6. Their age's range from 5 to 12.

7. Competitive foods - Foods and beverages that are sold, served, or given to children in schools but are not part of subsidized school meals (O'Toole, Anderson, Miller, & Guthrie, 2007).

Chapter 2

Literature Review

This review will address two areas: (a) school meal programs and (b) childhood obesity. The subtopics for (a) include: types of menu planning approaches, SMI, and 2005 Dietary Guidelines. The subtopics for (b) include: school food environment, competitive foods, and alternative school based programs.

School Meal Programs

School meal programs, including the NSLP and the SBP, play an important role in children's diets and can thus influence their weight status. On school days, children obtain a substantial proportion of their calories while at school, largely from the meal programs (Gleason & Suitor, 2001; Gordon, et al. 2007). The Third School Nutrition Dietary Assessment Study (SNDA-III) data indicated that more than one fourth (26%) of calories consumed by the average child on a school day were both obtained and consumed at school (Briefel, Wilson, & Gleason, 2009). The proportion of calories consumed at school was higher among school meal participants, with NSLP participants getting 35% of their daily food energy from foods obtained and consumed at school. Furthermore, those who participated in both the SBP and NSLP consumed 47% of their energy from the school meal program. Children also expend a large proportion of their daily energy (up to half) while at school (Institute of Medicine, 2005). Several commentators have suggested that by boosting children's intake of saturated fat and total calories, the meal programs may have contributed to the rising levels of childhood obesity (Haskins, 2005; Physicians Committee, 2007)

The majority of research on school meal programs have focused on dietary intake. The SNDA-III showed NSLP participation led to a higher intake of fat in children's diets, but lower intakes of carbohydrates and added sugars in particular. NSLP participation also leads to higher daily intakes of a number of key vitamins and minerals. The effects of the SBP are less consistent, and suggest children's intake at breakfast alone often did not persist over the SNDA-III study (Gordon, Devaney, & Burghardt, 2005).

Types of Menu Planning Approaches

Schools participating in the NSLP and SBP can use either a food-based or a nutrient-based approach in planning menus that meet nutrient requirements (USDA, 2007, a). Understanding and learning about the different approaches is important for each school district and food service facility. Regardless of the school's menu planning approach, school meals are required to meet the target nutrition goals or standards. It can be a challenge for a school district to make the proper choice. However, correctly implementing the selected approach is necessary to serve reimbursable meals (USDA, 2007, b).

The differences in meal planning requirements differed slightly depending on whether the school used food-based menu planning or nutrient standard menu planning. In schools with food-based menu planning systems, children were counted as NSLP participants if the food service staff reported school-aged children consumed at least three of the five required food items (i.e., one grain, one meat/meat alternative, two fruits and/or vegetables, one milk) for lunch. In nutrient standard menu planning schools, children were counted as NSLP participants if the food service staff reported school aged children consumed at least one entrée and one side for lunch and both were obtained from

the cafeteria and were on the school menu, or if the food service staff reported school aged children consumed at least one entrée or side obtained from the cafeteria that was on the school menu (Clark & Fox, 2009).

Food-based menu planning approach. The traditional food-based menu planning approach, which, according to the SNDA-III, the majority of schools are using, allows schools to serve one meal pattern to all children in a school system. There are two-kinds of food-based menu planning approaches: traditional and enhanced. Both use meal patterns as menu planning tools, and both require specific food components in specific quantities. These meal patterns are similar to the food groups of the My Pyramid Food Guidance System in which various foods have been grouped together based upon their nutritional contributions to our diets (Miller, 2009).

The food-based menu planning approach has advantages. First, the food-based menu planning approach offers ease in transition. The familiarity and structure of meal patterns eases the transition to incorporating healthier practices to meet the SMI requirements. Students and cashiers understand the requirements for a reimbursable meal. Second, there are not any additional costs involved in the purchase and support of computer hardware and USDA-approved software. Third, special computer skills or time for data entry and analysis are not required (USDA, 2007, e). Fourth, there is minimal staff training. The familiarity of meal patterns allows staff training to be minimized. Fifth, the food-based menu planning approach is linked to the USDA Food Guidance System. It's easier to use school meals as a link to classroom nutrition education because they are modeled after the My Pyramid USDA's Food Guidance System. Finally, the

nutrient analysis is conducted by the state agency. The state agency performs the nutrient analysis as part of the SMI review for a pre-determined week's menu (USDA, 2007, e).

The food-based menu planning approach has disadvantages. First, it is less flexible in initial menu planning. The structured meal patterns with specific food components and quantities may be less flexible for menu planning and more difficult to customize for specific populations. Second, nutrient levels are unknown until nutrient analysis is conducted. It is difficult to determine if the nutrient targets are being met without computer analysis (USDA, 2007, e).

Nutrient-based menu planning approach. There are two nutrient-based menu-planning approaches: nutrient standard menu planning approach and the assisted nutrient standard menu planning approach. Rather than planning menus based on specific food groups and quantities, menu planning is done through nutrient analysis. Reimbursable meals are defined as those meeting the nutrient standards for the appropriate age/grade groups when averaged over a school week (USDA, 2007, f). The use of computerized nutrient analysis for meal planning in schools provides information on probabilistic nutrient analysis (JADA, 1998).

The nutrient based menu planning approach has advantages. First, there is flexibility in menu planning. Menu items do not require any specific foods or specific quantities, except fluid milk, which must be offered at lunch and breakfast. All foods count toward meeting the nutrition requirements, except foods of minimal nutritional value that are not a part of a menu item (USDA, 2007, g). Second, there is an enhanced ability to meet specific student preferences. Schools may be better able to meet specific student preferences such as vegetarian diets or various ethnic entrees. Third, the nutrient

analysis offers immediate nutrition information feedback. Fourth, it provides the ability to inform students and parents of the nutritional content of school menus (USDA, 2007, f).

The nutrient based menu planning approach has disadvantages. First, the appropriate computer hardware and USDA-approved software must be initially purchased, supported, and maintained. Second, the menu planner must possess sufficient nutrition and food preparation knowledge to accurately conduct and evaluate the nutrient analyses, using the Nutrient Analysis Protocols manual to ensure that food items, recipes, and menu data entries have been correctly made (USDA, 2007, h). Third, it requires a sufficient amount of time. The nutrient information of commercially prepared foods that are not in the nutrient analysis database must be entered into the computer. Local recipes, including any modifications made to USDA recipes must be entered into the computer. If there are any changes to the menus for modifications and substitutions, the menus must be re-analyzed to meet nutrient analyzed (USDA, 2007, g).

Menu Cycles. Menu cycles are menus that are developed for a certain length of time and repeated on a periodic basis. Using menu cycles developed for breakfast and lunch for any of the menu planning approaches will save time and increase efficiency. Menu cycles can save time by allowing you to plan basic menus by meal patterns or by nutrient analysis only once during the school year (USDA, 2007, c).

Schools Meals Initiative

The SMI includes all of the NSLP and the SBP regulations and policies that address the nutrition standards for school meals. These SMI regulations augment the nutrition requirements for the NSLP and the SBP and provide schools with a variety of

alternatives for planning menus. In addition, SMI encompasses actions to support State agencies and school food authorities in improving school meals and encouraging children to improve their overall diets (USDA, 2007, d). Additionally, the SMI revolutionized the NSLP and SBP by incorporating the Dietary Guidelines for Americans into menu standards. Each year US schools renew their commitment to a specific menu planning strategy and information concerning the nutrient composition of meals planned using each approach (Priscilla & Simpson, 2004).

Since the SMI nutrient standards were established, there have been important changes in the environments in which school meal programs operate. Schools have been identified as a major venue for addressing childhood obesity and fostering healthy eating habits among school-aged children (Story, Kaphingst, & French, 2006). In addition, there have been major changes in nutrition recommendations and dietary reference standards for the US population. In particular, Dietary Reference Intakes have replaced the RDAs and the Dietary Guidelines were revised in 2005 (IOM, 2000).

2005 Dietary Guidelines

In 2005, the SNDA-III found that nearly all schools in their study provided lunches that were consistent with the 2005 Dietary Guidelines-based requirement for cholesterol (<100 mg). In contrast, essentially no school provided lunches with less than one third of the recommended maximum daily intake of sodium (767 mg per average lunch). The mean sodium content of lunches offered to children was 1,442 mg, almost twice the recommended level. Use of the 2005 Dietary Guidelines as the basis for assessing total fat resulted in a substantially larger share of school (about 60%) providing lunches that fell within the recommended range-three times as many as those that met the

SMI standard (19%). In almost all the remaining schools, the average lunch exceeded the upper limit of the range, providing more than 35% of energy from total fat (Crepinsek, Gordon, McKinney, Condon, & Wilson, 2009).

Childhood Obesity

Twenty-five million American children are overweight or obese. What has properly been termed an epidemic costs up to $14 billion annually in direct health care treatment and poses significant risks for children's physical health and psychosocial well-being. The Centers for Disease Control and Prevention (CDC) reported that the percentage of US children and adolescents who are overweight and obese has more than tripled since 1980. Nearly one out of three school-aged children in the United States are overweight or obese, and is thus predisposed to the associated negative health consequences, such as type 2 diabetes and coronary heart disease, later in life. Low-income and minority children are at increased risk. An 8-year study to determine the incidence of type 2 diabetes among adults showed that living in poor neighborhoods was a significant predictor of diabetes (Briefel, Crepinsek, Cabili, Wilson, & Gleason, 2009).

The prevalence of childhood overweight and obesity is highest among certain ethnic and racial groups such as African Americans, Latinos, and American Indians and Alaska Natives, and among low-income youth. In 2006, 16% of youth 6 to 17 years of age lived in poverty. Approximately 17% of youth (12.6 million) lived in households that were food insecure (lack of access at times to enough food). Obesity and hunger may co-exist in low-income families, presenting a challenge for school nutrition programs to balance both preventing hunger and preventing overweight (Haskins, Paxson, & Donahue, 2006).

School Food Environment

Environmental and policy changes that lead to improved dietary and physical activity behavior are a powerful strategy to reverse the obesity epidemic. In its action plan for the prevention of childhood obesity, the Institute of Medicine (IOM) concluded that schools should be a primary setting for such changes. The rationale is clear. Children spend a significant amount of their time at school. While there they consume, on average, 35% of their daily food intake and expend up to 50% of their daily energy (Briefel, Wilson, & Gleason, 2009).

The US Congress formally recognized the pivotal role schools can play in promoting children's health and reducing childhood obesity when, as part of the Child Nutrition and WIC Reauthorization Act of 2004, it required that local education agencies participating in federally sponsored child nutrition program develop school wellness policies. As a result of the 2004 legislation and a 2005 IOM report on childhood obesity, many state and local policymakers launched efforts to promote changes in school food environments and practices (Cullen, Watson, & Zakeri, 2008).

The school food environments and practices in any given school can be influenced by a variety of community and school-level characteristics (eg, public education finance systems, food availability and marketing, and cultural norms), and children's dietary behaviors and weight are influenced by many factors other than the school food environments and practices. One area receiving attention as a means to improve the school food environment involves competitive foods (Briefel, Crepinsek, Cabili, Wilson, & Gleason, 2009).

Competitive Foods

Schools may influence children's dietary intakes through two primary avenues. One is through the federally sponsored school meal programs, the NSLP and SBP, and the other is through competitive foods. They are foods and beverages that are sold, served, or given to children in schools but are not part of subsidized school meals. Competitive foods may be sold on an a la carte basis in cafeteria lines or in other locations on school campuses. These foods may be purchased through vending machines, a la carte menu items in cafeteria lines, school stores, or fundraising events. The revenue from the competitive foods provides children with classroom parties, school celebrations, or other activities. Such foods are usually low nutrient and energy-dense and are often influenced by contracts between schools and food and beverage companies (O'Toole, Anderson, Miller, & Guthrie, 2007).

Sales of competitive foods can generate a substantial amount of revenues, which schools use to support foodservice operations and student activities, such as field trips, assemblies, special programs, and athletic events. The USDA, which administers the school meal programs, has limited control over competitive foods. The only existing federal requirement that exerts specific restrictions on competitive food is that foods of minimal nutritional value, defined as foods and beverages that have <5% of the RDA per serving for eight key nutrients, cannot be sold in school foodservice areas during meal times (US General Accounting, 2005). Foods considered to be of minimal nutritional value include soft drinks, water ices, chewing gum, and certain candies. However, in the 2006-2007 school year, school districts that participated in the NSLP were required to

have a wellness policy that includes nutrition guidelines for all foods available on school campuses during the school day (Fox, Gordon, Nogales, & Wilson, 2009).

In 2004-2005, competitive foods were widely available in public schools. One or more sources of competitive foods were available in 73% of elementary schools, 97% of middle schools, and 100% of high schools. This included a la carte items sold in school cafeterias, as well as items from vending machines, school stores, snack bars, food carts, and other sources. A la carte options were common at all school levels, particularly at lunch, but there was a substantial difference in availability in elementary schools and secondary schools. About two thirds of elementary schools offered a la carte options at lunch, compared to 90% of middle schools and 92% of high schools. Similarly, about a third of all elementary schools offered a la carte options at breakfast, compared with 67% of middle schools, and 61% of high schools (Fox, Gordon, Nogales, & Wilson, 2009).

Vending machines were available to children in more than one quarter (27%) of all elementary schools, more than 8 of 10 middle schools, and virtually all high schools. In less than 80% of high schools and more than half of middle schools, vending machines were available in or near the cafeteria. Other sources of competitive foods were much less common than a la carte and vending machines (Fox, Gordon, Nogales, & Wilson, 2009).

Alternative School-Based Programs

School-based programs that combine healthful eating and physical activity may provide the best opportunity to enhance health and thus lower the risk of chronic diseases later in life. In elementary schools, the Girls Health Enrichment Multisite research found favorable outcomes in participation and behavioral change related to prevention of

obesity in African-American girls, and the Pathways research found positive changes in fat intake and in food and health-related knowledge, attitudes, and behaviors, although there was no substantial reduction in body fat. Planet Health, a middle-school obesity prevention program, achieved obesity reduction by promoting nutrition and physical activity and reducing television viewing (Caballero, et al. 2003).

Chapter 3

Methodology

Design of Study

The study was a cross-section observational study that used a self-developed observation checklist to determine the food selection trends of school-aged children. Quantitative data was gathered over the course of 5 days. The sample consisted of a stratified random sample of 881 students over 5 days participating in the NSLP. The Institutional Review Board (IRB) approved the study.

Sample

The sample consisted of a stratified random sample of 881 students. There was an average of 176 students per day. They were chosen from a population of 642 students at a local elementary school. Students were observed more than once. The school was chosen based on their willingness to participate in the study. The subjects were between the ages of 8 and 12 years old. They were male and female. The ethnicities of the subjects were Caucasian, African-American, Hispanic, and Asian.

The local elementary school was in a central Illinois town with a population of 21, 710. The major industries of the town were manufacturing, medical services, and farming. The total enrollment at the elementary school was 642 students. The grade levels taught at the school were fourth, fifth, and sixth grade.

Instrument

The name of the instrument is the "Ona Menu Planning Observation Checklist." The instrument was a self-developed data collection observation checklist. The menus for each day were available online on the school's website, and the checklist was organized

in advanced according to the menu. Horizontally on the x-axis, there were four sections: main entrees, side items, milk, and competitive foods. In the main entrees sub-section, there were three columns numbered: one, two, and three. In the side items sub-section, there were four columns numbered: one, two, three, and four. In the milk and competitive foods column, there was only one column per sub-section. The numbers in each column correspond to the names of the menu items in the legend. Vertically on the y-axis, there was a list of numbers from 1 to 60, and it corresponded to the number of students. A space at the top of the instrument indicated the date, lunch line number, and lunch period.

The instrument was influenced by a pilot study completed on 60 students. The initial instrument did not use numbers to signify the menu components. The names of the menu components were manually written onto the instrument. As the sample size increased, the researcher found the need to use numbers and a legend to represent the menu components. The numbers would be able to give each student a combination code of selected food components for data analysis.

Pre-Study Observations

The researcher attended a lunch period to become familiar with the lunchtime procedure and to determine if any modifications to the instrument were necessary. The pre-study observations gave the researcher an opportunity to meet the food service director and learn about the school's menu planning system.

Procedure for Data Collection

There were three lunch periods: A, B, & C. Each period was 30 minutes in duration, and the lunchtime was from 11:30am to 1:00pm. The data collection took place over 5 days. The researcher was stationed at the end of the lunch line alongside the

cashier. As the students exited the line, the selected menu components were checked off from the observation checklist. The data was stored with the researcher.

Data Analysis

Data was analyzed with Microsoft Excel. The types of trends (research objective 1) included: the number of selected food items, the most and least selected main entrees, the most and least selected side items, the selection of milk, and the extent of available competitive foods (research objective 4).

To determine if a 5-day lunch menu met the SMI and 2005 Dietary Guidelines (research objective 2), frequencies and percentages were used. The macronutrients and micronutrients for each menu item were inputted to a spreadsheet. The source of the nutritional information for each menu item was from the USDA National Nutrient Database for Standard Reference. Given that only one main entrée could be selected at a time, the mean was taken from the three main entrees. A sodium level of <767 mg and cholesterol of <100 mg were used as a requirement to determine if the 5-day lunch menu met the SMI and 2005 Dietary Guidelines.

To determine if the student's food selection met the SMI and 2005 Dietary Guidelines (research objective 3), frequencies and percentages were used. Each of the student's food selection combination was calculated. The food selection combination was the type and number of selected main entrées, side items, and milk. The total amount of macronutrients and micronutrients for the main entrees, side items, and milk were summed together for each student. The source of the nutritional information for each menu item was from the USDA National Nutrient Database for Standard Reference. A

sodium level of <767 mg and cholesterol of <100 mg were used as a requirement to determine if a student met the SMI and 2005 Dietary Guidelines.

Chapter 4

Results

The purpose of this study was to determine if students that participated in the NSLP were receiving an excessive or inadequate amount of macronutrients and micronutrients set by SMI nutrient standards and 2005 Dietary Guidelines. The following research objectives guided the study:

1. To examine the food selection trends of school-age children in a food-based menu-planning approach.
2. To determine if a one-week lunch menu meets SMI nutrition standards and 2005 Dietary Guidelines.
3. To determine if the student's daily food selection meets the SMI nutrition standards and 2005 Dietary Guidelines.
4. To examine the extent of the competitive foods available.

Data was collected for 5 consecutive days from Monday to Friday in late October of 2010. A total of 881 students participated in the study, and their selections were analyzed over the course of the study. The research hypothesis was rejected. The student's food selections did not meet the SMI and 2005 Dietary Guidelines.

Research Objective 1: To examine the food selection trends of school-age children in a food-based menu-planning approach.

A total of 881 students participated in the NSLP over 5 consecutive days, Monday to Friday. The students were offered a minimum of five food components: meat/meat alternative, two vegetable/fruit, grains/breads, and milk. The students were required to select at least three of the five required food items to be counted as participants in the

NSLP. However, there was not a maximum amount of food components students could purchase.

For the main entrees, two out of the three daily offered selections were pizza and hamburger. The third main entrée changed daily. On Monday, Tuesday, Wednesday, Thursday, and Friday, they offered chicken patty on bun, chicken nuggets, nachos, baked potato, and steak fingers, respectively. The most selected main entrée was pizza, 339 students. The least selected main entrée was baked potato, 16 students. The most selected main entrée offered once per week were chicken nuggets, 119 students. (Appendix B, Figure 1).

There were a total of four side items offered daily. Apples and salads were offered four out of the five days. Oranges were offered three out of the five days. Peaches were offered two out of the five days. Additionally, potatoes, green beans, mixed vegetables, pears, broccoli, gelatin, mashed potatoes, and applesauce were offered once per week. The most selected side item was salad, 237 students. The least selected side item was mixed vegetables, 38 students (Appendix B, Figure 2).

Milk was offered everyday to students. The most students selected milk on day 4, 191 students. Day 1 had the least students select milk, 150 students. Day 2 had the largest difference between the total number of students select milk and students that did not select milk, 24 students. Day 4 had the smallest difference between the total number of students select milk and students that did not select milk, 4 students. Overall, 7% of students did not select milk (Appendix B, Figure 3).

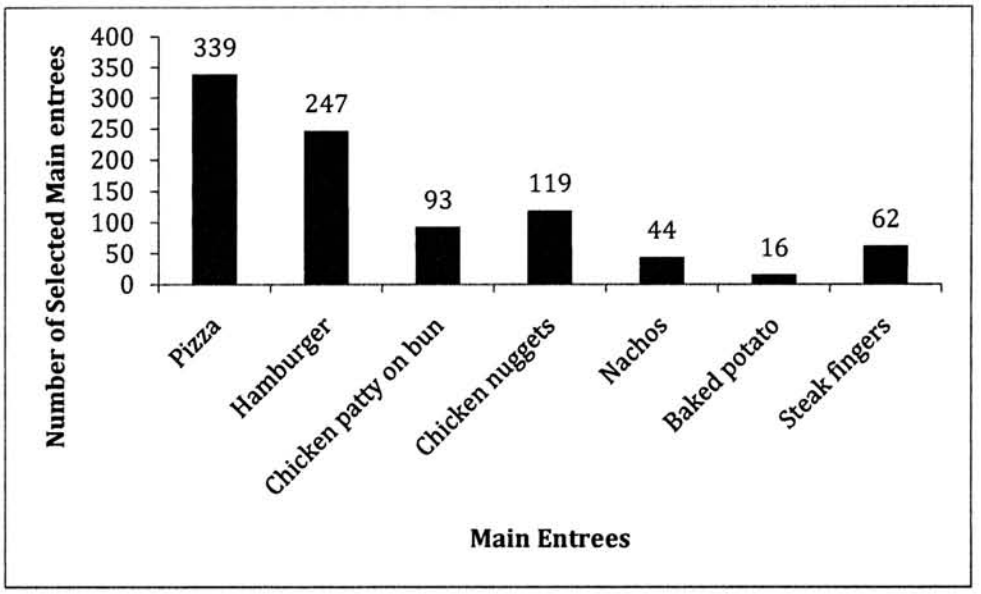

Figure 1. Frequency of Main Entrees

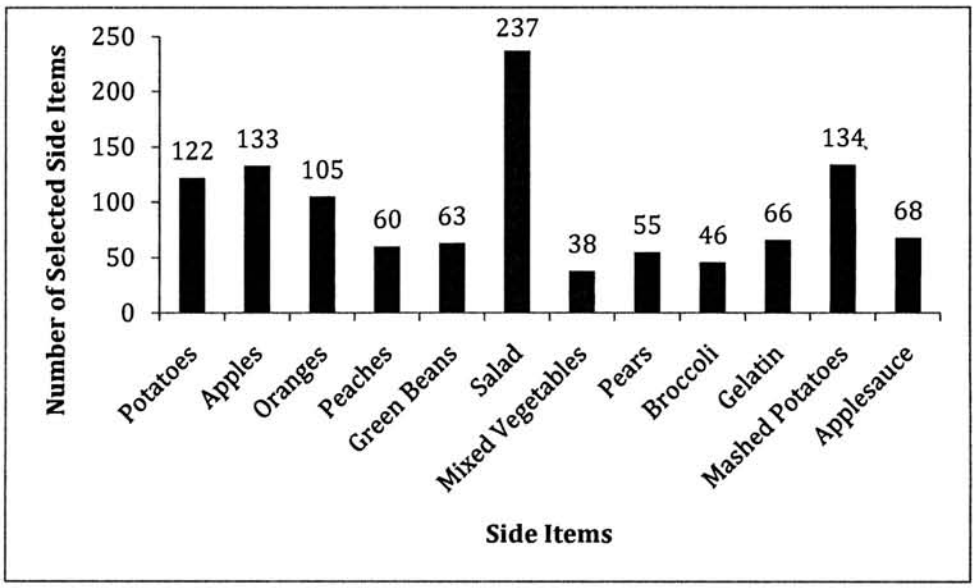

Figure 2. Frequency of Side Items

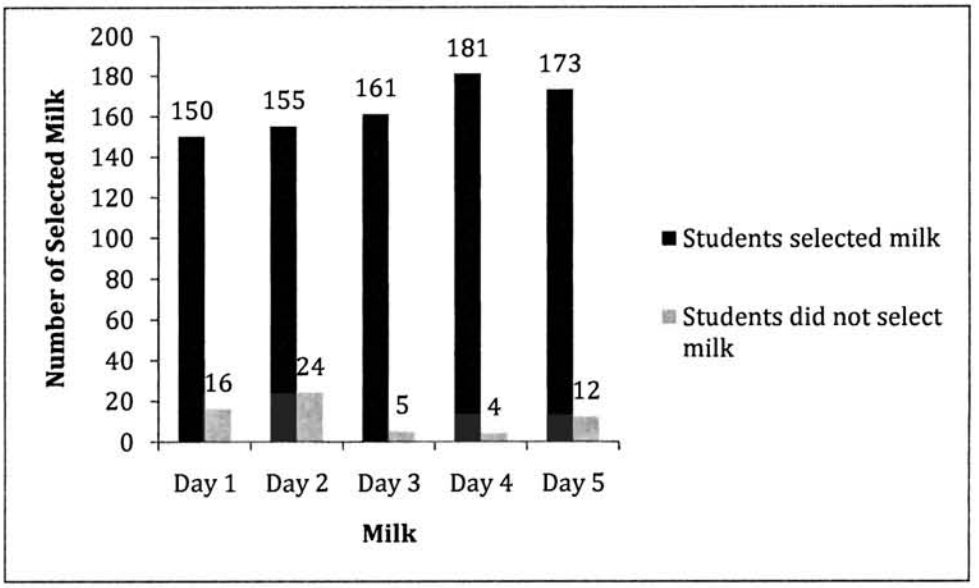

Figure 3. Frequency of Milk

Research Objective 2: To determine if a one-week lunch menu meets SMI nutrition standards and 2005 Dietary Guidelines.

To meet the requirements for the NSLP, a lunch must consist a minimum of five food components: meat/meat alternative, two vegetable/fruit, grains/breads, and milk. The lunch at the local elementary school offered three different types meat/meat alternative components, three vegetable/fruit components, one grain/bread component, and one milk component. The three-vegetable/fruit and one-grain/bread components comprised the side items. The three different types of meat/meat alternative consisted of the main entrees. Collectively, there was a total of eight food components offered to the students. It met the requirements for the NSLP.

The SMI and 2005 Dietary Guidelines-based requirements for sodium, <767 mg, and cholesterol, <100 mg, were used to determine if a 5-day lunch menu met the SMI and 2005 Dietary Guideline requirements. The source of the nutritional information was from the USDA National Nutrient Database for Standard Reference. The sodium and

cholesterol values for each food component were calculated based on the serving size. The average of the three main entrees was taken.

On day 1, the cholesterol and sodium values were 59 mg and 1226 mg, respectively. The cholesterol value met the requirement, however the sodium value exceeded it. On day 2, the cholesterol and sodium values were 57 mg and 712 mg, respectively. The cholesterol and sodium values met the requirement. On day 3, the cholesterol and sodium values were 45 mg and 955 mg, respectively. The cholesterol value met the requirement, however the sodium value exceeded it. On day 4, the cholesterol and sodium values were 45 mg and 725 mg, respectively. The cholesterol and sodium values met the requirements. On day 5, the cholesterol and sodium values were 46 mg and 930 mg, respectively. The cholesterol value met the requirement, however the sodium value exceeded it (Appendix C).

Research Objective 3: To determine if the student's daily food selection meets the SMI nutrition standards and 2005 Dietary Guidelines.

The SMI nutrition standards and 2005 Dietary Guidelines for sodium, < 737 mg and cholesterol, < 100 mg, were used to determine if the student's daily food selections met the requirements. There were 881 students that participated in the NSLP for the 5-day study. The percentage of students that met the requirement for cholesterol was 99% (873 students) and 1% of students (8 students) did not meet the requirement (Figure 4). The percentage of students that met the requirement for sodium was 55% (482 students) and 45% (399 students) of students did not meet the requirement for sodium (Figure 5). The percentage of students that met the requirement for both the sodium and cholesterol

was 55% (481 students) and 45% (400 students) of students did not meet both the requirements (Figure 6).

On day 1, lunch A and B had 100% of the students meet the cholesterol requirement and lunch C had 98 % of students meet the requirement. The percentage of students that met the sodium requirement for lunch A, B, and C were 6%, 8%, and 5%, respectively. The percentage of students that met both requirements for lunch A, B, and C were 6%, 8%, and 5%, respectively (Appendix D).

On day 2, the percentage of students that met the cholesterol requirement for lunch A, B, and C were 98%, 97%, and 93%, respectively. The percentage of students that met the sodium requirement and combined cholesterol and sodium requirements for lunch A, B, and C were 86%, 82%, and 78%, respectively (Appendix D).

On day 3, lunch A, B, and C had 100% of the students meet the cholesterol requirement. The percentage of students that met the sodium requirement and combined cholesterol and sodium requirements for lunch A, B, and C were 65%, 41%, and 48% (Appendix D).

On day 4, lunch A, B, and C had 100% of the students meet the cholesterol requirement. Lunch B had 100% of students meet the sodium requirement and combined cholesterol and sodium requirements. The percentage of students that met the sodium requirement and combined cholesterol and sodium requirements for Lunch A and C was 60% and 95%, respectively (Appendix D).

On day 5, lunch A, B, and C had 100% of the students meet the requirement for cholesterol. The percentage of students that met the sodium requirement and combined

cholesterol and sodium requirements for lunch A, B, and C was 41%, 43%, and 43%, respectively (Appendix D).

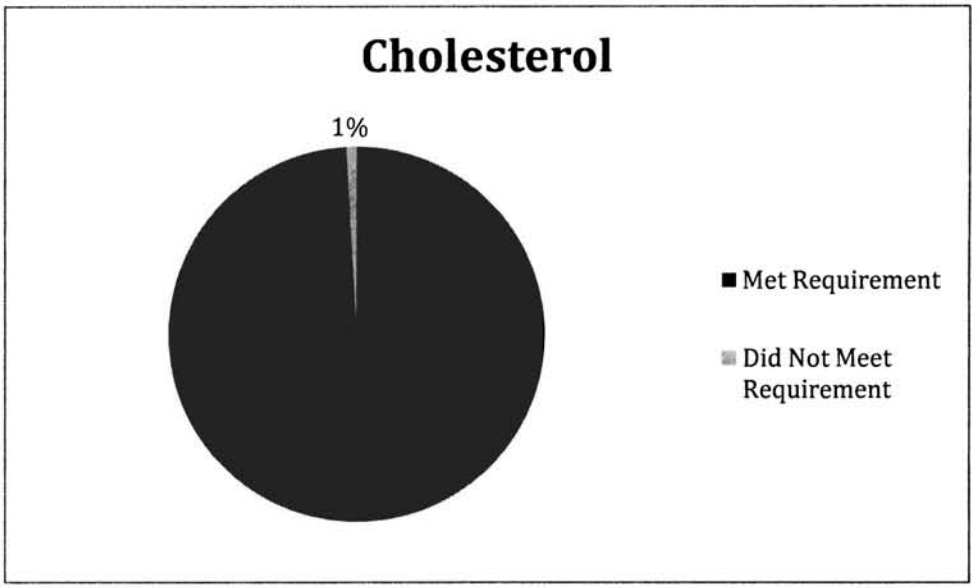

Figure 4. Percentage of Students that met Cholesterol Requirement

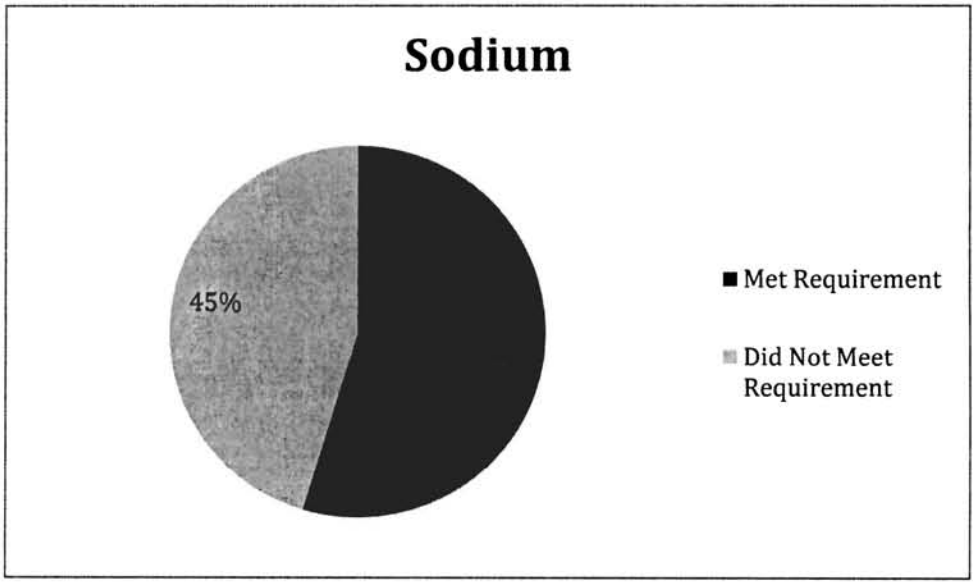

Figure 5. Percentage of Students that met Sodium Requirement

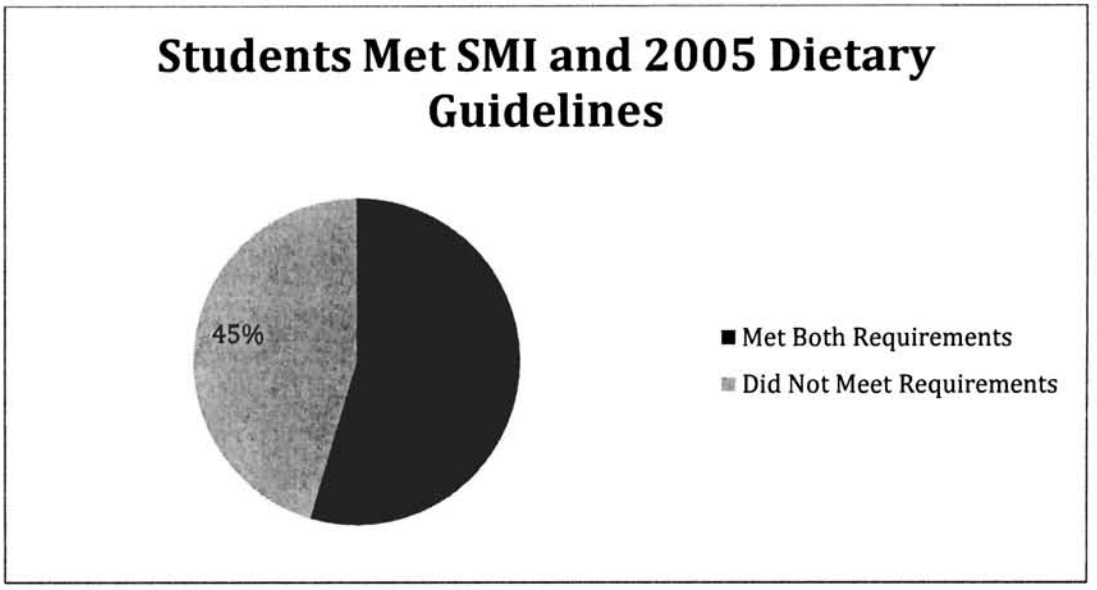

Figure 6. Percentage of Students that met Sodium and Cholesterol Requirements

Research Objective 4: To examine the extent of the competitive foods available.

Competitive foods are beverages and foods that are sold, served, or given to children in schools but are not part of subsidized school meals. Such foods are usually low nutrient and energy-dense and are often influenced by contracts between schools and food and beverage companies (O'Toole, Anderson, Miller, & Guthrie, 2007). In this research study, competitive foods were defined as foods that were not part of the food-based planned menus. The competitive foods were not counted towards the required minimum of three food components.

On day 1, the percentage of students that selected competitive foods for lunch A, B, and C were 13%, 21%, and 40%, respectively. On day 2, the percentage of students that selected competitive foods for lunch A, B, and C were 37%, 38%, and 35%, respectively. On day 3, the percentage of students that selected competitive foods for lunch A, B, and C were 37%, 38%, and 35%, respectively. On day 4, the percentage of students that selected competitive foods for lunch A, B, and C were 44%, 52%, and 40%,

respectively. On day 5, the percentage of students that selected competitive foods for lunch A, B, and C were 31%, 24%, and 38% (Appendix E).

Chapter 5
Discussion, Limitation, & Conclusion

Discussion

Research Objective 1: To examine the food selection trends of school-age children in a food-based menu-planning approach.

The results of research objective 1 offered insight into potential weaknesses of the school meals provided to students, which is a major component of the school food environment. The first weakness is the lack of variety in the main entrees offered to students. The results suggested that school meals offered children the same selection of main entrees daily, and the students repeatedly selected the same main entrees. The top two selected main entrees were pizza, 339, and hamburger, 247. Two out of the three daily offered main entrées were pizza and hamburger, and the third main entrée changed daily. Pizza and hamburger were considered a meat/meat alternative and grain/breads food component.

The school menu provided limited opportunities for children to select separate whole-grain products (as distinct items) at lunch. The student's food selections showed that a larger proportion of children consumed grain-based combination entrees, pizza (dough) and hamburger (bun), in comparison to separate whole-grain menu components. This suggests that efforts to increase whole-grain consumption at lunch could focus on incorporating whole-grains into combination entrees rather than promoting individual whole-grain items. For example, because a large proportion of children consumed pizza at lunch, schools that prepare dough from scratch could begin to gradually use whole-grain flours to develop a whole-grain pizza crust (Condon, Crepinsek, & Fox, 2009).

The USDA has taken many steps to increase the availability of fruits and vegetables in the school meal programs. A comparison of SNDA-III data to data from SNDA-II, conducted in school year 1998-1999, indicated that the availability of fresh fruit has increased in lunch menus (41% of menus in SNDA-II vs. 50% in SNDA-III) (Condon, Crepinsek, & Fox, 2009). The results of research objective 1 indicated the most selected side item was a vegetable, salad (237 students). The third most selected side item was a fruit, apple (133 students). Furthermore, salad and apples were offered four times a week. Oranges were offered three times a week. There were 12 different types of side items and 10 were either a fruit or vegetable. The results suggested that efforts to increase children's consumption, access, and availability of fruits and vegetables at lunch were satisfied.

To promote bone health and contribute to an overall healthful diet, the 2005 Dietary Guidelines stress the importance of consuming milk products, especially during childhood and adolescence. The results of research objective 1 suggested 7% of students did not select milk. Additionally, on day 4, there were only four students that did not select milk and 181 students selected milk. There were at least 150 students that selected milk each day. The highest amount of students that did not select milk was on day 2, 24 students. The high selection of milk by students could attribute to less proportion of students consuming other beverages, such as carbonated soda, fruit drinks, and bottled water. Therefore, the current availability of milk provided by the local elementary school and selection of milk by the students may promote bone health and contributes to an overall healthy diet, if the milk is consumed (Condon, Crepinsek, & Fox, 2009).

Research Objective 2: To determine if a one-week lunch menu meets SMI nutrition standards and 2005 Dietary Guidelines.

The results of research objective 2 indicated combination entrees provided most of the sodium in school lunches. Combination entrees can be counted as a meat/meat alternative and grain/bread food component. An unexpectedly large share of these entrees was prepared fast-food-like items, such as pizza (683 mg of sodium), chicken patty on bun (957 mg of sodium), steak fingers (650 mg of sodium), and nachos (816 mg of sodium). They were among the menu items with the highest amount of sodium. Chicken patty on bun (957 mg) and nachos (816 mg) were above the sodium requirement (767 mg) without side items or milk. The one-week lunch menu met the cholesterol requirement, < 100 mg. The fruit and vegetable side items, such as oranges, apples, peaches, salad, and broccoli did not have any cholesterol. The main sources of cholesterol in the menu were the main entrees, such as chicken patty on bun (60 mg of cholesterol) and chicken nuggets (58 mg of cholesterol).

Although prepared foods can be economical and convenient for schools to use, these results suggest exploring options to either develop more healthful products or equip schools with the necessary resources to prepare entrees from scratch. Nutrient standards for the school food industry could have a substantial influence on the overall sodium content of school meals. Another strategy may be to develop more meatless or vegetable entrees, testing them for acceptability by students. Reducing the sodium content of school lunch entrees may require changes to the food-based meal patterns; for example, there should be a reduction of the maximum quantities for meat/meat alternatives. In the meantime, states and school foodservice personnel responsible for food purchasing and

commodity processing can focus on providing vendors with specifications for maximum levels of sodium (Crepinsek, Gordon, McKinney, Condon, & Wilson, 2009).

A high sodium intake can lead to health related conditions, such as hypertension. Large population studies have demonstrated a positive association between dietary sodium intake and blood pressure over a wide range of sodium intakes. Intervention studies such as the Phase 2 of the Trials of Hypertension Prevention (TOHP) have shown that sodium reduction with or without weight loss can reduce the incidence of hypertension by 20%. A high salt intake has also been implicated in hypertensive target organ disease, including cardiovascular and renal damage (TOHP Collaborative Research Group, 2007).

Research Objective 3: To determine if the student's daily food selection meets the SMI nutrition standards and 2005 Dietary Guidelines.

There were a total of 881 students that were observed in the 5-day study. The percentage of students that met the requirement for cholesterol was 99% (873 students). The percentage of students that met the requirement for sodium was 55% (482 students). The percentage of students that met the requirement for sodium and cholesterol was 55% (481 students). Based on the percentage of students that met requirements for cholesterol and sodium, 55%, if a student met the requirement for sodium, they also met both requirements for cholesterol and sodium.

Overall, day 1 had the highest amount of sodium. The average sodium for day 1 was 1217 mg. It was 159% of the sodium requirement (767 mg). The menu component with the highest amount of sodium was chicken patty on bun, 957 mg. There were 93 students that selected chicken patty on bun. Those students were over the sodium

requirement, 767 mg, by the selection of the chicken patty on bun for their main entrée. The 2005 Dietary Guidelines for sodium intake in a day is 2,400 mg. The average sodium for day 1, 1217 mg, is almost half the recommended amount of sodium per day, 2,400 mg, in one meal. The student would need to average 600 mg of sodium for breakfast and dinner to fall below the 2,400 mg recommendation.

An important goal of the USDA school meal programs is to ensure that all children, especially those from economically disadvantaged families, have access to meals that make a significant contribution to their daily energy and nutrient requirements. A total of 881 students received a school meal in the 5-day study. Therefore, there is an inherent challenge for the USDA in meeting children's nutrient requirements while minimizing both hunger and obesity. Methods for revising school meal standards based on Estimated Energy Requirements, which account for body size and level of physical activity, could play a greater role in preventing childhood obesity through the school food environment. Hence, in the 5-day study, it was not possible to compare the energy content of school meals with the local elementary school-aged children's body size and level of physical activity (Crepinsek, Gordon, McKinney, Condon, & Wilson, 2009).

An increased need for children to access low sodium lunches has been a particular focus of SMI. The SNDA-II (school year 1998-1999) found that the average percentage of schools that exceeded the requirement for sodium was 100%. SNDA-III (school year 2004-2005) data showed that an additional 6 years of SMI implementation did not result in notable additional progress toward meeting the standard for sodium. The average percentage of schools that exceeded the requirement for sodium was 100%. Overall, the school did not meet the SMI and 2005 Dietary Guidelines requirement for sodium

(Gordon & Fox, 2007). The results of the SNDA-III were consistent with the results of the 5-day study; the local elementary school did not meet the SMI and 2005 Dietary Guidelines.

Research Objective 4: To examine the extent of the competitive foods available.

Interests in the availability and consumption of competitive foods have increased during the past decade, largely in response to concerns about childhood obesity. The SNDA-III data indicated that consumption of competitive foods was widespread, particularly in middle and elementary school. Sources of competitive foods varied by type of school, with vending machines and a la carte purchases most common in school lunches, fundraisers, and other school activities. The specific competitive foods consumed most frequently were low-nutrient, energy-dense foods such as fruit drinks/sport drinks, cookies/cakes/brownies, candy, and carbonated sodas. On average, children who consumed one or more competitive foods obtained 177 calories (8% of total daily energy intake) from low-nutrient, energy-dense competitive foods (Fox, Gordon, Nogales, & Wilson, 2009).

SNDA-III findings on the types of competitive foods being consumed by children are consistent with previous research that used smaller, local samples similar to the 5-day study. Children who ate school lunches were less likely than children who did not eat school lunches to consume competitive foods. (Fox, Gordon, Nogales, & Wilson, 2009). The results of the 5-day study were consistent with the SNDA-III. Less than 50% of students selected a type of competitive food in all 5 days. The highest average, 46% of students, took place on day 4. The lowest average, 21% of students, took place on day 1.

Limitations

A potential limitation is the exploration of the student's gender, age, and ethnicity. An accurate assessment of each student's gender, age, and ethnicity from an observational study would prove to be bias. The gender, age, and ethnicity of the sample would be based on the researcher's point of view. A questionnaire distributed to each student would be the only objective method to determine gender, age, and ethnicity. The focus of the study was on food selection and not consumption. A nutritional analysis of each student may have provided information about the student's macronutrient and micronutrient consumption.

Conclusion

It was hypothesized the food selections made by school-aged children would not meet the SMI nutrient standards and 2005 Dietary Guidelines. The results indicated a high selection of milk and in increased availability of fruits and vegetables as side items. Furthermore, The results suggested that the school meals offered children the same selection of main entrees (pizza and hamburger) daily, and the students repeatedly selected the same main entrees. Pizza and hamburger were among the highest in sodium. Therefore, the inadequate menu variety offered to students is related to the student's food selection trends as evidenced by the student's daily food selections not meeting the SMI nutrient standards and 2005 Dietary guidelines for sodium.

The 5-day menu met the SMI nutrient standards and 2005 Dietary Guidelines for cholesterol and exceeded the requirement for sodium. Each of the student's daily food selection met the SMI nutrient standards and 2005 Dietary Guidelines for cholesterol and exceeded the requirements for sodium. Students that participated in the NSLP were less

likely to select a competitive food. Therefore, the researcher's hypothesis was correct. The food selections made by the school-aged children did not meet the SMI nutrient standards and 2005 Dietary Guidelines.

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Appendix A – Ona Menu Planning Observation Checklist

Date									
Period				Menu Items					
Line									
Student	Main Entrees			Sides				Milk	Competitive Food
	1	2	3	1	2	3	4	1	1
1									
2									
3									
4									
5									
6									
7									
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60									

Main Entrees
1 =
2 =
3 =
Side Items
1 =
2 =
3 =
4 =
Milk
1 =
Competitive Food
1 =

Appendix B – Summary of Food Selections

Summary of Food Selections

Day 1	Period 1	Period 2	Period 3	Total	*Mean*	*Standard Deviation*
Main Entrée						
Hamburger	12	8	7	27	9	3
Chicken Patty on Bun	29	33	31	93	31	2
Pizza	12	18	21	51	17	5
Side Items						
Potatoes	39	38	45	122	41	4
Apples	8	9	10	27	9	1
Oranges	13	7	8	28	9	3
Peaches	10	13	12	35	12	2
Milk						
Milk	47	49	54	150	50	4
Competitive Food						
Chips	7	11	23	41	14	8
Total number of students - each period	52	57	57	166	55	3
Total number of students - day 1	166					

Day 2	Period 1	Period 2	Period 3	Total	*Mean*	*Standard Deviation*
Main Entrée						
Pizza	9	10	10	29	10	0
Chicken Nuggets	42	37	40	119	40	2
Hamburgers	10	18	18	46	15	4
Side Items						
Green Beans	34	14	15	63	21	9
Salad	17	16	17	50	17	0
Oranges	13	20	19	52	17	3
Peaches	19	22	19	60	20	1
Milk						
Milk	50	52	53	155	52	1
Competitive Foods						
Chips	22	23	21	66	22	1
Total number of students - each period	59	60	60	179	60	0
Total number of students - day 2	179					

Day 3	Period 1	Period 2	Period 3	Total	*Mean*	*Standard Deviation*
Main Entrée						
Pizza	18	18	13	49	16	3
Nachos	10	17	17	44	15	4
Hamburger	27	19	30	76	25	6
Side Items						
Mixed Vegetables	15	14	9	38	13	3
Apples	13	15	21	49	16	4
Pears	20	21	14	55	18	4
Salad	24	14	27	65	22	7
Milk						
Milk	52	52	57	161	54	3
Competitive Foods						
Chips	18	23	22	63	21	3
Total number of students - each period	54	54	58	166	55	2
Total number of students - day 3	166					

Day 4	Period 1	Period 2	Period 3	Total	*Mean*	*Standard Deviation*
Main Entrée						
Baked Potato	10	3	3	16	5	4
Hamburger	32	36	37	105	35	3
Pizza	23	23	25	71	24	1
Side Items						
Broccoli	17	19	10	46	15	5
Salad	20	23	25	68	23	3
Apples	16	16	25	57	19	5
Gelatin	28	19	19	66	22	5
Milk						
Milk	61	56	64	181	60	4
Competitive Foods						
Chips	28	33	25	86	29	4
Total number of students - each period	63	61	61	185	62	1
Total number of students - day 4	185					

Day 5	Period 1	Period 2	Period 3	Total	*Mean*	*Standard Deviation*
Main Entrée						
Steakfingers	29	18	15	62	21	7
Hamburgers	23	29	33	85	28	5
Pizza	8	20	19	47	16	7
Side Items						
Mashed Potatoes	48	50	36	134	45	8
Salad	14	17	23	54	18	5
Oranges	7	10	8	25	8	2
Applesauce	22	27	19	68	23	4
Milk						
Milk	57	55	61	173	58	3
Competitive Foods						
Chips	18	15	24	57	19	5
Total number of students - each period	59	63	63	185	62	2
Total number of students - day 5	185					
Total number of students - 5 days	881					

Appendix C
Sodium and Cholesterol Levels for a 5-Day Menu

	Entrées				Sides					
Day 1	Hamburger	Chicken Patty on Bun	Pizza	Mean	Potatoes	Apples	Oranges	Peaches	Milk	Total
Serving Size (g)	86	182	108	125	72	149	140	251	250	987
Cholesterol (mg)	28	60	29	39	0	0	0	0	20	59
Sodium (mg)	378	957	683	673	373	1	1	13	165	1226
Day 2	Pizza	Chicken Nuggets	Hamburgers	Mean	Green Beans	Salad	Oranges	Peaches	Milk	Total
Serving Size (g)	108	64	86	86	135	207	140	251	250	1069
Cholesterol (mg)	29	53	28	37	0	0	0	0	20	57
Sodium (mg)	683	367	378	476	3	54	1	13	165	712
Day 3	Pizza	Nachos	Hamburger	Mean	Mixed Vegetables	Apples	Pears	Salad	Milk	Total
Serving Size (g)	108	113	86	102	275	149	251	207	250	1234
Cholesterol (mg)	29	18	28	25	0	0	0	0	20	45
Sodium (mg)	683	816	378	626	96	1	13	54	165	955
Day 4	Baked Potato	Hamburger	Pizza	Mean	Broccoli	Salad	Apples	Jello	Milk	Total
Serving Size (g)	296	86	108	163	184	207	149	2	250	955
Cholesterol (mg)	18	28	29	25	0	0	0	0	20	45
Sodium (mg)	382	378	683	481	20	54	1	4	165	725
Day 5	Steakfingers	Hamburgers	Pizza	Mean	Mashed Potatoes	Salad	Oranges	Applesauce	Milk	Total
Serving Size (g)	71	86	108	88	200	207	140	246	250	1131
Cholesterol (mg)	20	28	29	26	0	0	0	0	20	46
Sodium (mg)	650	378	683	570	134	54	1	5	165	929

2005 Dietary Guidelines	
Cholesterol	<100 mg
Sodium	<767 mg

Source

USDA National Nutrient Database for Standard Reference
http://www.nal.usda.gov/fnic/foodcomp/search/index.html

Appendix D
Percentage of Students that Met SMI and 2005 Dietary Guidelines

Day 1	Cholesterol	Sodium	Both
Lunch A (*n*=52)	100%	6%	6%
Lunch B (*n*=52)	100%	8%	8%
Lunch C (*n*=57)	98%	5%	5%
Day 2			
Lunch A (*n*=59)	98%	86%	86%
Lunch B (*n*=61)	97%	82%	82%
Lunch C (*n*=60)	93%	78%	77%
Day 3			
Lunch A (*n*=54)	100%	65%	65%
Lunch B (*n*=54)	100%	41%	41%
Lunch C (*n*=58)	100%	48%	48%
Day 4			
Lunch A (*n*=63)	100%	60%	60%
Lunch B (*n*=63)	100%	100%	100%
Lunch C (*n*=63)	100%	95%	95%
Day 5			
Lunch A (*n*=59)	100%	41%	41%
Lunch B (*n*=63)	100%	43%	43%
Lunch C (*n*=63)	100%	43%	43%
Total	99%	55%	55%

Appendix E
Percentage of Students that Selected Competitive Foods

	Day 1
Lunch A (*n* =52)	13%
Lunch B (*n* =52)	21%
Lunch C (*n* =57)	40%
Average	25%
SD	14%
	Day 2
Lunch A (*n* =59)	37%
Lunch B (*n* =61)	38%
Lunch C (*n* =60)	35%
Average	37%
SD	1%
	Day 3
Lunch A (*n* =54)	33%
Lunch B (*n* =54)	43%
Lunch C (*n* =58)	38%
Average	38%
SD	5%
	Day 4
Lunch A (*n* =63)	44%
Lunch B (*n* =63)	52%
Lunch C (*n* =63)	40%
Average	46%
SD	6%
	Day 5
Lunch A (*n* =59)	31%
Lunch B (*n* =63)	24%
Lunch C (*n* =63)	38%
Average	31%
SD	7%