Comparison of NSLP Lunches and Lunches Brought from Home in Four Elementary Schools Receiving HealthierUS School Challenge Awards

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National Food Service Management Institute
The University of Mississippi

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VISION

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COMPARISON OF NSLP LUNCHES AND LUNCHES BROUGHT FROM HOME IN FOUR ELEMENTARY SCHOOLS RECEIVING HEALTHIERUS SCHOOL CHALLENGE AWARDS

EXECUTIVE SUMMARY

The United States Department of Agriculture (USDA) oversees the National School Lunch Program (NSLP), and in doing so is able to provide meals to students who may not otherwise have access to a complete meal during the school day (USDA, 2012d). A primary goal of the NSLP has always been to level the field of success for school children of varying backgrounds by providing foods necessary for proper growth and development (Stitzel, 2004). Insufficient nutritious foods in the proper proportions, or "under nutrition," and the over consumption of some nutrients, or "over nutrition," are major concerns for the health of American youth for reasons pertaining to short- and long-term health, wellness, growth, and success. Both under nutrition and over nutrition bear a heavy burden on the health of children. The NSLP is one way the USDA works to improve the integrity of child nutrition in the United States (US).

National School Lunch Program meals are an opportune place to address the nutrition-related health concerns that plague US children, and it is important those meals meet the nutritional needs of students. Since the inception of the NSLP in the 1940s, policies have been enacted to improve the quality of meals served in schools (Stitzel, 2004). In 2011, thirty-one million children ate NSLP lunch each school day (USDA, 2012d). Because of the numbers of students who consume NSLP lunch daily, experts in the field of health and nutrition believe that school meals are advantageous places to address malnutrition-related health issues facing US children. The Academy of Nutrition and Dietetics has published position papers that

state continued importance of support for the government sponsored NSLP to fight malnutrition in American children and also calls for those meals to meet Dietary Guidelines for Americans (Stang, 2010).

Not all students eat NSLP meals. Some students eat packed lunches brought from home (LBFH). Very few studies give insight into the nutritional quality of lunches the children bring from home compared to NSLP meals.

In addition to implementing more strict standards for target nutrients in school meals served to students through the NSLP, the USDA has developed a voluntary program for schools to implement in an effort to address school-related activities that can contribute to wellness. The HealthierUS School Challenge (HUSSC) encourages schools to promote healthy lifestyles by encouraging participation in the NSLP. The HealthierUS School Challenge also encourages serving more whole grains, fruits, and vegetables during meals, as well as enacting a curriculum that includes nutrition education, physical education, and wellness policies that promote healthy eating and exercise behaviors (USDA, 2012b). The HealthierUS School Challenge has specific menu requirements for NSLP meals. These include serving foods that meet current standards but also have less added sugar, fat and sodium (USDA, 2012b). Schools participating in HUSSC also make efforts to increase students' physical activity and focus on school-wide wellness standards and goals (USDA, 2012b).

The purpose of the current investigation was to compare the nutritional content of lunches brought from home (LBFH) and lunches served in school as part of the NSLP in elementary schools that earned HUSSC awards. Lunches served and lunches consumed were considered separately.

Results were based on the nutrient content of 1,085 lunches from 560 individual students in four HUSSC schools. In addition, demographic data for 759 of these lunches was obtained (354 from NSLP and 404 LBFH).

Chi-squared tests indicated a statistically significant difference ($p < 0.05$) between the sex of a student and where they obtained their lunch. Of the meals examined, a majority of LBFH (64.9%) were brought by females, whereas a majority of NSLP meals (64.9%) were eaten by males.

For lunches served, two sample *t*-tests revealed that several differences were statistically significant ($p < 0.05$). Lunches obtained from the NSLP contained more of the following nutrients compared to LBFH: protein, calcium, cholesterol, iron, sodium and Vitamin C. However, lunches obtained from the NSLP contained less of the following nutrients: food energy, percentage of calories from total fat, percentage of calories from saturated fat, carbohydrates, and fiber. Similarly for lunches consumed, these same differences were found to be statistically significant ($p < 0.05$) with the addition of the fact that lunches obtained and consumed from the NSLP contained more Vitamin A than LBFH.

When considering both lunches served and consumed independently, Chi-squared tests indicated a statistically significant ($p < 0.05$) difference between the percent of NSLP meals and LBFH that met the various School Meal Initiative (SMI) guidelines. National School Lunch Program meals met guidelines for lunches both served and consumed more often for the percentage of calories coming from total fat, protein, calcium, iron, and Vitamins A and C. Lunches brought from home met guidelines more often for food energy both served and consumed.

A relatively low percentage of all served lunches, whether NSLP or LBFH, met all the SMI nutrient standards. Moreover, an even lower percentage of lunches consumed met the standards. Nonetheless, NSLP lunches tend to meet the SMI standards more often than LBFH.

INTRODUCTION

The United States Department of Agriculture (USDA) oversees the National School Lunch Program (NSLP), and in doing so is able to provide meals to students who may not otherwise have access to a complete meal during the school day (USDA, 2012d). A primary goal of the NSLP has always been to level the field of success for school children of varying backgrounds by providing foods necessary for proper growth and development (Stitzel, 2004). Students who do not participate in the NSLP bring their lunch from home. Insufficient nutritious foods in the proper proportions, or "under nutrition," and the over consumption of some nutrients, or "over nutrition," are major concerns for the health of American youth for reasons pertaining to short- and long-term health, wellness, growth and success. In the year 2011, 20.6% of households in the United States (US) with children were food insecure, defined as inconsistent, and undependable access to enough food for active, healthy living (Coleman-Jensen, Nord, Andrews, & Carlson, 2012). Coincidently, the results from the 2007-2008 National Health and Nutrition Examination Survey (NHANES) indicate that an estimated 19.6% of children ages 6-11 years are overweight in the US (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). Both under nutrition and over nutrition bear a heavy burden on the health of US Children. The NSLP is one way the USDA works to improve the integrity of child nutrition in the US.

Under nutrition can lead to serious health consequences in children. The quality and quantity of food that children consume contributes to both their ability to be academically successful as well as to their long-term health outcomes. It has been observed that children who are inadequately nourished are more likely to have delays in cognitive development (Kapil & Bhavna, 2002; Otero, Aguirre, Porcayo, & Fernandez, 1999). In addition, children who are under nourished may suffer from adverse behavioral and mental health problems (Juby & Meyer,

2011). Although the term "malnutrition" has typically referred to the effects of undernutrition, it can also be used to describe over nutrition.

A state of over nutrition can occur when one or more nutrients are consumed in excess of what is required for normal development, growth and metabolism. Consumption of the nutrients fat and sugar in excessive amounts contributes to overweight, obesity and negative health outcomes. Health complications stemming from over nutrition include hypercholesterolemia and hypertension, which in turn can contribute to chronic cardiovascular disease, type 2 diabetes and metabolic syndrome (Freedman, Zuguo, Srinivasan, Berenson, & Dietz, 2007). Furthermore, research suggests eating excessive fat and sugar and whether one perceives their own weight as healthy or not can have negative effects on mental health and learning (Francis & Stevenson, 2011; Florin, Shults, & Stettler, 2011). According to Francis and Stevenson (2011), the hippocampus, the structure of the brain implicated in memory, is impaired in people with diets high in fat and sugar, resulting in impaired memory function. In an analysis of a recent Youth Risk Behavior Survey, US children who identified themselves as being overweight were more likely to have been identified as having poor academic performance compared to those who identified themselves as having a normal weight (Florin, Shults, & Stettler, 2011). As more evidence becomes available that school-aged children are at risk of developing academic, behavior, and health-related issues associated with over and under nutrition, schools have become a target for improving the food served to and consumed by children.

Lunches Served in Schools

National School Lunch Program meals are an opportune place to address the nutrition-related health concerns that plague US children, and it is important those meals meet the nutritional needs of students. Since the inception of the NSLP in the 1940s, policies have

been enacted to improve the quality of meals served in schools (Stitzel, 2003). In 2011, thirty-one million children ate NSLP lunches each school day (USDA, 2012d). Because of the numbers of students who consume NSLP lunch daily, experts in the field of health and nutrition believe that school meals are advantageous places to address malnutrition-related health issues facing US children. The Academy of Nutrition and Dietetics has published position papers that state continued importance of support for the government sponsored NSLP to fight malnutrition in American children and also calls for those meals to meet Dietary Guidelines for Americans (Stang, 2010).

To ensure that all students have access to a meal at school, the USDA has implemented a system offering lunch at free or reduced cost, based on their families' average income compared to the poverty level. Any child attending a school that participates in the NSLP may purchase a meal. Children from families with incomes at or below 130% of the poverty level are eligible for free meals. Reduced-price meals are available for students from families with incomes between 130% and 185% of the poverty level. Children from families with incomes greater than 185% of the poverty level pay full price, and the price of the meal reflects a degree of subsidization. For the 2012-13 school year, 130% of the poverty level was $29, 965 for a family of four (United States Department of Agriculture, 2012d).

In order to assess the ability of meals served at school to meet the needs of children, the USDA sponsors the School Nutrition Dietary Assessment (SNDA) studies. The first SNDA study in 1991-1992 found that school lunches were high in fat and saturated fat compared to the recommended levels of the Dietary Guidelines for Americans (Gordon, Cohen, Crepinsek, Fox, Hall, & Zeidman, 2009). The results of SNDA led to the implementation of the School Meals Initiative for Healthy Children (SMI) (Gordon et al., 2009). The SMI required that schools offer

meals that provide less than or equal to 30% of total energy from fat and less than 10% of total energy from saturated fat, while at the same time providing adequate levels of these target nutrients: calories, protein, calcium, Vitamin A and Vitamin C. Table 1 shows the SMI Guidelines for the Traditional Food-Based Menu Planning Method, which was used in the four schools included in the current study. The SNDA-II was conducted in the school year 1998-1999. It showed that schools had reduced fat and saturated fat levels in meals served, but school meals were still high in fat and saturated fat when compared to the standards established by SMI (Gordon et al., 2009). The SNDA-III was reported most recently for data collected during the 2004-2005 school year.

Table 1

School Meals Initiative for Healthy Children Guidelines: Minimum Nutrient Levels for School Lunches Traditional Food-Based Menu Planning Approaches (School Week Average)

Nutrients and Energy Allowances	Minimum Requirements	
	Group III Grades K-3 Ages 5-8	**Group IV Grades 4-12 Ages 9 and Older**
Energy allowances (calories)	633	785
Total fat (as a percentage of actual total food energy)	[a, b]	[b]
Saturated fat (as a percentage of actual total food energy)	[a, c]	[c]
Recommended daily allowance for protein (g)	9	15
Recommended daily allowance for calcium (mg)	267	370
Recommended daily allowance for iron (mg)	3.3	4.2
Recommended daily allowance for Vitamin A (RE)	200	285
Recommended daily allowance for Vitamin C (mg)	15	17

[a] The Dietary Guidelines recommend that after 2 years of age "...children should gradually adopt a diet that, by about 5 years of age, contains no more than 30% of calories from fat."
[b] Not to exceed 30% over a school week
[c] Less than 10% over a school week

The SNDA-III analyzed school meal quality based on the SMI nutrient standards, the Dietary Guidelines for Americans 2005 and the Dietary Reference Intakes (DRIs), which recommend nutrient intake levels needed for individuals to achieve a healthful diet and prevent disease (Gordon et al., 2009). Data were collected from district foodservice directors and their staff, school foodservice managers, principals, students, and their parents in a nationally

representative sample of 398 schools within 130 districts that offer federally subsidized school meals (Gordon et al., 2009).

The results of SNDA-III show that more than 85% of schools offered reimbursable lunches that met the SMI standards for each of the key target nutrients: protein, Vitamin A, Vitamin C, calcium, and iron (Story, 2009.) When compared to the standards for energy, it was found that 61% of middle schools and 77% of high schools offered lunches that provided less energy than SMI standards require, while lunches offered in 40% of elementary schools provided less energy than required (Gordon, Crepinsek, Briefel, Clark, & Fox, 2009.) Most schools offered lunches that exceeded SMI standards for energy from fat and saturated fat; 81% of schools exceeded the standard for fat, 72% for saturated fat (Gordon, Crepinsek, Briefel, Clark, & Fox, 2009). Only 6% of schools offered lunches that met all of the SMI standards. Sodium levels exceeded the recommendation at almost all schools, and very few lunches met the recommendation for fiber (Story, 2009; Gordon, Crepinsek, Briefel, Clark, & Fox, 2009). The SNDA-III showed that school meals typically provided appropriate amounts of protein, Vitamin A, Vitamin C, calcium and iron, but calories are sometimes underserved and fat, saturated fat and sodium are often over served to students.

Lunches Brought from Home

Not all students eat NSLP meals. Some students eat packed LBFH. Very few studies give insight into the nutritional quality of lunches the children bring from home compared to NSLP meals. When specific foods were assessed in a smaller sub-sample (n=2,314 on day one of survey and n=666 on day two through parent-assisted recall for elementary students) as part of SNDA-III, analysis did compare the dietary intake of NSLP participants and non-participants (Gordon et al, 2009). Nearly all NSLP lunch menus (96%) that were studied included one or

more vegetable options in addition to any vegetables that were part of entrees. The NSLP participants were more likely to consume vegetables than non-participants whose lunches were brought from home (Gordon et al., 2009). Similar findings showed that nearly all school lunch menus (94%) included fruit, and NSLP participants were more likely to eat fruit at lunch than non-participants (Gordon et al., 2009). School lunch menus almost always (99%) offered flavored milk which was usually low fat or skim and NSLP participants were almost four times more likely than non-participants to drink milk at lunch (75% vs. 19%) (Gordon et al., 2009). When the daily energy intakes of a NSLP participant samples were compared to a matched sample of non-participants, it was found that elementary and high school students who participated in NSLP consumed an average of 130 calories more than non-participants (Gordon et al., 2009). In elementary schools, there were no significant differences in the adequacy of the usual intakes of Vitamin A, Vitamin B-6, Vitamin C, folate, thiamin, magnesium, and phosphorus between NSLP participants and non-participants (Gordon et al., 2009). The percentage of energy from fat and saturated fat was comparable between NSLP participants and non-participants. The NSLP participants had a significantly greater mean intake of fiber than non-participants across elementary, middle, and high schools (Gordon et al., 2009).

Earlier research into LBFH in the US largely contrasts the results of SNDA-III. Rainville (2001) found that the LBFH and NSLP meals had roughly the same number of calories. However, LBFH had more calories from fat and saturated fat. Rainville's study indicated that in LBFH, fat and saturated fat provided 33% of the total calories in the meal. In comparison, fat and saturated fat accounted for only 29% of the calories in NSLP meals (Rainville, 2001). Unlike SNDA-III, Rainville found NSLP meals had significantly more protein as well as more of the Vitamins A, B-6, B-12, D, folate, thiamin, and minerals, zinc, calcium, and iron than LBFH. The

LBFH had significantly more fat, sugar, carbohydrates and Vitamin C. Both Rainville and SNDA-III agree that NSLP meals contain more fiber than LBFH, as well as larger quantities of fruit and vegetables.

A recent study by Johnson, Bednar, Kwon, and Gustof (2009) compared the LBFH meals of elementary students to USDA, NSLP standards. The study was based on the standards used for analyses on the reimbursable school lunch requirements for grades K-6. These requirements are designed to meet the Dietary Guidelines for Americans, and provide one-third the daily Recommended Dietary Allowance for calories, protein, Vitamins A and C, calcium and iron (Johnson et al., 2009). This study found that LBFH had fewer calories, less Vitamin A, less calcium, less iron and less fiber than recommended in NSLP standards (Johnson et al., 2009). The LBFH were in excess of nutrient requirement for protein, Vitamin C and sodium, all of which were statistically significant ($p < 0.001$) (Johnson et al., 2009).

The menu components of LBFH and NSLP meals were recently investigated and compared (Johnston, Moreno, El-Mubasher, & Woehler, 2012). The researchers examined LBFH and NSLP lunches of second grade students for the presence or absence of each of the following: vegetable, fruit, dairy item, high fat or high sugar snack, a fruit beverage other than water, or 100% fruit juice. Only 45.3% of LBFH in the sample had fruit, and 13.2% had a vegetable when compared to NSLP meals, where 75.9% contained fruit and 29.1% contained a vegetable. The NSLP meals were significantly more likely to have a dairy component, such as milk or yogurt. Analysis revealed that LBFH had significantly more high-fat foods and more high-sugar snacks and drinks than NSLP lunches (Johnston et al., 2012). Results suggest that NSLP meals contain more food components that are nutrient dense such as fruit, vegetable, and dairy than LBFH. As evidence continues to reveal that children eat fewer servings of fruits and

vegetables than recommended for optimal growth and development, it is important that children's lunches, LBFH or NSLP, provide healthy options.

The evidence that many LBFH are of low nutritional quality has come to the attention of health professionals, as approximately 35% of students bring LBFH (Rainville, 2001; Johnson et al., 2009; Johnston et al., 2012). Johnston et al. (2012) suggests an intervention for parents sending LBFH that includes suggesting the kinds of foods that would improve nutrient quality. This intervention would include focusing on fruits and vegetables, which could be readily available in the home. In addition, it is suggested that positively reinforcing students for making healthy food choices in LBFH could also serve as an area of intervention (Johnston et al., 2012). Rainville (2001) suggests advertising the superior quality and convenience of the NSLP to discourage bringing LBFH.

Based on the research studies to date, the nutritional quality of LBFH is uncertain. This could be a result of the variety of methods used to address the content of LBFH, since they vary considerably. More research is needed to clarify the nutritional value of LBFH.

HealthierUS School Challenge

In addition to implementing more strict standards for target nutrients in school meals served to students through NSLP, the USDA has developed a voluntary program for schools to implement in an effort to address school-related activities that can contribute to wellness. The HealthierUS School Challenge (HUSSC) encourages schools to promote healthy lifestyles by encouraging participation in NSLP. The HUSSC also encourages serving more whole grains, and fruits and vegetables during meals, as well as enacting a curriculum that includes nutrition education, physical education, and wellness policies that promote healthy eating and exercise behaviors (USDA, 2012b). There are four levels of distinction: bronze, silver, gold, and gold

award of distinction, which can be earned by a school along with a monetary award. There are specific menu requirements for each award level for NSLP meals (Table 2). These include serving foods that meet current standards but also have less added sugar, fat and sodium (United States Department of Agriculture, 2012b). Schools participating in HUSSC also make efforts to increase students' physical activity and focus on school-wide wellness standards and goals summarized in Table 3 (USDA, 2012b).

Table 2

HealthierUS School Challenge Guidelines 2011-2012: Food Groups

HUSSC Requirement	Vegetable	Cooked Dry Beans or Peas	Fruit	Whole Grain	Milk
For All HUSSC-Awarded Schools	Offer a different vegetable every day of the week. Minimum serving: ¼ cup. Of these 5 servings, 3 must be dark green or orange.	A serving of cooked dry beans or peas must be offered each week. Minimum serving: ¼ cup.	Different fruit must be offered weekly. Minimum serving: ¼ cup/serving.	Incorporate whole-grain products, focusing on variety in the type of products and "whole grain" listed as the first ingredient.	Only offer low-fat (1%) or fat-free (skim) milk
Silver Level Specification			Bronze and silver: 1 day per week	Bronze and silver: 3 times per week	
Gold Level Specification			Gold and Gold Award of Distinction: 2 days per week	1 serving per day	

Table 3

HealthierUS School Challenge Guidelines 2011-2012: Menu, Food, and School Health Policies and Practices

HUSSC Requirement	Menu Practices	Competitive Foods Criteria	School Health Policies and Practices
For All HUSSC-Awarded Schools	Every child should be able to select a reimbursable meal that meets the Challenge criteria. Menu items planned for the Challenge should be selected routinely by the students.	Applies to all foods sold or served outside the school meals programs; ala carte, vending, snack bar, school store.	Fundraising, nutrition education, physical activity and wellness policy should all support a wellness environment and provide consistent messages.
Silver Level Specification		Bronze and silver: applies during meals in all foodservice areas	
Gold Level Specification		Gold and Gold in Distinction: applies throughout the school day, throughout the school campus	

Purpose of the Current Investigation

The purpose of the current investigation was to compare the nutritional content of LBFH and lunches served in school as part of the NSLP in elementary schools that participate in HUSSC. Lunches served and lunches consumed were considered separately. In addition, demographic data for some of the children who participated in this study were collected to analyze the impact between varying socio-economic statuses and ethnic groups represented in the schools.

Research Objectives

The specific objectives of this project included the following:

- Develop and test a method of visual lunch component analysis from digital pictures.
- Compare the nutrient content of lunches *served* in elementary schools that are participating in the NSLP with HUSSC award status to lunches students at the same school brought from home.
- Compare the percentage of lunches meeting SMI standards that are *served,* by elementary school students in schools that have achieved HUSSC award status based on whether their meal was brought from home or served at school.
- Compare the nutrient *consumption* of elementary school students at lunch in schools that have achieved HUSSC award status based on whether their meal was brought from home or served at school.
- Compare the percentage of lunches meeting SMI standards that are *consumed,* by elementary school students in schools that have achieved HUSSC award status based on whether their meal was brought from home or served at school.
- Compare lunches *served* and *consumed* in schools with disparate socioeconomic groups and ethnic groups within Washington State.

METHOD

Phase I: Method Development

To accurately and efficiently estimate nutrients, a custom computer database management program was created by computer science students at Central Washington University. For each lunch investigated, a student identification number and tray identification number were linked to digital images of the lunch. A digital image of each lunch was created both before and after the lunch was consumed. The custom nutritional database management tool with digital camera connected is pictured in Figure 1. The images were used to estimate the amount served and left unconsumed for each food item on the tray. These amounts were entered into the program individually. Figure 2 shows the input screen used to enter these data for each tray. Each food item was, in turn, linked to its nutritional information as recorded in either the United States Department of Agriculture's (USDA) Child Nutrition Database (USDA, 2012a) or, for items not in this database, to a custom database created by the researchers using nutrition information provided by the foodservice directors or the product manufactures. Figure 2 shows the user interface for entering nutritional information for an item. The program compiled the information and yielded the complete nutritional information for each tray, both before and after consumption. The student identification number was used to link each tray to the socioeconomic demographic information for the child, when it was available.

Visual estimation of plate waste from digital photography has been reported as a reliable method of estimation, making larger scale research projects more feasible (Parent, Niezgoda, Keller, Chambers, & Daly, 2012).

Figure 1

Digital Camera Connected to Custom Nutritional Database Management Tool

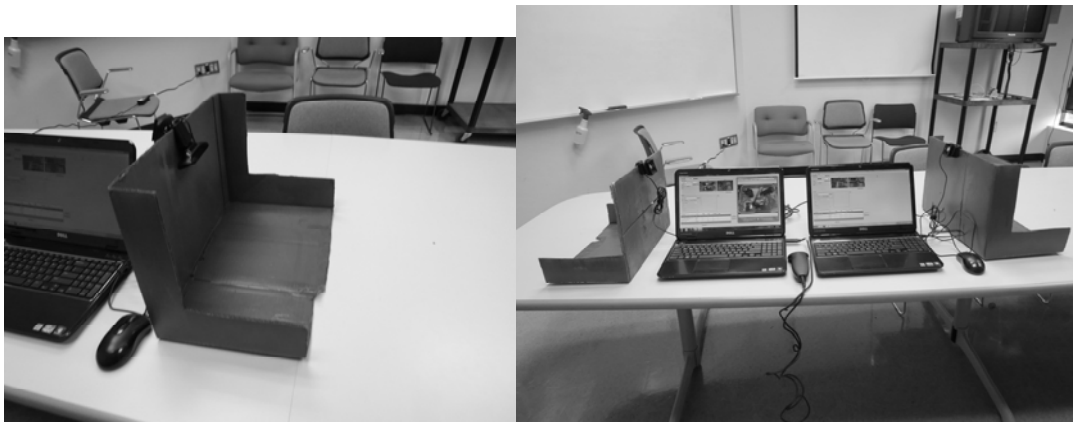
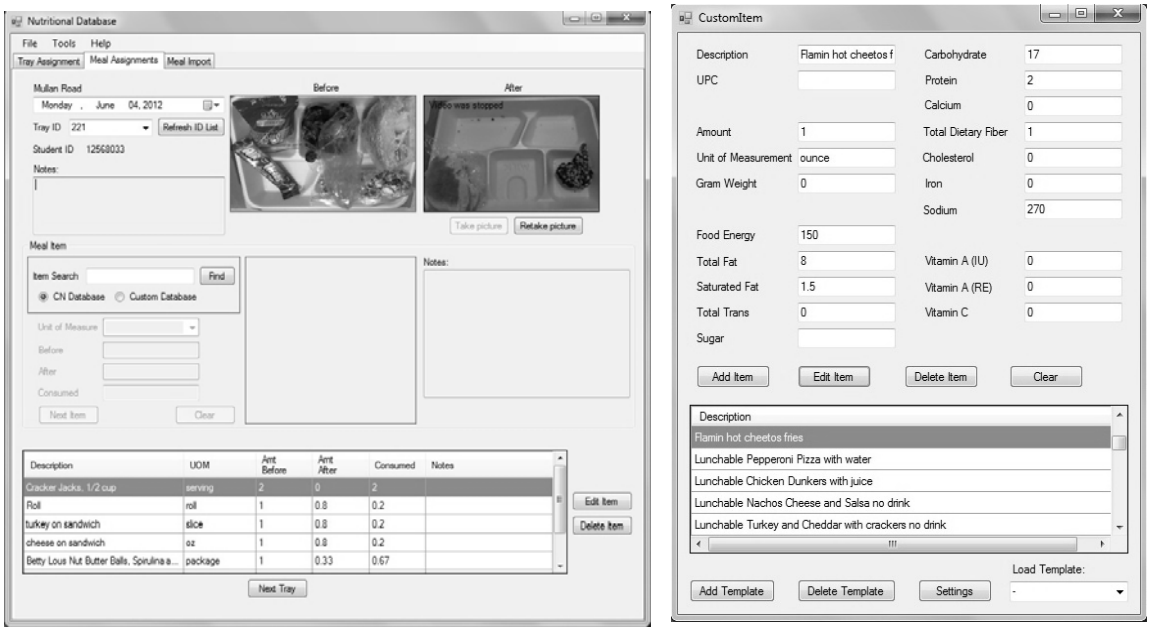


Figure 2

User Interfaces for the Custom Nutritional Database Management Tool



Phase II: Validation of Method

Prior to initiating data collection, the method of estimating various food items amount was tested and validated. The method validation was conducted using both National School Lunch Program (NSLP) lunches and lunches brought from home (LBFH) from a central Washington elementary school. These data were used only for validation purposes and are not included in the study results. To determine the validity of the method of estimating food amounts, 12 NSLP lunches and 16 LBFH, for a total of 136 food items, were evaluated. Each food item was weighed both before and after the meal was consumed. In addition, digital photographs were taken before and after each meal was consumed. After the lunch service period, two trained research assistants used the digital photographs to visually estimate the weighed amounts. The reliability between estimated percentage of each item that was consumed and the actual percentages calculated from weights were assessed by computing the interclass correlation coefficient (ICC). Data were analyzed using IBM SPSS software 19.0. The ICC for intermodal agreement was high at 0.903, establishing a sufficient degree of validity.

Phase III: Informed Consent

Before initiation of the investigation, the study was approved by the internal review boards at Central Washington University and The University of Southern Mississippi (the sponsoring institutions). Passive consent was obtained prior to data collection by mailing a letter in English and Spanish to all parents/guardians of students in the second, third, fourth, and fifth grades at four selected schools. The letter explained the purpose and methods of the study, and indicated that demographic information (gender, age, grade level, free or reduced price lunch status) would be accessed from the participating school districts. Parents/guardians who did not want their student(s) to participate were advised to sign the letter and return it to the school's

administrators prior to data collection. The researchers kept track of students who had been identified as individuals who would not be participating with the use of an opt-out list during the data collection phase. A total of 33 students were opted out by their parents prior to the data collection phase.

United States public elementary school students from two school districts in Washington State served as the target population of this study. Data were collected from four schools, two from each district. During the spring of the 2011-2012 school year, researchers analyzed nutrient information for 1,085 lunches from 560 students. Of the 1,085 lunches, 547 were NSLP meals and 538 were LBFH. Selection of school districts to participate in the study was based on the designation as HUSSC school districts (USDA, 2012c), willingness to participate, geographic location, and the demographic makeup of the student population.

Phase IV: Data Collection

As students entered the room where lunch was served, they were visually identified as either having brought lunch from home or having lunch served in school. Students who brought lunch from home carried a lunch box or bag to the lunch tables, whereas students having lunch served in school stepped into line to receive their NSLP meal.

To collect data from students receiving a NSLP lunch, chronologically numbered foam trays were given to students in the lunch service line after determining student consent for participation. Verifying consent involved both asking if they were interested in participating and verifying that they were not already on the opt-out list. Once given a tray, students were instructed to receive their lunches as usual and then approach the researchers' data collection table for a picture to be taken of their lunch tray. When students approached the data collection table, they were asked to place their tray under the camera. Their tray number was entered into

the custom database management program. Students were asked their name in order to determine their identification number, which was also entered into the custom database management system. The researchers then took a "before" photo of the numbered trays before they consumed their meal. The custom database management program linked together the date, the tray number, the student identification number and the "before" picture for recall later. At the end of the lunch service time, the students returned their trays to the researchers for a final picture or "after" photo. Any empty packages were removed from the tray and not included in the after picture for clarity of food remaining. This helped to identify items that were consumed entirely. The researchers asked students if they ate anything that had not been on their tray when the first photograph had been taken and recorded any pertinent information in the "notes" section of the custom database to ensure accuracy of data entry. Students were then asked to throw their trays away. The custom database management program linked this information with the information collected previously via the date and tray number. After the lunch period, researchers were able to review the "before" and the "after" pictures of the trays as well as the notes recorded to determine the amount initially present of each food item and the amount remaining after consumption. The researchers entered these data into the custom database management system.

Students identified as having LBFH were approached by a researcher as they entered the lunchroom. The students were asked if they would like to participate in a research study by having a few pictures taken of their lunch. Once the students' informed consent was verified verbally and checked against the "opt-out" list, students with LBFH were instructed to remove the food from their lunch bags and place it on a numbered foam tray identical to the trays used for NSLP. The students were asked their name in order to determine their identification number. The tray number and the student identification number were entered into the custom database

management system. The researchers arranged the food in order to accurately represent the contents of the meals in the photo. The students were asked questions regarding contents of unrecognized foods or food that were not identifiable by photo alone, such as sandwich type, contents of closed containers or unknown food items. When closed containers were present, the student was asked to remove the lid so that a picture could be taken of the contents. This information was recorded within the "notes" section of the custom database management system. The researchers took a "before" photo of the tray, and instructed the students to return when they finished eating for an "after" picture. Any empty packages were removed from the tray and not included in the "after" picture for clarity. Returning LBFH students were asked if they had eaten anything that was not in the first picture and if they would like to take any items left from their lunch home with them. As with NSLP lunches, after the lunch period, the researchers analyzed the pictures of the trays to determine the amount of each food item present initially and after consumption. The researchers entered these data into the custom database management system.

As mentioned above, the "before" and "after" amounts of each food item were linked to the date, tray number and student identification number. In addition, each food item was linked to its nutritional content information as recorded in either the USDA's Child Nutrition Database (USDA, 2012a) or, for items not in this database, to a custom database created by the researchers. The program compiled the information and yielded the complete nutritional information for each tray. Consumption of calories and the following nutrients was determined: carbohydrate, protein, fat, saturated fat, fiber, sugar, sodium, calcium, Vitamin C, Vitamin A, and iron. The student identification number was used to link each tray to the socioeconomic demographic information for the child, when it was available. These demographic data included

gender, age, grade level, ethnicity, and free or reduced price lunch status, and were obtained from the school district administrations. Student confidentiality was strictly maintained throughout the study.

Phase V: Data Analysis

Data were analyzed using IBM SPSS software 21.0. For all tests, a significance level of $\alpha = 0.05$ was used. Initial data analysis included using a Chi-squared test to determine if the gender of a child influenced whether they received LBFH or NSLP lunches. Similarly, a Chi-squared test was used to determine if the eligibility status for free or reduced price meals of the child influenced whether they received LBFH or NSLP lunches. For key nutrients, the mean content of LBFH and NSLP lunches were compared using a one-way ANOVA test. Lunches served and lunches consumed were considered separately. Further, the nutrient content of each lunch was compared against the SMI guidelines for lunches. The SMI guidelines used were for the Traditional Food-Based Menu Planning Method and may be found in Table 1 in the previous section. For each nutrient included in the SMI guidelines, each lunch was classified as having either met or not met the guideline. A Chi-squared test was used to compare the percentage of LBFH and NSLP lunches that met the guidelines for each nutrient. Lunches served and lunches consumed were considered separately. The data were further separated by the eligibility status for free or reduced price meals of the child and a Chi-squared test comparing the percentage of LBFH and NSLP lunches that met the guidelines for each nutrient was run again. As above, lunches served and lunches consumed were considered separately.

RESULTS AND DISCUSSION

Characteristics of Those Consuming Lunches

The nutrient content of 1,085 lunches from 560 unique individual students was analyzed. In addition, demographic data for 759 of these lunches was obtained (354 from National School Lunch Program (NSLP) lunches and 404 from lunches brought from home (LBFH).

Chi-squared test indicates a statistically significant difference ($p < 0.05$) between the sex of a student and where they obtained their lunch. Of the meals examined, a majority of females (64.9%) ate LBFH, whereas a majority of males (64.9%) ate NSLP meals. Table 4 shows the number and percent of NSLP and LBFH examined and the number and percent of the types of meals examined belonging to males and females.

Table 4

Gender of Students Compared by Type of Lunch

	Count (Row Percentage)		
	NSLP	**LBFH**	**Total**
Female	162 (35.1%)	300 (64.9%)	462 (100%)
Male	192 (64.9%)	104 (35.1%)	296 (100%)
Total	354 (46.7%)	404 (53.3%)	758 (100%)

Chi-squared tests also revealed ($p < 0.05$) that students who qualified for a free or a reduced-price NSLP meal were more likely to eat a NSLP meal. Students who would have paid the full price for a NSLP meal were more likely to bring a lunch from home. These results are summarized in Table 5.

Table 5

The Student Eligibility Status for Free or Reduced Price Meals Compared by Type of Lunch

	Count (Row Percentage)		
	NSLP	**LBFH**	**Total**
Free [a]	175 (86.6%)	27 (13.4%)	202 (100%)
Reduced [b]	30 (78.9%)	8 (21.1%)	38 (100%)
Full Pay [a, b]	149 (28.8%)	369 (71.2%)	518 (100%)
Total	354 (46.7%)	404 (53.3%)	758 (100%)

[a] Chi-squared and post-hoc tests indicate a statistically significant difference ($p < 0.05$) in the proportions of students bringing lunches from home between students with eligibility for free status and students with full-pay status.
[b] Chi-squared and post-hoc tests indicates a statistically significant difference ($p < 0.05$) in the proportions of students bringing lunches from home between students with reduced pay status and students with full-pay status.

Nutrient Contents of Lunches

For lunches served, one-way ANOVA revealed that several differences were statistically significant ($p < 0.05$) between NSLP meals and LBFH. Lunches obtained from the NSLP contained more of the following nutrients compared to LBFH: protein, calcium, cholesterol, iron, sodium and Vitamin C. Moreover, lunches obtained from the NSLP contained less of the following nutrients: food energy, total fat, saturated fat, carbohydrates and fiber.

Similarly for lunches consumed, these same differences were found to be statistically significant ($p < 0.05$) with the addition that lunches obtained from the NSLP contained more Vitamin A than LBFH. Table 6 shows the mean nutrient content of lunches served and consumed.

Table 6

The Mean Nutrient Content of Lunches Compared by Type of Lunch

	Served		Consumed	
	NSLP (n = 547)	**LBFH (n =538)**	**NSLP (n = 547)**	**LBFH (n = 538)**
Food Energy (kCals)[a,b]	600.27 ± 131.78	640.38 ± 244.62	444.88 ± 151.99	504.69 ± 214.55
Total Fat (g)[a,b]	18.53 ± 7.42	22.88 ± 12.91	13.58 ± 6.76	18.08 ± 10.75
Saturated Fat (g)[a,b]	6.09 ± 3.42	7.25 ± 5.08	4.48 ± 2.98	5.79 ± 4.45
Carbohydrates (g)[a,b]	81.92 ± 24.78	91.69 ± 36.50	60.83 ± 24.04	71.79 ± 31.75
Protein (g)[a,b]	28.40 ± 7.10	21.27 ± 10.81	21.16 ± 8.77	17.08 ± 9.69
Calcium (mg)[a,b]	507.63 ± 220.41	239.34 ± 204.11	373.94 ± 217.51	189.32 ± 173.40
Total Dietary Fiber (g)[a,b]	6.04 ± 3.07	6.97 ± 4.11	4.43 ± 2.66	5.30 ± 3.47
Cholesterol (mg)[a,b]	53.43 ± 39.70	37.51 ± 43.12	40.27 ± 36.91	30.58 ± 37.05
Iron (mg)[a,b]	3.61 ± 1.43	2.16 ± 2.01	2.71 ± 1.47	1.61 ± 1.55
Sodium (mg)[a,b]	1148 ± 427	922 ± 525	844 ± 414	739 ± 471
Vitamin A (IU)[b]	2128 ± 3004	1777 ± 4971	1555 ± 2584	1111 ± 3097
Vitamin C (mg)[a,b]	36.60 ± 43.18	23.30 ± 36.62	27.05 ± 34.24	17.56 ± 28.79

[a] Two-sample *t*-test indicates a statistically significant difference ($p < 0.05$) between nutrients served in NSLP lunches and LBFH.
[b] Two-sample *t*-test indicates a statistically significant difference ($p < 0.05$) between nutrients consumed in NSLP lunches and LBFH.

As was previously mentioned, the NSLP was developed to help meet the nutritional needs of vulnerable populations. Consequently, those students who qualified to receive either a free or a reduced-price lunch from the NSLP were separated from those students who would have paid the full price. Table 7 shows the mean nutrient contents of the types of lunch served by the student's eligibility for free and reduced price meals or full price meals.

When comparing lunches served, one-way ANOVA tests indicate ($p < 0.05$) that, among students qualifying for a free or a reduced priced lunch, meals obtained from the NSLP contained more of the following nutrients compared to LBFH: protein, calcium and iron. Meanwhile, lunches obtained from the NSLP contained less of the following nutrients: food energy, total fat and saturated fat. Similarly, among students qualifying for a free or a reduced priced lunch and when considering lunches actually consumed, these same differences were found to be statistically significant ($p < 0.05$) with the addition that meals obtained from the NSLP contained more Vitamin A than LBFH.

Among students who paid the full price for a NSLP meal, similar differences were found. When comparing lunches served, one-way ANOVA tests indicate ($p < 0.05$) that meals obtained from the NSLP contained more of the following nutrients compared to LBFH: protein, calcium, cholesterol, iron, sodium, Vitamin A and Vitamin C. Meanwhile, lunches obtained from the NSLP contained less of the following nutrients: total fat, saturated fat, carbohydrates and fiber. Similarly among students who would have paid full price for a NSLP meal and when only considering the lunches actually consumed, these same differences were found to be statistically significant ($p < 0.05$) with the addition of the fact that meals obtained and consumed from the NSLP contained less food energy but the same cholesterol and sodium compared to LBFH. Table 8 shows the shows the mean nutrient contents consumed in the types of lunch by the student's eligibility for free and reduced price meals or full price meals.

Table 7

The Mean Nutrient Content of Lunches Served Compared by Type of Lunch by Eligibility Status for Free or Reduced Price Meals

	Served			
	Free/Reduced		Paid	
	NSLP (n = 205)	LBFH (n = 35)	NSLP (n = 149)	LBFH (n = 369)
Food Energy (kCals)[a]	605.33 ± 146.27	689.49 ± 253.29	570.89 ± 108.2	597.31 ± 215.12
Total Fat (g)[a,b]	19.28 ± 7.74	26.25 ± 11.51	17.02 ± 6.44	20.93 ± 11.75
Saturated Fat (g)[a,b]	6.59 ± 3.22	8.24 ± 4.23	5.49 ± 2.34	6.61 ± 4.69
Carbohydrates (g)[b]	81.33 ± 28.05	93.42 ± 41.71	79.53 ± 18.59	86.43 ± 31.68
Protein (g)[a,b]	28.31 ± 6.69	21.95 ± 11.66	26.11 ± 6.82	20.67 ± 10.14
Calcium (mg)[a,b]	524.14 ± 222.04	238.88 ± 203.67	469.5 ± 224.98	227.14 ± 195.8
Total Dietary Fiber (g)[b]	6.44 ± 3.17	6.13 ± 4.34	5.77 ± 3.23	7.14 ± 4.01
Cholesterol (mg)[b]	56.72 ± 43.79	50.67 ± 57.47	40.44 ± 18.25	32.74 ± 38.43
Iron (mg)[a,b]	3.82 ± 1.45	2.12 ± 1.69	3 ± 1.32	2.13 ± 2
Sodium (mg)[b]	1109 ± 390	1112 ± 512	907 ± 323	809 ± 468
Vitamin A (IU)[b]	2023 ± 2988	1096 ± 3032	2792 ± 4101	1917 ± 5216
Vitamin C (mg)[b]	34.89 ± 43.83	24.63 ± 34.48	42.81 ± 53.05	24.23 ± 37.63

[a] Among children eligible for a free or reduced price lunch, Chi-squared tests indicate a statistically significant difference ($p < 0.05$) in the nutrient amount between NSLP lunches and LBFH.

[b] Among children who would pay a full price for lunch, Chi-squared tests indicate a statistically significant difference ($p < 0.05$) in the nutrient amount between NSLP lunches and LBFH.

Table 8

The Mean Nutrient Content of Lunches Consumed Compared by Type of Lunch by Eligibility Status for Free or Reduced Price Meals

	Consumed			
	Free/Reduced		**Paid**	
	NSLP (n = 205)	**LBFH (n = 35)**	**NSLP (n = 149)**	**LBFH (n = 369)**
Food Energy (kCals)[a,b]	452.9 ± 152.73	542.41 ± 241.72	444.74 ± 141.35	480.92 ± 194.42
Total Fat (g)[a,b]	14.26 ± 7.04	20.91 ± 10.86	12.73 ± 5.93	16.87 ± 9.77
Saturated Fat (g)[a,b]	4.96 ± 2.94	6.87 ± 4.48	4.09 ± 2.15	5.37 ± 4.07
Carbohydrates (g)[b]	60.99 ± 24.28	72.94 ± 36.82	62.42 ± 22.2	69.34 ± 28.55
Protein (g)[a,b]	21.27 ± 8.54	17.33 ± 10.18	20.53 ± 8.28	16.78 ± 9
Calcium (mg)[a,b]	386.99 ± 213.17	205.08 ± 193.59	373.21 ± 225.51	182.84 ± 163.86
Total Dietary Fiber (g)[b]	4.8 ± 2.68	4.74 ± 3.91	4.25 ± 2.75	5.56 ± 3.36
Cholesterol (mg)	43.97 ± 42.5	38.84 ± 46.52	31.56 ± 18.53	27.37 ± 34.5
Iron (mg)[a,b]	2.84 ± 1.52	1.61 ± 1.4	2.39 ± 1.23	1.62 ± 1.48
Sodium (mg)	823 ± 375	880 ± 453	715 ± 314	662 ± 428
Vitamin A (IU)[a,b]	1517 ± 2665	488 ± 1062	2176 ± 3455	1260 ± 3220
Vitamin C (mg)[b]	26.63 ± 34.2	17.44 ± 25.71	29.78 ± 41.4	19.11 ± 30.09

[a] Among children eligible for a free or reduced price lunch, Chi-squared tests indicates a statistically significant difference ($p < 0.05$) in the nutrient amount between NSLP lunches and LBFH.

[b] Among children who would pay a full price for lunch, Chi-squared tests indicates a statistically significant difference ($p < 0.05$) in the nutrient amount between NSLP lunches and LBFH.

Lunches Meeting School Meals Initiative Guidelines

When considering both lunches served and consumed independently, Chi-squared tests indicated a statistically significant ($p < 0.05$) difference between the percent of NSLP meals and LBFH that met the various SMI guidelines. These percentages are summarized in Table 9.

The NSLP meals met the guidelines for lunches both served and consumed more often for the percentage of calories coming from total fat, protein, calcium, iron, and Vitamins A and C. Moreover, NSLP meals met guidelines less often for both food energy served and consumed. There was no significant difference found between NSLP and LBFH served or consumed in the percentage of meals that met the guidelines for the percentage of calories from saturated fat.

A relatively low percentage of served lunches met all the SMI nutrient standards. An even lower percentage of lunches consumed met the standards. Nonetheless, NSLP lunches tended to meet the standards more often than LBFH.

Table 9

The Percentage of Lunches Meeting School Meals Initiative Guidelines for the Child Compared by Type of Lunch

	Served		Consumed	
	NSLP (n = 354)	**LBFH (n = 404)**	**NSLP (n = 354)**	**LBFH (n = 404)**
Food Energy[a,b]	14.4%	26.5%	3.7%	11.9%
Total Fat[a,b]	62.7%	45.3%	63.8%	45.0%
Saturated Fat	55.4%	57.7%	61.9%	59.4%
Protein[a,b]	93.2%	78.0%	79.4%	63.4%
Calcium[a,b]	81.1%	25.5%	55.9%	15.3%
Iron[a,b]	36.7%	16.3%	19.2%	8.4%
Vitamin A[a,b]	23.2%	13.4%	17.2%	11.4%
Vitamin C[a,b]	48.6%	35.4%	39.0%	28.7%

[a] Chi-squared tests indicates a statistically significant difference ($p < 0.05$) between served percentages in NSLP lunches and LBFH.
[b] Chi-squared tests indicates a statistically significant difference ($p < 0.05$) between consumed percentages in NSLP lunches and LBFH.

It is important to determine if NSLP meals are meeting the needs of the most vulnerable populations. Consequently, as with nutrients, the data were separated into those students who were eligible for a free or reduced priced NSLP meal and those who were not. Considering each of these populations separately, the percentage of NSLP lunches and LBFH meeting the various SMI guidelines were compared using a Chi-squared test. These percentages and findings for each population are summarized in Tables 10 and 11.

Among students eligible for a free or reduced price lunch, lunches obtained from the NSLP were more likely to meet the SMI standards for protein, calcium, iron and the percentage

of calories coming from total fat for both lunches served and consumed. The LBFH met guidelines more often for food energy both served and consumed.

Among students who would have paid full price for a NSLP meal, lunches obtained from the NSLP were more likely to meet the SMI standards for protein, calcium, iron, Vitamin A and the percentage of calories coming from total fat for both lunches served and consumed. The LBFH met guidelines more often for food energy both served and consumed. The percentage of lunches consumed that met the standard for calories coming from saturated fat was higher in NSLP lunches consumed. Likewise, the percentage of lunches served meeting the Vitamin C standard was higher for NSLP lunches.

Table 10

The Percentage of Lunches Served Meeting School Meals Initiative Guidelines for the Child Compared by Type of Lunch by Free/Reduced Status

	Served			
	Free/Reduced		Paid	
	NSLP (n = 205)	LBFH (n = 35)	NSLP (n = 149)	LBFH (n = 369)
Food Energy[a,b]	17.1%	40.0%	10.7%	25.2%
Total Fat[a,b]	54.6%	31.4%	73.8%	46.6%
Saturated Fat	49.8%	48.6%	63.1%	58.5%
Protein[a,b]	96.1%	74.3%	89.3%	78.3%
Calcium[a,b]	86.8%	31.4%	73.2%	24.9%
Iron[a,b]	44.4%	11.4%	26.2%	16.8%
Vitamin A[b]	22.9%	8.6%	23.5%	13.8%
Vitamin C[b]	49.8%	37.1%	47.0%	35.2%

[a] Among children obtaining a free or reduced price lunch, Chi-squared tests indicates a statistically significant difference ($p < 0.05$) in the percentage of student meeting SMI nutrient guidelines between NSLP lunches and LBFH.
[b] Among children obtaining a full-pay priced lunch, Chi-squared tests indicates a statistically significant difference ($p < 0.05$) in the percentage of student meeting SMI nutrient guidelines between NSLP lunches and LBFH.

Table 11

The Percentage of Lunches Consumed Meeting School Meal Initiative Guidelines for the Child Compared by Type of Lunch by Free/Reduced Status

	Consumed			
	Free/Reduced		**Paid**	
	NSLP (n = 205)	**LBFH (n = 35)**	**NSLP (n = 149)**	**LBFH (n = 369)**
Food Energy[a,b]	4.9%	22.9%	2.0%	10.8%
Total Fat[a,b]	54.6%	31.4%	76.5%	46.3%
Saturated Fat[b]	55.6%	51.4%	70.5%	60.2%
Protein[a,b]	81.5%	60.0%	76.5%	63.7%
Calcium[a,b]	58.5%	22.9%	52.3%	14.6%
Iron[a,b]	22.9%	5.7%	14.8%	8.7%
Vitamin A[b]	14.6%	2.9%	20.8%	12.2%
Vitamin C	41.5%	28.6%	35.6%	28.7%

[a] Among children obtaining a free or reduced price lunch, Chi-squared tests indicates a statistically significant difference ($p < 0.05$) in the percentage of student meeting SMI nutrient guidelines between NSLP lunches and LBFH.
[b] Among children obtaining a full-pay priced lunch, Chi-squared tests indicates a statistically significant difference ($p < 0.05$) in the percentage of student meeting SMI nutrient guidelines between NSLP lunches and LBFH.

CONCLUSIONS AND RECOMMENDATIONS

Research Study Conclusions

The purpose of this study was to investigate and compare nutrient content of National School Lunch Program (NSLP) lunches from schools that have earned a HealthierUS School Challenge (HUSSC) award and lunches brought from home (LBFH). Digital photography and a custom database management tool were used to assist with the assessment of the nutrients served and consumed.

The results of the present study suggest that males were more likely to eat a NSLP lunch, and females are more likely to eat a LBFH. Analysis using linked demographic information about the students revealed that students who are eligible for free lunch were more likely to eat a NSLP lunch at school than a LBFH. The LBFH were more often brought by children who qualified for full priced lunch.

Nutrient analysis of the lunches found that NSLP lunches contained more of the following nutrients compared to LBFH: protein, calcium, cholesterol, iron, sodium and Vitamin C. The NSLP lunches had less food energy, a lower percentage of calories from total fat, fewer carbohydrates, and less fiber. When the nutrient contents of lunches were compared to School Meals Initiative (SMI) guidelines, it was discovered that very few meals, NSLP or LBFH, met the SMI standards; however, NSLP meals did meet guidelines more often than LBFH.

The findings of the current study of NSLP lunches support previous findings in the School Nutrition Dietary Assessment (SNDA)-III that many NSLP lunches meet guidelines for protein, and calcium (Gordon et al., 2009). The SNDA-III revealed that many elementary schools did not serve meals that met food energy standards. The present study had similar results that 85.6 % of NSLP lunches served did not meet the minimum requirement for food energy.

When the present study's results were compared to the SNDA-III's comparison of participants in the NSLP and non-participants, some differences were noteworthy. The SNDA-III found that participants had greater daily food energy intake, however our results suggest that for both meals served and consumed, NSLP lunches had less food energy then LBFH (Gordon et al., 2009). In addition, the SNDA-III showed that NSLP participants and non-participants of the NSLP consumed similar percentages of energy from total fat, where the present study results suggest that LBFH had significantly higher percentages of calories from total fat then NSLP meals. Furthermore, SNDA-III found that NSLP participants consumed significantly more fiber than non-participants, which is contradictory to the present study for lunches both served and consumed.

The nutritional values found in the present study of NSLP lunches and LBFH largely echo the results of Rainville (2001). Both investigations agree that LBFH contained more food energy, total fat, and more carbohydrates than NSLP meals. Both investigations found that NSLP meals provided more protein, calcium, cholesterol, iron, sodium and Vitamins A and C. Johnson et al., (2009) found that the majority of LBFH fall short of USDA standards which is also supported by the results of the present study. One finding that does differ in the current study from Rainville (2001) and Johnson (2009) is that LBFH in the current study contained more fiber than NSLP meals. Rainville (2001) and Johnson (2009) both found more fiber in the NSLP than the LBFH.

Research Implications

The inconsistency between the present study and past investigations suggests that more research into the nutrient content of school lunches is necessary. Future research should:

- Compare the nutrient content of 2012's NSLP lunches with lunches from the subsequent school years to assess the effects of recent changes in the NSLP on the nutrient content of NSLP lunches. It is important to assess where changes in the NSLP brought about by the implantation of the Healthy, Hunger-Free Kids Act of 2010 resulted in improvements to what American children are served and consume at school.
- Employ the same method of investigation in a representative United States (US) sample of elementary students. Potential sampling sites should be identified across the nation to represent the geographic, ethnic, cultural, and socioeconomic diversity that exists in the US. Data should then be collected on LBFH and NSLP meals at the representative locations in Healthier US School Challenge (HUSSC) and non-HUSSC schools.
- Establish a central data storehouse to compile, manage, and analyze nutritional data from the various locations mentioned above.
- Compare the US NSLP with meal programs in other nations. This analysis may provide information about the quality of US school lunches related to those in other countries. Ultimately, this investigation would reveal how well the US meets the nutritional needs of children as they prepare to compete in a global marketplace.

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