

To the Graduate Council:

I am submitting herewith a thesis written by Nicole Lynn McGee entitled “Implementation of Healthier School Meals: Education and Acceptance.” I have examined the final paper copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Nutrition.

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Implementation of Healthier School Meals: Education and Acceptance

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Abstract

Background

As part of a Coordinated School Health Program project to improve the nutrition quality of school meals, a series of nutrition education and culinary training in-service workshops were conducted followed by the implementation of healthier menu options. The objectives of this study were 1) to evaluate the effect of the training on food service employees' attitudes about nutrition, self-efficacy for preparing healthier meals, and meal preparation behavior changes and 2) to determine the plate waste percentages of school meals and school meal participation rates before and after healthier school meals were implemented.

Methods

The study was completed in a rural East Tennessee school district. The subjects were 12 food service employees. Three workshops, two-hours each, and one full day workshop were planned and conducted by a registered dietitian, chef, and public health nutrition graduate student for the food service employees. Pre-, post-, and follow-up questionnaires were administered to participants. Following the conclusion of the workshops, three plate waste measurements were completed in each elementary school, using a random sample of students' trays in grades first through sixth. These measurements were completed at baseline, after the healthier menu options were implemented, and at four weeks follow-up.

Results

The nutrition education and culinary training in-service workshops improved the food service employees' self-efficacy for preparing healthier school meals. The plate waste results at School 1

indicated no significant change in plate waste from baseline to after implementation of healthier school meals. No significant change in lunch, but significantly increased waste for breakfast at School 2 after implementation ($P<.001$) and at follow-up ($P<.001$). School 3 showed significantly increased waste for breakfast after implementation ($P<.001$) and at follow-up ($P<.001$) and lunch after implementation ($P<.001$) and at follow-up ($P<.001$).

Conclusion

Educating food service employees is an important step in implementing healthier menu items. However additional efforts may be necessary throughout the school to encourage the support of principals, parents, and teachers to help promote children's consumption of healthier menu items.

Preface

To aid the reader, an explanation of the format used for this thesis follows. This thesis consists of three parts. Part I contains an introduction, extensive review of the literature, and the study's research questions. Parts II and III contain the research components. Part II contains the manuscript for nutrition and culinary training for food service employees and Part III contains the plate waste study manuscript.

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PART I: OVERVIEW

Introduction

The prevalence of childhood obesity in the United States has increased since 1980, but new data suggest that the trend may be beginning to stabilize (1). Although these data show that the prevalence of obesity has not increased from 1999 to 2006, it has not decreased either. It continues to be very high at an estimated 17.0% for 2003 to 2006 (1). Overweight and obesity in children can continue into adulthood, putting them at a higher risk for chronic disease in adulthood (2). To prevent overweight and obesity, healthy eating practices must begin early in life and be encouraged throughout childhood and adolescence (3, p19-5). One important way to encourage healthy eating among children is through school nutrition interventions (3, p19-6).

Research shows that children exposed to different types of healthy foods at an early age are more accepting of new foods and are more likely to eat a variety of healthy foods, such as fruits and vegetables, throughout their lives (4). Different types of healthy foods can be presented to children by way of school meals from the National School Lunch Program (NSLP) and the School Breakfast Program (SBP). These programs were developed to protect the “health and well-being of the Nation’s children” (5). The NSLP and SBP provide nutritional meals to students at affordable prices, reduced-prices, or at no charge, depending on students’ family incomes (6). However, studies have shown that meals provided at school may contain more sodium, cholesterol, and kilocalories from fat and saturated fat than recommended (7-10).

Nationally the NSLP served an average of 30.5 million children daily in 2007 (5). In Tennessee 72.3% of children participated daily in the school lunch program during the 2006 to 2007 school

year (6). From the daily participants in Tennessee, 60.0% were provided with free and reduced-price lunches (6). With this large percent of children participating in the school meal programs, it is important that the meals provide healthy food choices.

Currently the recommendations for school meals are based on the 1995 Dietary Guidelines for Americans (11). The United States Department of Agriculture (USDA) has slowly released new requirements that must be incorporated into the NSLP and SBP based on the 2005 Dietary Guidelines for Americans (11). Along with the new requirements for the Federal child nutrition programs, many states have released new regulations regarding competitive foods. In the state of Tennessee, a rule revised in March 2008, requires schools to meet minimum nutritional standards for all food items sold or offered for sale (12). Although these standards are only required for foods sold in school stores, vending machines, canteens, and as a la carte items, the Tennessee Board of Education “strongly recommends” that these standards be applied to federally reimbursable meals as well (12). To comply with these new policies many schools must revise their menus to include healthier meal options. As healthier options are incorporated into school meals, it is important to ensure that these changes do not negatively impact students’ consumption of school meals. This raises the question; can healthier menu options be implemented without effecting the students’ consumption of school meals? The aims of this study were to answer this question by 1) evaluating the impact of in-service training on school food service employees’ attitudes about nutrition, self-efficacy about preparing healthier meals, and meal preparation behavior changes and 2) determining the plate waste percentages of school meals and school meal participation rates before and after healthier school meals were implemented.

Literature Review

Childhood Overweight and Obesity

The Expert Committee on the Assessment, Prevention, and Treatment of Child and Adolescent Overweight and Obesity has proposed to use the terms “overweight” and “obese” to replace the terms “at-risk for overweight” and “overweight” in children (13). “Overweight” is defined as an age- and gender-specific body mass index (BMI) between the 85th and 95th percentile, while “obese” is defined as an age- and gender-specific BMI at or above the 95th percentile (13).

These new recommended definitions will be presented throughout this document. To determine if a child is overweight or obese their BMI is calculated by dividing a child’s weight in kilograms by their height in meters squared. After BMI is calculated, it is plotted on a gender specific BMI-for-age growth chart, which was developed by the Center for Disease Control and Prevention (14). The growth chart allows comparison of a child’s BMI to that of other children of the same age and gender. Other terms that will be used throughout this document include “children” and “adolescents”. The term “children” represents those individuals ages 6 to 11 years old and the term “adolescents” represents those individuals ages 12 to 19 years old.

The prevalence of obesity in children and adolescents has stabilized in the United States from 1999 to 2006 (1). The analysis from four consecutive time periods showed that the trend in prevalence has not increased, but it has not decreased either (1). Obesity levels in children are still at very high levels. For 2003 to 2006, 17.0% of children between the ages of 6 to 11 were obese (1). The National Survey of Children’s Health (NSCH) reported that in 2005, 32.5% of children ages 10 to 11 years old in Tennessee were obese compared to 21.9% nationally. NSCH

is a parent-reported survey that examines the physical and emotional health of children. The children's BMIs were calculated from the height and weight reported by the parent. Also, this survey reported a decrease in obesity with increased income level (15). According to the Coordinated School Health and Tennessee Department of Health, 43% of children in Tennessee during 2006 were overweight or obese (16).

Childhood obesity is a concern because of the long-term implications. Obese children and adolescents have a 70% chance of becoming overweight or obese adults and are more likely to have risk factors associated with cardiovascular disease than children and adolescents at healthy weights. These risk factors include high blood pressure, high cholesterol, and Type 2 diabetes (2,17).

Based on the trends and long-term implications, Healthy People 2010 has designated obesity and overweight as one of the ten leading health indicators and has designed objectives to combat this problem (18). Objective 19-3 in Health People 2010 states, "Reduce the proportion of children and adolescents who are overweight or obese (3, p19-13)." The target for children is to decrease the percentage of obesity to no more than 5% by 2010. Although it is clear that this objective will not be met in 2010, it may be accomplished in the future by establishing healthful eating and physical activity behaviors, which should begin in childhood and be maintained throughout adulthood. Health People 2010 recommends that healthy eating patterns should be encouraged through school nutrition education. Healthy weight in children should maintain healthy growth through a properly balanced diet. Another objective, 19-15, states, "Increase the proportion of children and adolescents aged 6 to 19 years whose intake of meals and snacks at school

contributes to good overall dietary quality (3, p19-40).” Healthy People 2010 states that improving the quality of students’ dietary intake in the school setting is important because, for many children, meals and snacks consumed at school make a major contribution to their total daily consumption of food and nutrients. Establishing an environment that supports a good overall diet would enable school nutrition and food services to make an important contribution to short- and long-term disease prevention and health promotion (3).

Background on Foods in Schools

The NSLP and SBP are meal programs that were established by the Federal government to improve the quality of lunches provided by schools. The programs are administered at the Federal level by the Food and Nutrition Service of the USDA. The NSLP began in 1946 and lead to the development of the SBP in 1966. Since their development the programs have been assessed and revised to meet the continuing need for good nutrition in school-aged children (5).

The NSLP was established as a measure of national security by the National School Lunch Act of 1946 to “to safeguard the health and well-being of the Nation's children and to encourage the domestic consumption of nutritious agricultural commodities and other foods, by assisting the States, through grants in aid and other means, in providing an adequate supply of food and other facilities for the establishment, maintenance, operation and expansion of nonprofit school lunch programs (5).” The first year, from 1946 to 1947, saw an enrollment of 7.1 million children. Since then, the NSLP has expanded to reach 30.5 million children in 2007 and was provided \$7.7 billion dollars in Federal funding. The program was expanded in 1998 to incorporate reimbursement for snacks in afterschool programs (5).

The SBP began in 1966 as a two-year pilot program for schools in areas with high poverty and where there were long distances between children's homes and their schools. In the first year, 80,000 children were enrolled in the SBP costing the Federal government \$573,000. After several time extensions of the SBP, it was permanently adapted by Congress in 1975. In 2007, the program participation was 10.1 million children and provided \$2.2 billion in funding (5).

Schools eligible to participate in NSLP and SBP are public or nonprofit private schools from elementary through high school. In order to receive Federal reimbursement schools must offer free or reduced price lunches or breakfasts to children who are eligible. In addition, schools must provide meals that meet the federally established nutritional requirements. All children that attend a school participating in either the NSLP or SBP can purchase a meal. In order for children to be eligible for free meals their family income must be at or below 130% of the Federal poverty level. Children eligible for reduced-priced meals have family incomes between 130% and 185% of the poverty level. These children can be charged a maximum of 30 cents for breakfast and 40 cents for lunch. Children with family incomes above 185% of the poverty level can purchase a meal for full price, which is set by individual school districts. In 2007, 59.3% of NSLP participants received free or reduced-price lunches and 80.6% of SBP participants received free or reduced-price breakfasts (5).

To ensure students receive adequate nutrition, Federal nutrition requirements mandate that all school meals meet the 1995 Dietary Guidelines for Americans (5). The Dietary Guidelines for Americans recommend that less than 30% of kilocalories come from fat and less than 10% of kilocalories come from saturated fat. In addition, school lunches must provide one-third of the

Recommended Daily Allowances (RDA) of kilocalories, protein, vitamin A, vitamin C, iron, and calcium. The SBP must provide one-fourth of the RDA for kilocalories, protein, vitamin A, vitamin C, iron, and calcium, using the 1989 RDA (5). Over the span of the NSLP and SBP, new information on nutrition has been introduced and new recommendations have been made. In December 2007, the USDA contracted with the Institute of Medicine to organize child nutrition experts of different specialties to begin plans for incorporating the new 2005 Dietary Guidelines for Americans into school meals (11). Some recommendations, which are awaiting formal ruling, have already been released such as increasing whole grains, fruits, vegetables, and fiber. Other recommendations include offering only low-fat and fat-free milk and milk products, reducing sodium, limiting the amount of cholesterol to less than 100mg for lunch and less than 75mg for breakfast and minimizing trans fats (11). The USDA encourages School Food Authorities to begin updating their menus to reflect these new dietary guidelines (11). Many of the new recommendations will be required when the Child Nutrition and WIC Reauthorization Act of 2004 is reauthorized again (6).

Evaluation of School Meals

New discoveries in the field of nutrition lead to the routine evaluation of the school lunch program so it may provide the best nutrition possible to school-aged children. The nutrition content of the meals in the NSLP and SBP has been evaluated by several major studies. The first major evaluation occurred during the 1980 to 1981 school year and was known as the first National Evaluation of School Nutrition Programs (NESNP-1) (19). The results of this study showed that NSLP participants' lunches, when compared to lunches of nonparticipants, contained a significantly greater amount of kilocalories ($P < .01$), protein ($P < .01$), vitamin A (P

<.01), vitamin B6 ($P <.01$), calcium ($P <.01$), magnesium ($P <.05$), phosphorus ($P <.01$), riboflavin ($P <.01$), niacin ($P <.05$), and thiamin ($P <.01$), but a significantly lower amount of vitamin C ($P <.01$) (20). The results of this study showed the positive nutritional impacts of the NSLP, yet as nutrition standards advanced other studies were needed to determine if the same advances were being implemented in school nutrition programs.

In 1992 the first School Nutrition Dietary Assessment Study (SNDA-I) was conducted which, similar to the NESNP-1, showed NSLP participants' lunches contained significantly ($P <.01$) more kilocalories, protein, vitamin A, calcium, and magnesium and less vitamin C than nonparticipants lunches (7). The study also found that NSLP participants consumed 35% of kilocalories from fat and 13% of kilocalories from saturated fat, which was significantly ($P <.01$) more than nonparticipants at 33% and 12%, respectively (7). The SNDA-I looked at the SBP and found saturated fat, cholesterol, and sodium intakes where above the recommended dietary levels. SBP participants had a higher percentage of kilocalories from fat at 28% ($P <.01$), saturated fat at 11% ($P <.05$), and protein at 51% of the RDA ($P <.01$) when compared to nonparticipants with 24% of kilocalories from fat, 10% of kilocalories from saturated fat, and 36% of the RDA for protein. A lower percentage of kilocalories from carbohydrates, 61% of kilocalories, was seen in SPB participants' breakfasts compared to 65% of kilocalories in nonparticipants' breakfasts ($P <.01$) (7). When this study was conducted, there were no specific target regulations on total fat, saturated fat, sodium, or cholesterol (8). After results were published, the USDA worked to establish regulations and in 1995 began the School Meals Initiative for Healthy Children (SMI) (9). The SMI provided food service personnel resources for preparing nutritious and appealing meals and set new nutrition standards. These standards

followed the previous recommendations, as well as setting new standards for fat and saturated fat (9). Now over a one week time period lunches must provide less than 30% of kilocalories from fat and less than 10% of kilocalories from saturated fat (5).

The second School Nutrition Dietary Assessment Study (SNDA-II) was conducted during the 1998 to 1999 school year to determine if schools were beginning to meet the SMI nutrition standards (9). The results showed a decrease in fat and saturated fat content from SNDA-I to SNDA-II in elementary schools. Elementary schools decreased total fat from 37.5% to 33.5% and saturated fat from 15.2% to 11.9% ($P = .001$), although the average amount of kilocalories from fat and saturated fat were still above the recommended levels (9). The third School Nutrition Dietary Assessment Study (SNDA-III) was completed during the 2004 to 2005 school year, eight years after SMI was implemented (10). The results from this study did not show any significant changes from SNDA-II. The average saturated fat content decreased slightly, but there were no differences in total fat content (10).

Changing School Meals

Implementing healthy changes in NSLP and SPB meals can be challenging. Previous studies have shown different approaches to implementing change in school meals (21-28). Many of the studies rely on certain components, which have proven to be essential to healthier school meals. These components include establishing policies and laws, nutritional analysis of current school menus, and educating food service employees.

The first approach to improve school meals is to strengthen policies and laws at the Federal and state levels. Federal policies for all schools that receive reimbursement for NSLP and SBP include following the Dietary Guidelines for Americans and the SMI recommendations, which were discussed previously. State level policies mainly target competitive foods. These competitive foods are found as options in vending machines, school stores, and during lunch as a la carte items (29). Competitive foods have been shown to contain twice the amount of sugar and contribute 38% to total fat intake (29). One study showed that one-third of sixth grade students purchased competitive foods and as a result, wasted more of their school lunches (29). In another study, a focus group of middle school children found that children said that they selected the unhealthy competitive foods over nutritious lunches when presented with the option (30). In Tennessee, a law was passed to increase the nutritional content of competitive foods sold to students in prekindergarten through eighth grade (12). The law changed minimum nutrition standards of these foods by restricting beverages, limiting portion sizes on foods and beverages, and setting standards for sodium and kilocalories from total fat, saturated fat, and sugar (12).

The final two approaches to creating healthier school meals includes analyzing and revising school menus and educating food service employees to prepare healthier school meals. The Child and Adolescent Trial for Cardiovascular Health (CATCH) was one intervention that used both of these components. CATCH incorporated a variety of programs in the areas of physical education, classroom curriculum, and food service to work toward improving the cardiovascular health of elementary school students (21). The program in the food service area, the Eat Smart program, made nutritional modifications to the school menus and trained food service employees

(22). After three years of intervention, the results showed a decrease in the consumption of total fat from 32.7% to 30.3% of kilocalories and saturated fat from 12.8% to 11.4% of kilocalories in the intervention schools and no significant results in the control schools (21). After the three year period the control schools were given the Eat Smart program package and a one day workshop for food service employees (22). Five years after the intervention was complete, a follow-up study was conducted to determine if the intervention schools were still complying with the SMI standards (22). Menu and recipe analysis were used at the intervention schools and the control schools, along with schools that were never exposed to the CATCH program. The results showed the intervention schools met the SMI standards more closely than the control schools and the unexposed schools (22). The results of this study suggest that food service training should be used to emphasize the importance of preparing foods that meet the SMI standards (22).

Another study revised NSLP menus to increase the amount of fresh fruits and vegetables and lower the amount of fat in entrees served. In addition, a Registered Dietitian (RD) provided training for food service employees. The purpose of the training was to provide food service employees with an explanation of the menu changes and to earn support for the changes. The results of this study showed an increase in amount of fruits and vegetables served from a baseline of 1.10 servings per student per day to 1.42 servings per student per day at six weeks (23).

Research shows that educating food service employees is essential to the success of developing healthier school meals. Educating food service employees will increase their knowledge of nutrition, which has been associated with healthy eating (24). The food service intervention areas should target educating food service employees on menu planning, recipe development,

food purchasing, and food preparation (25). Other successful health education programs have cited the training and educating of staff as their reason for success (26-27). The use of an outside facilitator when educating staff has been shown to enhance implementation by providing new strategies and organization to the program (28).

Plate Waste Studies

After implementing changes, plate waste studies have been used to determine how much of the school meal is actually being consumed. In a study completed with sixth grade students, factors that increased plate waste were identified as preparation methods and availability of competitive foods (31). Serving foods like whole apples resulted in a lower acceptance (23%) and a greater plate waste (62%), where as serving applesauce had a greater acceptance (37%) and a lower plate waste (23%) (31). The purchase of competitive foods significantly increased the amount of school lunch fruits wasted from 36% to 52% ($P = .0001$), grain product wasted from 14% to 26% ($P = .009$), meats wasted from 16% to 25% ($P = .015$), and mixed dishes wasted from 18% to 30% ($P = .0001$) (31). Another plate waste study showed that students with a low variety of fruits and vegetables, only four items, took 117gm and consumed only 36gm of fruits and vegetables compared to a lunch menu that contained a higher variety, six items, of fruits and vegetables, where 107gm of fruits and vegetables were taken but 61gm were consumed (32). The conclusion to this study showed that when children were presented with a wide selection of fruits and vegetables, they were more likely to take the items they would eat and wasted less of the item (32). Also, this study showed that a larger number of students selected fruits and vegetables when more were available to them (77 students compared to 70 students) (32). In addition, plate waste studies have been used to determine what time lunch should be scheduled in

relation to the time of recess (33). The study showed a significant decrease in plate waste, from 40.7% to 27.2%, when recess was scheduled before lunch ($P < .0001$) (33). Plate waste studies were found to be more accurate for obtaining dietary intakes of children than other methods, such as 24-hour dietary recalls, food frequency, and other observational methods (32).

Summary

Over the past four years, childhood obesity has stabilized at a high rate of 17.0% (1). This rate will likely remain high unless interventions that target the environment, consumption patterns, and dietary intake and physical activity patterns are put into place. In 2007, the NSLP participation was 30.5 million children and the SBP participation was 10.1 million children (5). School meals are served to large amounts of children and make up a major part of their diet. Thus, improving the nutritional quality of school meals is important (3). School menus should be analyzed and updated with new nutritional recommendations. Additionally, food service employees should be educated in why these new changes are needed. Further, plate waste studies should be used to determine if the new changes are accepted by the students.

Research Questions

The purpose of this study was to evaluate if healthier menu options can be implemented without negatively effecting the students' consumption of school meals. The specific questions answered by this research include:

1. Are there significant differences in the nutrition attitudes, self-efficacy for preparing healthier meals, and behavior scores of school food service employees at baseline, after

in-service training workshops, and at the end of the study period as tested by a questionnaire?

2. Are there significant differences in school breakfast and lunch mean plate waste percentages before and after the implementation of healthier school meal options at three elementary schools?
3. Are there differences in school breakfast and lunch participation rates before and after the implementation of healthier school meal options?
4. Are there differences in nutrients consumed before and after the implementation of healthier school meal options?

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**PART II: IMPACT OF NUTRITION AND CULINARY
IN-SERVICE TRAINING ON SCHOOL FOOD SERVICE
EMPLOYEE ATTITUDES, EFFICACY, AND BEHAVIOR**

Abstract

Background

As part of a Coordinated School Health Program project to improve the nutrition quality of school meals, a series of nutrition education and culinary training in-service workshops were conducted. The objective of this study was to evaluate the effect of the training on food service employees' attitudes about nutrition, self-efficacy for preparing healthier meals, perceived barriers to preparing healthier meals, and food preparation behavior changes.

Methods

The subjects for this study were 12 school food service employees from a rural school district located in East Tennessee. Three workshops, two-hours each, and one full day workshop were planned and conducted by a registered dietitian, chef, and public health nutrition graduate student for the food service employees. Baseline, post-workshop, and follow-up questionnaires were administered to participants. The mean response ratings of each questionnaire section were analyzed by repeated measures ANOVA to determine if there were significant differences between the three time points and the differences in means were evaluated by post hoc comparisons with Bonferroni corrections.

Results

The nutrition education and culinary training in-service workshops provided in this study showed no change in school food service employees' nutrition attitudes, self-efficacy for preparing healthy meals, and food preparation behavior. However, the workshops were successful in reducing perceived barriers to preparing lower-fat meals and serving fruits and vegetables. The results for

perceived barriers to preparing lower-fat meals showed a significant difference in mean response ratings (3.56 ± 0.54 , 3.02 ± 0.48 , and 3.16 ± 0.5 at baseline, after the educational workshop, and at follow-up, respectively; $F(2,9)=5.52, P=.027$). Post hoc comparisons showed a significant decrease in these perceived barriers between baseline and after the educational workshops ($P=.019$). The mean response rating for perceived barriers to serving fruits and vegetables was 3.52 ± 0.62 , 3.20 ± 0.49 , 2.86 ± 0.49 at baseline, after educational workshops, and at the end of the study period, respectively, and showed an overall significant difference ($F(2,9)=12.283, P=.003$). Post hoc comparisons showed a significant decrease in mean response ratings from baseline to after the educational workshops ($P=.001$) and from baseline to follow-up ($P=.036$).

Conclusion

The use of an integrated model of nutrition education in schools for food service employees is important when implementing change, as it may be able to reduce employees' perceived barriers to preparing healthy school meals. Different modes of training by those who are experts in their fields should be utilized to create a healthy school nutrition environment.

Introduction

Educating food service employees is an important step to implementing healthier menu options in schools. Providing education to food service employees on why it is important to change school menus may encourage implementation of healthier options. The training and educating of employees has been cited as the reason for success in some health education programs (1-2).

A study developed to improve the cardiovascular health of elementary school children, The Child and Adolescent Trial for Cardiovascular Health (CATCH), incorporated training of food service employees into the Eat Smart Program. Food service employee training was integrated into a three-year intervention at some schools and then in a one day training session at other schools (3). A follow-up study conducted five years after the completion of the intervention showed the intervention schools that received the three-year intervention met the NSLP standards more closely than schools that received the one day training and schools that were unexposed. Training of food service employees can assist schools in meeting the School Meal Initiative standards (3).

In a study by Cullen and colleagues, middle school lunch menus were revised to increase the amount of fresh fruits and vegetables and lower the amount of fat in entrees served. A Registered Dietitian (RD) then explained the menu changes to food service employees and tried to earn their support for the changes. The results of this study showed an increase in the amount of fruits and vegetables served from a baseline of 1.10 servings per student per day to 1.42 servings per student per day at six weeks follow-up (4).

While several studies have incorporated training for food service employees, few have examined the use of nutrition education and culinary training on food service employees' attitudes, self-efficacy, perceived barriers, and behaviors. Self-efficacy is defined as the belief in one's own capabilities and has been shown to positively impact an individual's ability to successfully perform tasks or implement changes in behavior (5). As part of a Coordinated School Health Program project to improve the nutrition quality of school meals, a series of nutrition education and culinary training in-service workshops were conducted by educators not affiliated with the school district, including a RD, a chef, and a public health nutrition graduate student. The use of outside facilitators to educate staff has been shown to enhance the implementation of programs by providing new strategies and organization (6). The objective of this study was to determine the effect of training on food service employees' attitudes about nutrition, self-efficacy for preparing healthier meals, perceived barriers to preparing lower-fat meals and serving fruits and vegetables, and food preparation behaviors, as tested by a questionnaire at baseline, after in-service training workshops, and at four months follow-up.

Methods

Subjects

A rural school district located in East Tennessee was selected for this study. The subjects for the nutrition education and culinary in-service training were all food service employees in the school district, a total of 12 employees. Required approval was obtained from The University of Tennessee Institutional Review Board prior to conducting the project. Participant informed consent was obtained prior to administering the questionnaires.

Procedure

Three, educational, in-service training, workshops, two-hours each, followed by a full day workshop, were provided to the 12 school food service employees. The purposes of the workshops were to improve food service employees' nutrition attitudes about encouraging healthy lifestyles among students, improve their self-efficacy for preparing healthy meals for children, decrease barriers to preparing healthy meals, and provide culinary training on healthy meal preparation. The topics for the workshop were chosen based on an extensive literature review and upon request by the Coordinated School Health Director and Director of Foodservice in the school district.

The first in-service educational workshop took place in late summer. The topics included a background on the United States obesity epidemic with a special focus on childhood and adolescent overweight and obesity, which was presented by the RD, and information on the nutrition facts label, which was presented by the public health nutrition graduate student. Employees were given a nutrition facts label handout (Figure A-1) and questions about the food label were discussed and clarified. To conclude the lesson, a label reading activity was conducted with three food item boxes and a worksheet (Figure A-2), which were completed by the participants. The answers to the worksheet were then reviewed as a group.

The second in-service educational workshop included information on the Dietary Guidelines for Americans presented by the RD. The public health nutrition graduate student presented information about MyPyramid on food groups, recommended servings, physical activity, and

portion sizes. Participants received a MyPyramid worksheet, (Figure A-3), which allowed them to review how well they balanced their own food choices.

The third workshop was conducted by the public health nutrition graduate student and the chef in the fall. During this workshop, information was presented on the health benefits of fruit and vegetable consumption. The chef prepared examples of healthy fruit and vegetable dips, focused on the ascetics of food preparation, and discussed ways to preserve food on a food line. All participants were able to sample the dips with fresh fruits and vegetables. Recipes used during this workshop can be found in Figure A-4.

At the final full day workshop, the chef demonstrated how to prepare a low-fat meal of meatloaf, green beans, and mashed potatoes. The RD provided information on the use of fresh ingredients, herbs, and spices to enhance recipes while lowering total, saturated, and trans fats, cholesterol, and sodium. Food service employees participated in an activity to test their knowledge of sodium and herbs and spices (Figure A-5) and had the opportunity to discuss the preliminary analysis of menus and develop an action plan.

A questionnaire was developed using questions from the CATCH Eat Smart Food Service Worker Questionnaire (7) and a questionnaire developed to evaluate self-efficacy for preparing healthy meals among participants in a community-based diabetes education program (8). The only questions eliminated from the CATCH questionnaire were those that pertained directly to the Eat Smart Program. The questionnaire was divided into six main sections that utilized response scales and a demographic section at the end to collect information about the employees.

Each response scale section was averaged to determine if there were significant changes that occurred in the employees' attitudes about nutrition, their self-efficacy for preparing healthier meals, perceived barriers, or their food preparation behaviors. A copy of the questionnaire can be found in Figure A-6.

The first section of the questionnaire evaluated the employees' attitudes about the importance of encouraging a healthy lifestyle in children. The section utilized a Likert-like response scale from one, which indicated not at all important, to five, which indicated very important. One question in this section, regarding participation in Coordinated School Health Program, was included in this section because the researchers agreed that it was related to encouraging a healthy lifestyle in children. This program, especially in this school district, educates school staff on ways to encourage healthy lifestyle behaviors in children.

The next section evaluated the food service employees' nutrition attitudes toward the impact of school foods on child health through the employees' agreement with statements. Agreement was rated on a Likert-like response scale from one, which indicated strongly disagree, to five, which indicated strongly agree. A higher mean response rating on this scale indicated a more positive attitude regarding the impact of school foods on child health.

The third section tested the food service employees' self-efficacy in their ability to prepare healthier meals. This section asked the employees to rate their confidence on a Likert-like response scale from one, which indicated not at all confident, to five, which indicated completely confident. A higher mean response rating on this scale indicated a more positive attitude

regarding the food service employees' self-efficacy in their ability to prepare healthier meals. After this section, there was an opinion question about the implementation of the Coordinated School Health Program. This question was not analyzed in the results because it did not relate to the employees attitudes about nutrition, self-efficacy for preparing healthier meals, or food preparation behaviors.

The fourth response scale section measured the food service employees' perceived barriers in preparing foods lower in fat. The section asked the employees to indicate their agreement with statements that make it hard to prepare foods that are lower in fat at their school. The response scale for this section was from one, which equaled strongly disagree, to five, which equaled strongly agree. A higher response indicated a strong agreement that barriers existed to preparing foods lower in fat at school.

The fifth response scale section examined the food service employees' perceived barriers for serving fruits and vegetables. The section asked the employees to indicate their agreement with statements that make it hard to serve fruits and vegetables at their school. The response scale for this section was the same as the last section, from one, which signified strongly disagree, to five, which signified strongly agree. A higher response in this section indicated a strong agreement that barriers existed to serving fruits and vegetables at school.

There were two yes or no questions prior to the final response scale section. These questions asked about the time children had to eat lunch and who was included in menu planning. These

questions were used to obtain information for later menu revisions and were not analyzed for this study.

The final response scale section tested for changes in food preparation behaviors by asking about methods used in preparing school meals. The response scale for this section was from one, which signified never, to five, which signified always. There was also a selection for “doesn’t apply” for this section, but it was eliminated when analyzing this section, as no employees selected this response. A higher mean response rating on this scale indicated positive food preparation behaviors.

To keep the confidentiality of the employees, each food service employee was asked to randomly select a card containing the name and a picture of a fruit and to write the name of the fruit on their questionnaire. The food service employees’ then wrote their name on the cards, which were kept by the participants for further reference at each administration of the questionnaire. This allowed the surveys to be anonymous, while still allowing researchers to match the baseline, follow-up, and retention results. The entire questionnaire was given prior to the beginning of the first in-service training workshop. The same questionnaire was administered at the end of the in-service training workshops to evaluate the effectiveness of the educational workshops on improving the response ratings. The questionnaire was administered a third time, four months after the end of the workshops, to test retention and behavior change.

Data Analysis

The mean ratings of each response scale section of the questionnaire were calculated to determine if there were significant differences in attitudes about nutrition, self-efficacy for

preparing healthier meals, perceived barriers to preparing low-fat meals and serving fruits and vegetables, and food preparation behavioral ratings of the food service employees' at baseline, after in-service training workshops, and after a four month follow-up period. SPSS statistical analysis software was used for data analysis (9). The mean response ratings from each section of the food service employee questionnaire were first analyzed by repeated measures ANOVA to determine if there were significant differences between the three time points and the differences in means were then evaluated by post hoc comparisons with Bonferroni corrections.

Results

The questionnaire was taken by 12 food service employees, which included five cafeteria workers, three cafeteria managers, and one food service director. All of the employees were White/Caucasian females with four employees at School 1 and School 2, and three employees at School 3. Years of experience and further demographic statistics of the participants can be seen in Table 2-1.

The first section of the questionnaire included four questions that evaluated the importance of encouraging a healthy lifestyle in children. The section means were 4.39 ± 0.96 , 4.75 ± 0.52 , 4.33 ± 0.56 at baseline, after the educational workshops, and at follow-up, respectively. All of the means were above 4.0, which showed that the food service employees thought encouraging a healthy lifestyle in children was important. The results of the repeated measures ANOVA indicated a significant difference ($F(2,10)=4.93, P=.032$) and post hoc comparisons showed a significant decrease between mean ratings after the workshop and at follow-up ($P=.027$). However, there were no significant differences between baseline and post-workshop and

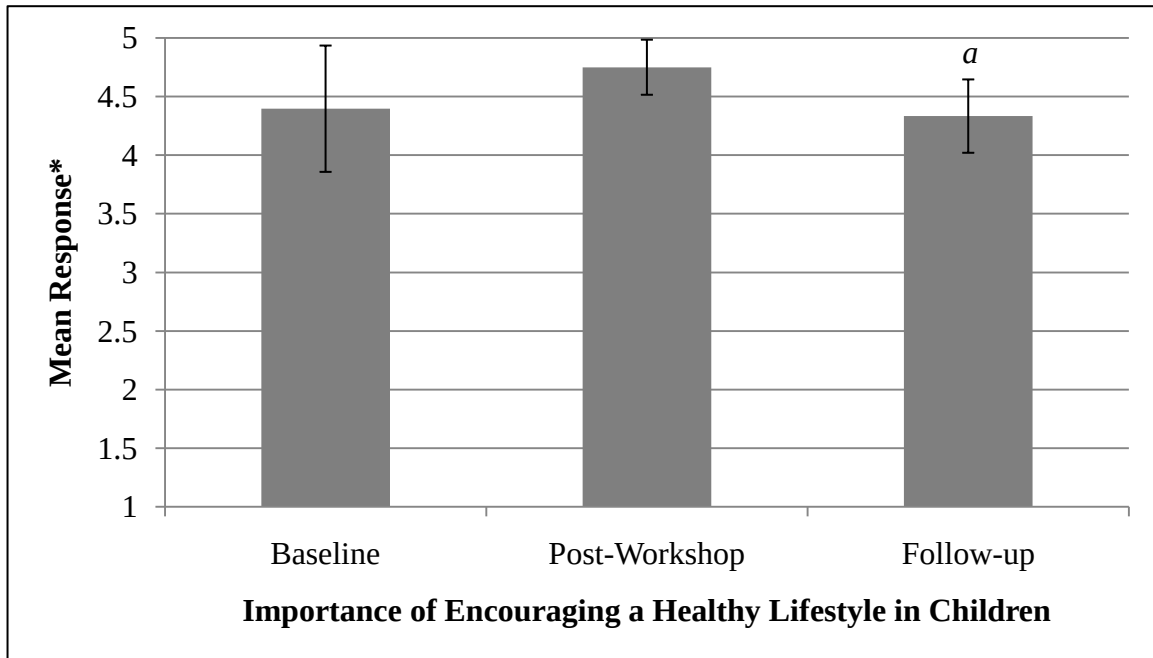
Table 2-1. Social Demographics About School Food Service Employees.

	Minimum	Maximum	Mean	Standard Deviation
Age	31.0	66.0	47.8	10.5
Years employed at current school	0.0	30.0	9.5	9.2
Years employed at current position	0.0	14.0	5.9	4.9
Years employed in food service	0.0	30.0	11.7	8.3

between baseline and follow-up questionnaire. The results comparing the mean responses for this section of the questionnaire are depicted in Figure 2-1. Table 2-2 shows the mean responses by each question in the section.

The next section tested nutrition attitudes through employees' level of agreement to six different statements. The total means of this section were $3.47 \pm .99$ at baseline, 3.83 ± 0.88 after educational workshops, and 3.65 ± 0.83 at follow-up. The results of the repeated measures ANOVAs did not indicate a significant difference ($F(2,10)=3.93, P=.075$). The mean responses for each question in section two are listed in Table 2-3.

The third section tested the food service employees' self-efficacy for preparing healthy meals and included six questions. The mean ratings were 3.83 ± 0.81 , 3.68 ± 0.77 , 3.94 ± 1.19 at baseline, after the educational workshops, and at follow-up, respectively. The results showed that they were more than "kind of confident" in their abilities at each measurement, with each of



^a Analysis of variance indicates that follow-up was significantly lower than the post-workshop at $P < .05$. Error bars indicate 95% confidence intervals.

*Response scale: 1 = not at all important to 5 = very important

Figure 2-1. Attitudes About the Importance of Encouraging a Healthy Lifestyle in Children Among School Food Service Employees at Baseline, Post-Workshop, and Follow-up.

Table 2-2. Mean Response Ratings Regarding Importance of Encouraging a Healthy Lifestyle in Children Among Food Service Employees at Baseline, Post-Workshop, and Follow-up.

Question/Statement	Baseline			Post-Workshop			Follow-Up		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
a. How important is it to encourage elementary school children to eat a diet that is low in fat?	12	4.33	1.23	12	4.58	0.79	12	4.17	0.72
b. How important is it to encourage elementary school children to eat at least 5 fruits & vegetables a day?	12	4.08	1.08	12	4.75	0.45	12	4.42	0.52
c. How important is it to have children be active during the school day?	12	4.50	0.52	12	4.75	0.45	12	4.50	0.52
d. How important is it for cafeteria staff to participate in coordinated school health?	12	4.58	0.90	12	4.92	0.29	12	4.25	0.45
Total Mean Ratings		4.37	0.93		4.75	0.50		4.34	0.55

Response scale: 1 = not at all important to 5 = very important

Table 2-3. Mean Response Ratings Regarding Importance of School Food Nutrition Among School Food Service Employees at Baseline, Post-Workshop, and Follow-up.

Question/Statement	Baseline			Post-Workshop			Follow-Up		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
a. Children who eat low-fat foods at school will be healthier than children who do not eat low-fat foods at school.	12	3.42	0.67	12	3.58	0.67	12	3.58	0.90
b. Children who eat fruits & vegetables at school will be healthier than children who do not eat fruits & vegetables at school.	12	2.83	0.72	12	4.08	0.67	12	3.92	0.67
c. Children who are overweight have more health risks than children who are normal weight.	12	4.25	0.75	12	4.67	0.65	12	4.17	0.72
d. What a child eats at home is more important to a child's diet than what I serve at school.	12	3.42	1.08	10	3.10	0.99	11	3.45	0.52
e. Children who are healthier now will be healthier as adults.	12	3.92	1.17	12	3.58	1.00	12	3.67	0.89
f. Schools that have coordinated school health will help prevent chronic diseases such as obesity, cardiovascular disease, and type 2 diabetes.	12	3.83	0.94	12	3.92	0.52	12	3.00	0.85
Total Mean Ratings		3.61	0.89		3.82	0.75		3.63	0.76

Response scale: 1 = strongly disagree to 5 = strongly agree

the means approaching four on a scale of one to five, where one indicated not at all confident and five indicated completely confident. The results indicated no change over the different time points ($F(2,9)=.892, P=.443$). Table 2-4 lists the individual mean responses for each question in section three.

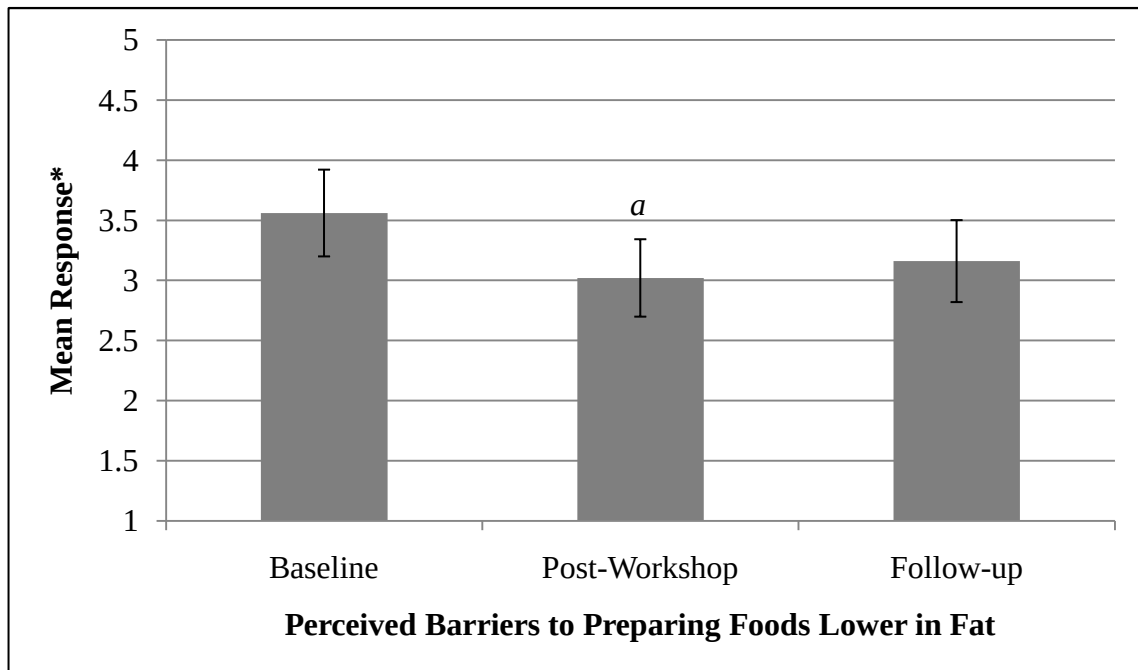
The fourth response scale section measured the food service employees' perceived barriers to preparing foods lower in fat. There were ten statements rated in this section. The mean results for perceived barriers showed a mean of 3.56 ± 0.54 at baseline, a mean of 3.02 ± 0.48 after the educational workshop, and a mean of 3.16 ± 0.51 at follow-up. The results of the repeated measures ANOVAs were $F(2,9)=5.52, P=.027$, which indicated a significant difference. Post hoc comparisons were performed to determine which time points differed. The results showed a significant decrease in the perceived barriers for preparing foods lower in fat between baseline and after the educational workshop ($P=.019$). No significant difference was seen between baseline and follow-up or after the educational workshop and at follow-up. Figure 2-2 depicts the mean responses and indicates the time points in which the significant differences occurred for this response scale section. Table 2-5 list the mean responses for each question in section four.

The fifth response scale section examined the food service employees' perceived barriers for serving fruits and vegetables. This response scale section included ten statements to be rated. The mean responses for perceived barriers were 3.52 ± 0.62 , 3.20 ± 0.49 , 2.86 ± 0.49 at baseline, after educational workshops, and at follow-up, respectively. Results indicated significant differences across time ($F(2,9)=12.283, P=.003$). After conducting post hoc comparisons, a significant decrease was detected in mean responses from baseline to after the educational

Table 2-4. Mean Response Ratings Regarding Self-Efficacy for Preparing Healthy Meals Among School Food Service Employees at Baseline, Post-Workshop, and Follow-up.

Question/Statement	Baseline			Post-Workshop			Follow-Up		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
a. How confident are you that you can prepare healthy meals?	12	3.92	0.90	12	3.58	0.79	11	4.45	0.82
b. How confident are you that you know how to use food labels?	12	3.58	0.67	12	4.08	1.00	11	4.73	0.65
c. How confident are you that you can prepare school foods that are low in fat?	12	3.67	0.78	12	3.83	0.72	11	4.18	0.87
d. How confident are you that you can make more fruits & vegetables available as school foods?	12	3.58	0.90	12	3.42	0.67	11	3.00	1.41
e. How confident are you that you can prepare school foods that are lower in salt (sodium)?	12	4.00	0.85	12	3.42	0.67	11	3.73	1.27
f. How confident are you that you can make more whole grain food choices available as school foods?	12	3.83	0.84	12	3.50	0.67	11	3.55	1.21
Total Mean Rating		3.76	0.82		3.64	0.75		3.94	1.04

Response scale: 1 = Not at all confident to 5 = Completely confident



^a Analysis of variance indicates that post-workshop was significantly lower than the baseline at $P < .05$. Error bars indicate 95% confidence intervals.

*Response scale: 1 = Strongly Disagree to 5 = Strongly Agree

Figure 2-2. Perceived Barriers to Preparing Foods Lower in Fat Among School Food Service Employees at Baseline, Post-Workshop, and Follow-up.

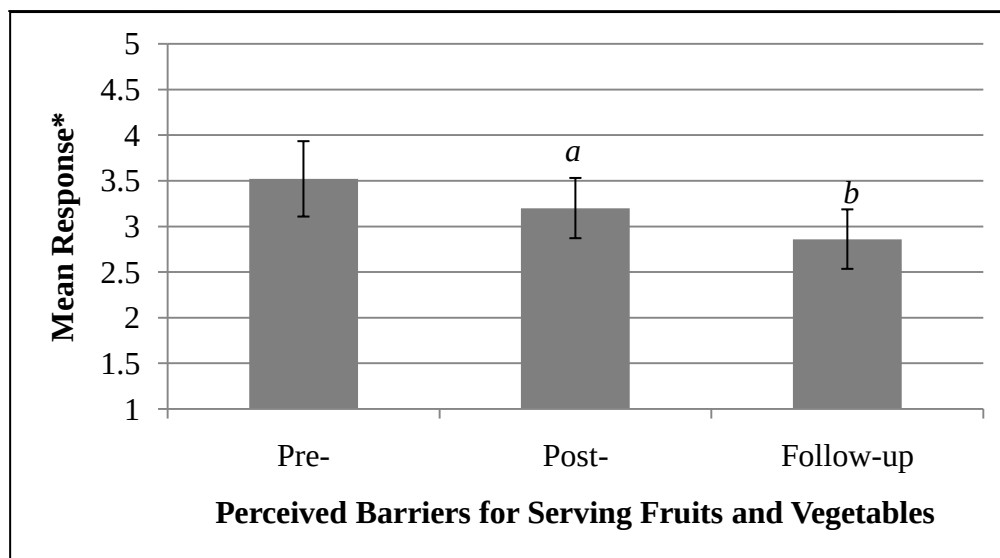
Table 2-5. Mean Response Ratings for Perceived Barriers to Preparing Foods Lower in Fat Among School Food Service Employees at Baseline, Post-Workshop, and Follow-up.

Leading Question: At your school, what makes it hard to prepare foods that are lower in fat?									
Question/Statement	N	Baseline Mean	SD	N	Post-Workshop Mean	SD	N	Follow-Up Mean	SD
a. Not enough time	12	2.67	0.78	12	2.75	0.87	10	3.00	1.16
b. Lack of ingredients	11	3.73	0.91	11	2.73	1.19	11	4.36	0.67
c. Low-fat foods are too expensive	12	3.42	1.17	12	3.25	0.75	11	3.82	0.60
d. Low-fat foods are harder to prepare	11	3.18	0.60	12	2.25	0.87	11	2.45	1.13
e. Student food preferences	11	4.36	0.92	11	3.82	0.75	11	3.73	0.79
f. Not enough parent support	12	3.67	1.30	11	3.27	1.19	10	3.40	0.84
g. Not enough classroom teacher support	12	4.00	0.95	12	3.33	1.23	11	2.82	1.40
h. Not enough Principal support	12	3.67	1.61	12	3.25	1.06	11	2.91	1.38
i. Not enough support at the district level	12	3.58	0.79	11	3.27	1.10	11	3.09	0.83
j. I'm not trained to prepare low-fat foods	12	2.83	0.84	12	2.25	0.87	11	1.91	0.54
Total Mean Ratings		3.51	0.99		3.02	0.99		3.15	0.93

Response scale: 1 = Strongly Disagree to 5 = Strongly Agree

workshops ($P=.001$) and from baseline to follow-up ($P=.036$). No significant difference was found after the educational workshop to follow-up. The mean responses for this section are depicted in Figure 2-3. The mean responses for each question in section five are listed in Table 2-6.

The final response scale section tested for changes in food preparation behaviors and showed no change in mean responses from baseline (3.75 ± 1.29), to after the educational workshops (3.75 ± 1.330), to follow-up (3.78 ± 1.132). The results from the repeated measures ANOVA, $F(2,10)=.018, P=.982$, showed that no significant changes were seen in the food service employees' food preparation behaviors. The mean responses for each question in section six are listed in Table 2-7.



^a Analysis of variance indicates that post-workshop was significantly lower than the baseline at $P<.001$.

^b Analysis of variance indicates that follow-up was significantly lower than the baseline at $P<.05$.

Error bars indicate 95% confidence intervals.

*Response scale: 1 = Strongly Disagree to 5 = Strongly Agree

Figure 2-3. Perceived Barriers to Serving Fruits and Vegetables Among School Food Service Employees at Baseline, Post-Workshop, and Follow-up.

Table 2-6. Mean Response Ratings for Barriers to Serving Fruits and Vegetables Among School Food Service Employees at Baseline, Post-Workshop, and Follow-up.

Leading Question: At your school, what makes it hard to serve fruit and vegetables?									
Question/Statement	Baseline			Post-Workshop			Follow-Up		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
a. Not enough time	12	2.67	0.65	12	2.50	0.67	11	2.00	0.89
b. Lack of availability of fruits & vegetables	12	4.00	0.85	12	3.83	1.19	11	3.82	0.98
c. Fruits & vegetables are too expensive	12	4.08	1.00	12	3.67	0.99	11	3.55	0.93
d. Foods with fruits & vegetables are harder to prepare	12	2.25	1.06	12	1.83	0.58	11	1.82	0.41
e. Student food preferences	12	3.75	0.75	12	3.00	1.04	11	3.45	0.52
f. Not enough parent support	12	3.67	1.07	12	3.33	0.78	10	2.70	1.06
g. Not enough classroom teacher support	12	3.75	0.97	12	3.42	1.08	11	2.64	1.12
h. Not enough principal support	12	3.33	1.30	12	3.17	1.27	11	2.64	1.29
i. Not enough support at the district level	12	3.75	0.97	12	3.42	1.17	11	3.09	1.14
Total Mean Ratings		3.51	0.62		3.20	0.49		2.86	0.47

Response scale: 1 = Strongly Disagree to 5 = Strongly Agree

Table 2-7. Mean Response Ratings Regarding Food Preparation Behaviors Among School Food Service Employees at Baseline, Post-Workshop, and Follow-up.

Leading Question: Do you currently use any of these methods in preparing school meals?									
Question/Statement	Baseline			Post-Workshop			Follow-Up		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
a. Follow recipes measuring all ingredients with standardized measuring utensils.	12	4.25	0.75	12	4.00	0.85	12	4.00	0.85
b. Serve menu items with standardized serving utensils.	12	4.50	0.80	12	4.42	0.67	12	4.42	0.67
c. Drain and rinse fat from cooked meat.	12	4.08	1.38	12	4.08	1.24	12	4.08	1.24
d. Offer skim, non-fat, or low-fat plain and flavored milk.	12	4.75	0.45	11	4.91	0.30	11	4.91	0.30
e. Increase use of fresh, frozen, canned, and dried fruits.	12	3.83	0.72	12	4.25	0.75	12	4.25	0.75
f. Increase use of fresh, frozen, or canned vegetables and salads.	12	3.33	0.78	12	4.08	0.90	12	4.08	0.90
g. Reduce or eliminate butter, oil, margarine, and animal fat added to vegetables.	12	4.18	0.75	12	3.67	1.07	12	3.67	1.07
h. Reduce or eliminate butter, oil, margarine, and animal fat added to pasta and rice.	12	3.83	0.84	12	3.58	1.08	12	3.58	1.08
i. Reduce or eliminate butter & mayonnaise added to breads (e.g., sandwiches, toast, biscuits, rolls).	12	4.08	0.79	12	3.42	0.90	12	3.42	0.90
j. Use skim, low-fat, or non-fat dry milk in cooking.	12	4.67	0.49	12	4.33	0.89	12	4.33	0.89
k. Gradually reduce the amount of fat used in recipes.	12	4.00	0.95	11	3.55	0.69	11	3.55	0.69
l. Replace butter or shortening with vegetable oil or margarine whenever possible.	12	4.08	1.31	12	3.92	0.79	12	3.92	0.79
m. Use non-stick coating spray or pan liners instead of greasing pans.	12	3.33	1.67	12	3.83	0.84	12	3.83	0.84
n. Use herbs in place of salt	12	1.83	1.19	12	2.42	1.56	12	2.42	1.56
o. Use artificial sweeteners instead of sugar?	12	1.58	0.79	12	2.50	2.20	12	2.50	2.20
Total Mean Ratings		3.75	0.91		3.80	0.98		3.80	0.98

Response scale: 1 = Never to 5 = Always

Discussion

The National School Lunch Program and School Breakfast Programs have new nutritional recommendations, such as increasing whole grains, fruits, vegetables, and fiber. Other recommendations include offering only low-fat and fat-free milk and milk products, reducing sodium, limiting the amount of cholesterol to less than 100mg for lunch and less than 75mg for breakfast, and minimizing trans fats (10). Therefore, most schools must change their menus to comply (10). In order to implement these new recommendations and improve the health of children in schools, programs to educate school food service employees have been initiated in schools. Studies have shown that educating and training staff is essential to the success of health programs as measured by self-reports and observations (1-2,11). Providing nutrition education to food service employees and explaining why the changes need to be made, instead of just providing them with healthier recipes, may encourage their support of the new requirements (12). This study evaluated the effect of nutrition and culinary in-service training on food service employees' nutrition attitudes, self-efficacy for preparing healthier meals, perceived barriers for preparing low-fat meals and serving fruits and vegetables, and food preparation behaviors at baseline, after in-service training workshops, and at four months follow-up as tested by a questionnaire.

The attitudes of the food service employees' towards encouraging a healthy lifestyle in children was seen as important at each evaluation. Survey results indicated that directly after the in-service workshops the food service employees' felt encouraging a healthy lifestyle in children was the most important, but four months after the in-service workshops were completed, their

opinions reverted back to the baseline measurements. This indicates that the slight increase in responses seen after the workshop, although not significant, was not sustained at follow-up. These results were similar to those found in a five-year follow-up study on the CATCH Eat Smart Program, which compared schools who received three years of the Eat Smart intervention, schools that received one day of training, and schools that were unexposed. Among these three groups, no differences were seen in food service employees' attitudes towards encouraging a healthy lifestyle in children, as each group believed this was important (3).

When the food service employees' were asked questions about their self-efficacy in their ability to prepare healthier meals, no changes were seen. They were confident in their abilities at each measurement point. The workshop did not have an additional impact on the employees' self efficacy for preparing healthier meals. When questions were asked about their perceived barriers for preparing low-fat meals and serving fruits and vegetables, at baseline the food service employees agreed that barriers existed. As a result of the in-services, a significant decrease was seen in their view of the perceived barriers, which may indicate that they had increased confidence for overcoming the barriers for preparing foods lower in fat and serving fruits and vegetables. The decrease in perceived barriers was retained at follow-up. The use of a professional chef to teach food service employees how to prepare foods that were lower in fat or contained fruits and vegetables may have given the employees a sense of support from the school district and principals. Our commitment to include key stakeholders (the food service workers) in the process of improving the menus may have also encouraged the support of district administrators and principals. These findings are similar to those reported by other studies that

concluded that the use of an outside facilitator was essential to the implementation of programs that address nutrition and physical activity (6,13).

The behavior responses were expected to show no change from baseline to after the educational workshops, because during the duration of the workshops the food service employees did not change their preparation methods of school meals. After the workshops healthier menu options were implemented, but again no change was seen in the food service employees' behaviors. This result may have occurred because the in-service trainings ended prior to implementation of healthier meals. These findings may suggest that in-service training throughout the implementation period is warranted. A study conducted by Hoelscher and colleagues showed that one educational training session was not effective, although continued training sessions were effective in implementing NSLP standards (3). This study attempted to use multiple training session, but did not have effective behavioral reinforcements to support change once the new menu items were implemented. These findings are representative of other studies findings that training of staff must include behavior change techniques in order to promote change (1,3).

Limitations

Limitations of this study included the one-group pre-test/post-test design to analyze the change in nutrition attitudes of the food service employees. This research design may increase the risk for changes in the subjects that would have occurred anyway and the learning effect on the post-test from taking the pre-test (14). The sample population for the food service workshop was only 12 employees, which limits the strength of the statistical analysis. However, the use of repeated measures ANOVA allowed for each participant to be measured at each time point allowing for a

stronger analysis. The lack of ability to have a control group of food service employees was a limitation as well. Working with a unique school district with a small number of schools made it difficult to find a control group of food service employees outside of the school district. Also, due to the small size of the district, it did not allow for a control group inside the same district.

Conclusion

The nutrition education and culinary training in-service workshops provided in this study significantly decreased the food service employees' perceived barriers for preparing healthier school meals, including preparation of lower fat meal preparation and serving fruits and vegetables. The use of an integrated model of nutrition education, similar to the one in this study, for school food service employees are important when implementing change. Providing information to participants should only be one part of the overall education. Different modes of training by those who are experts in their fields should be utilized to provide visual examples, activities, and discussions. Reducing perceived barriers was a good first step, but nutrition education should be expanded to include components that create behavior changes in food preparation. These various methods of education should be combined to create in-service trainings for food service employees' that will aid in creating a healthy school nutrition environment.

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**PART III: EFFECTS OF IMPLEMENTING HEALTHIER
SCHOOL MEALS ON THE AMOUNT OF PLATE WASTE IN
ELEMENTARY SCHOOLS**

Abstract

Background

As part of a Coordinated School Health Program project to improve the nutrition quality of school meals, a series of nutrition education and culinary training in-service workshops were conducted followed by the implementation of healthier school meals. As healthier school meals are incorporated into schools, it is important to ensure the changes do not negatively impact students' consumption of school meals. The objective of this study was to determine if there were significant differences in school breakfast and lunch plate waste percentages before and after implementation of healthier school meals.

Methods

The study was done in a rural school district in East Tennessee. At each measurement point, 100 breakfast and lunch trays of students in grades first through sixth were selected at three schools. Plate waste measurements were conducted at baseline, after healthier school meals were implemented, and at four weeks follow-up in each school.

Results

The plate waste results at School 1 indicated no significant change in plate waste from baseline to after implementation of healthier school meals at either breakfast or lunch. There was no significant change in lunch, but a significantly increased waste for breakfast at School 2 after implementation ($P<.001$) and at follow-up ($P<.001$). School 3 showed significantly increased

waste for breakfast after implementation ($P<.001$) and at follow-up ($P<.001$) and lunch after implementation ($P<.001$) and at follow-up ($P<.001$).

Conclusion

The acceptance of healthy school meals by students was mixed. The USDA provides recipes to schools that meet nutrient recommendations and incorporates the use of commodity foods. This study shows that the USDA entrée recipes for meatloaf, chicken fajitas, and chicken salad were accepted by students. However, the entrée recipes for meat lasagnas and chicken stir-fry had the highest waste and were not well accepted by students. Further school recipes should be evaluated to ensure children are consuming the meals that are offered.

Introduction

The prevalence of childhood obesity in 2003 to 2006 was an estimated 17.0% (1). Overweight and obesity in children can continue into adulthood, putting them at a higher risk for chronic disease in adulthood (2). To prevent overweight and obesity, healthy eating practices must begin early in life and be encouraged throughout childhood and adolescence (3). One important way to encourage healthy eating among children is through school nutrition interventions (3).

Research shows that children exposed to different types of healthy foods, such as fruits and vegetables, at an early age are more accepting of new foods and are more likely to eat a wide selection of healthy foods throughout their life (4). Healthy foods can be presented to children through school meals from the National School Lunch Program (NSLP) and the School Breakfast Program (SBP). Currently, the recommendations for school meals are based on the 1995 Dietary Guidelines for Americans (5). However, in recent years the United States Department of Agriculture (USDA) has been slowly releasing new requirements based on the 2005 Dietary Guidelines for Americans, which must be incorporated into the NSLP and SBP (5).

Nationally the NSLP served an average of 30.5 million children daily in 2007 (6). In Tennessee 72.3% of children participated daily in the school lunch program during the 2006-2007 school year (7). Of the daily participants, 60.0% of Tennessee children were provided with free and reduced-price lunches (7). With this large percentage of children participating in the school meal programs, it is important for these meals to provide healthy food choices.

As healthier options are incorporated into school meals, it is important to ensure that the changes do not negatively impact students' consumption of school meals. The main objective of this study was to determine if there were significant differences in school breakfast and lunch plate waste percentages before, immediately after, and four weeks after the implementation of healthier school meals at three schools. All of the breakfast meals served during the study were evaluated for Calories, total fat, saturated fat, cholesterol, sodium, protein, and fiber. The lunch meals served during the study were evaluated for Calories, total fat, saturated fat, cholesterol, and sodium to ensure that healthier meals were consistent with the 2005 Dietary Guidelines for Americans. Additionally, school breakfast and lunch participation rates were evaluated throughout the study period to ensure that rates were not negatively impacted by the implementation of the healthier school meals.

Methods

Subjects

The study took place in three rural schools in East Tennessee, where lunch and breakfast menus were revised by a Registered Dietitian (RD) to include healthier meal options in collaboration with the Coordinated School Health Program. Initially, the healthy menu options were planned to lower the total fat and saturated fat, limit cholesterol and, if possible, to decrease sodium and increase fiber. However, one breakfast menu item was planned specifically to increase fiber and protein. The school district served an average 589 elementary children lunch daily in April 2008, of those 53.5% received free and reduced-price lunches. The school district had a total enrollment of 850 students; of those on average about 69% participated in the school lunch program. At each measurement point, 100 breakfast and lunch trays of students in grades first

through sixth were selected at three schools. The first 17 trays from each grade, up to the planned 100 trays, if possible, were selected to ensure an even distribution throughout the grade levels. The sample was random because the order that students from each grade level returned their trays was not ordered or monitored.

Procedure

Food service employees were first educated through nutrition and culinary in-services on the importance of implementing healthier meals by a RD, chef, and public health nutrition graduate student. Individual plate waste measurements were completed over a four-month period in each of three schools for grades first through sixth. Data were collected at three time points for breakfast and lunch. The first collection was one to two months prior to the implementation of healthier school meals in order to obtain baseline data. The second plate waste collection occurred after the healthier school meals were implemented, about one to three months after baseline measurements. The third plate waste collection of the same healthier school meals occurred four weeks after the second measurements for follow-up. However, data from the third plate waste was not obtained from one school due to a weather-related closing.

Each school served a different healthier breakfast meal and two different healthier lunch entrees with two new side items. The baseline and healthier breakfast meals are listed in Table 3-1 and the baseline and healthier lunch meals are listed in Table 3-2. The healthier meals were chosen to meet the established USDA recommendations, using recipes from the 1999 publication *Child Care Recipes: Food for Health and Fun from USDA's Child and Adult Care Food Program* (8). The targeted baseline meals were chosen because they were meals that contained one or more of

Table 3-1. Baseline and Healthier Breakfast Meal Choices.

	Baseline	Healthier Choice
School 1	Egg biscuit	English muffin with Canadian bacon
School 2	Sausage biscuit	Bagel and Yogurt
School 3	Cinnamon rolls	English muffin with egg

Table 3-2. Baseline and Healthier Lunch Meal Choices.

	Baseline	Healthier Choice
School 1	Chicken salad or Chicken soup with Cheese toast and Tossed salad	Chicken fajitas or Chicken salad wrap with Brown rice and Glazed carrots
School 2	Steak patty or Sausage patty with Egg patty and Hashbrown triangle	Turkey or Meatloaf with Green beans and Mashed potatoes
School 3	Corndog or Two mini hamburgers with Oven fries and Pork and beans	Meat lasagna or Chicken stir-fry with Glazed carrots and Mixed vegetables

the following: highest in total fat and saturated fat, highest in milligrams of cholesterol, and/or highest in sodium. One breakfast baseline meal was selected for change because it was low in protein and fiber. Each school was assigned different healthier menu items, which were measured at that school throughout the study period. Production records were obtained on the days that the plate waste study was conducted to ensure that the healthier options were made according to the recipes for accurate analysis of the nutritional content of the meals. At each measurement point, three sample portions of each food item to be analyzed were weighed and averaged to gain an average individual serving weight for each food item to serve as the standard portion weight. The students were served standard portions from the same serving line. A minimum of 100 trays from all schools were planned, but due to attendance and participation

rates, a minimum of 100 trays were randomly collected from Schools 1 and 2 and a minimum of 70 trays from School 3 were randomly collected. Upon disposal of trays by the students, researchers collected the trays for measurement. On each breakfast tray the main food item(s) was weighed and on each lunch tray four major components were weighed. Each food item was scraped from the tray onto a 2-gram plate. The 2-gram plate was then placed on one of three Ohaus Scout Pro scales and the individual weight of that food item was recorded on a spreadsheet. Trained research assistants, under the supervision of the project coordinator, conducted the plate waste measurements. A weight station was set up in the dish room. The weight station consisted of the three scales as well as a computer for data entry. Writing paper was provided as a back-up data recording method.

The food items from the randomly selected trays from each grade for lunch were scraped individually onto the scales and weighed. The weight of each food item was recorded into the spreadsheet after each individual plate was scraped onto the scale as they were returned to the tray line. When all of the data had been collected, the weight of the 2-gram plate was subtracted from the recorded weight to determine the actual weight of the individual menu items. To find the individual percent plate waste, the grams of the individual food item waste was divided by the mean weight of the samples and multiplied by 100.

After the plate waste measurements were completed, a dietary analysis was completed using Nutrition Data System for Research (NDSR) software version, 2008 developed by the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN (9). Breakfast and lunch production records were collected from each school to verify the foods and food brands

used in meal preparation. Each individual item and preparation method was entered into the NDSR computer program and evaluated for the amount of Calories, total fat, saturated fat, cholesterol, and sodium. For breakfast items, protein and fiber were evaluated also. The nutrient totals of each item were then added together to obtain the total nutrients for the breakfast meals and the lunch meals.

The participation rates for each school during the study period were calculated. The total number of students who received school breakfast or lunch and the total school attendance for each day during the study period were obtained from the Food Service Director. The participation rates were calculated by dividing the total amount of students who received school breakfast or lunch by the total school attendance for the same day, multiplied by 100.

Data Analysis

Data were analyzed for mean percent plate waste, mean amount of nutrients consumed, and average participation rates. SPSS statistical analysis software was used for data analysis (10). Data from the plate waste were analyzed by school. Data from trays that had plate wastes greater than 110% were discarded.

The mean percent waste from breakfast and lunch meals at School 1 used Independent Samples t test to compare the mean percent waste at baseline and after the healthier meals were implemented, because inclement weather prevented a follow-up measurement. Mean percent plate waste for Schools 2 and 3 for breakfast and lunch were first analyzed by an ANOVA to determine if there were significant differences between the three data collection times. The

differences in means were then evaluated by post hoc comparisons with Bonferroni corrections. Breakfast was evaluated for one main component, except at School 2 where two main breakfast components were evaluated, and lunch was evaluated for three items, the combined main entrées selected and two side items. These were analyzed together to get a total mean percent meal waste. After the meals were analyzed together the combined main entrée items were separated and analyzed in the same way; Independent Samples t test at School 1 and ANOVA with post hoc comparisons and Bonferroni corrections at Schools 2 and 3 to determine if there were changes in consumption of the entrée choices. The results of this analysis determined if significant differences in school breakfast and lunch plate waste percentages existed before and after the implementation of healthier school meals and at follow-up.

The second analysis was conducted to determine differences in the nutrient content of the school meals. The breakfast and lunch dietary intake data were collected and analyzed using Nutrition Data System for Research software version, 2008 developed by the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN (9) to determine the nutritional content of Calories, total fat, saturated fat, cholesterol, and sodium of lunch meals as well as the protein, and fiber content of breakfast meals. The results were then analyzed using SPSS computer software (10). Independent Samples t test were performed on School 1 to compare the nutrients consumed at each data collection point to determine where the significant differences occurred within each school. Data from Schools 2 and 3 were analyzed using ANOVA to determine the differences in mean nutrients consumed for the breakfast meal and the lunch meal from the three different plate waste measurements. If significant interactions occurred across the

three data collection points, post hoc comparisons with Bonferroni corrections tests were conducted on each school to determine where the significant differences occurred.

The participation rates for each school were analyzed to determine if participation increased or decreased as a result of implementing the healthy menu options. One way ANOVA analyses were conducted on each school to determine if there were significant changes in participation rates. If significant changes were seen, post hoc comparisons with Fisher's LSD corrections were performed to determine where the changes occurred.

Results

Trays analyzed at breakfast included 318 trays from baseline, 266 trays from the initial healthy meal data collection, and 168 trays from the follow-up healthy meal data collection. The distribution of trays at the lunch data collection times were 280 trays from baseline, 280 trays from the initial healthy meal data collection, and 183 trays from the follow-up healthy meal data collection. The follow-up data collection, for both breakfast and lunch, was only from Schools 2 and 3. Due to weather related school closing, follow-up data were not obtained at School 1.

Breakfast

Participation rate trends for breakfast are shown in Figure 3-1. The results showed no significant change in the breakfast participation rates at Schools 1 and 3. The rates for the days when data were collected from these schools fall along the trend line. School 2 participation rates did show a significant change over time ($P=.043$). Post hoc comparisons with Fisher's LSD corrections

showed that the participation rates from December were significantly higher than February rates ($P=.013$).

Three different baseline breakfast meals and three different healthier breakfast meals were analyzed. The nutrition analysis estimated the Calories, total fat, saturated fat, cholesterol, sodium, fiber, and protein content for each meal. The analysis for each breakfast meal is listed in Table 3-3. At School 1 the baseline breakfast meal was an egg biscuit, which was replaced with an English muffin with Canadian bacon. School 2 served a sausage biscuit for breakfast at baseline and then a bagel and yogurt as the healthier menu item. School 3 served cinnamon rolls for their baseline breakfast item, which was replaced with an English muffin with egg as the healthier breakfast meal.

The first breakfast plate waste analysis used an Independent Samples *t* test to compare the mean percent waste from School 1 at baseline and after the healthier meals was implemented. The results from breakfast at School 1 showed a mean plate waste of 18.8% at baseline and 20.4% after the healthier meal was implemented. The Independent Samples *t* test results from breakfast at School 1 showed no significant change in percent waste from baseline to after the healthier meal was implemented.

The second breakfast plate waste analyses were conducted for Schools 2 and 3 to compare the plate waste percentages of each school at all three data collection times. The results from breakfast at School 2 showed a mean plate waste of 18.3%, 41.8%, and 41.6% at baseline, after the healthier meal was implemented, and at four weeks follow-up, respectively. The post hoc

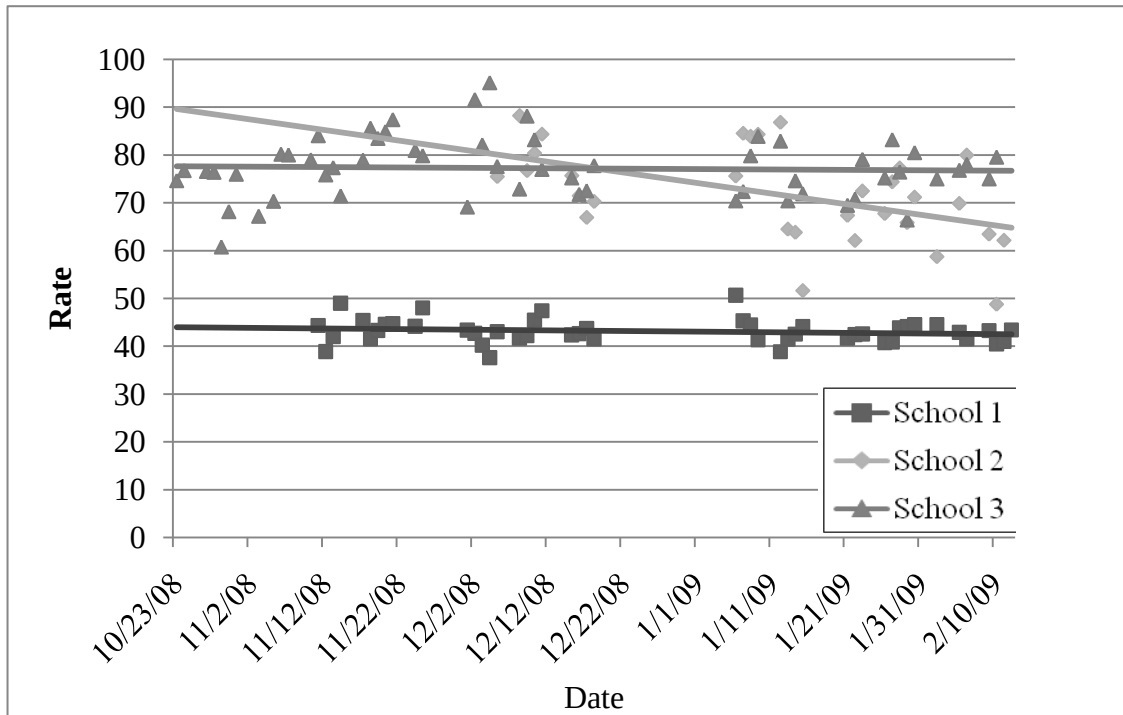


Figure 3-1. Breakfast Participation Rates from October 2008 through February 2009.

Table 3-3. Comparison of Breakfast Nutrients at Baseline and Healthier School Meals.

	Energy (kcal)	Fat (g)	Saturated Fat (g)	Cholesterol (mg)	Sodium (mg)	Fiber (g)	Protein (g)	% Fat	% Saturated Fat
School 1:									
Baseline									
Breakfast	310.0	15.3	4.92	220.6	1006.0	1.0	8.0	4.94	1.59
Healthier Breakfast	207.0	4.50	1.61	24.4	891.0	3.0	16.0	2.17	0.78
School 2:									
Baseline									
Breakfast	381.0	24.3	7.34	32.1	994.0	2.0	12.5	6.38	1.93
Healthier Breakfast	179.0	0.56	0.14	0.0	230.0	0.0	6.0	0.31	0.09
School 3:									
Baseline									
Breakfast	143.0	5.39	1.58	9.17	348.0	0.5	2.0	3.77	1.10
Healthier Breakfast	219.0	6.86	2.96	220.0	332.0	3.0	10.0	3.13	1.35

comparisons showed a significant increase in percent plate waste from baseline to after the healthier meal was implemented ($P<.001$) and from baseline to four weeks follow-up ($P<.001$). No significant change was seen between the implementation of healthier meals and four weeks follow-up.

The results from breakfast at School 3 showed a mean plate waste of 30.4%, 56.0%, and 55.9% at baseline, after the healthier meal was implemented, and at four weeks follow-up, respectively. The post hoc comparisons at School 3 showed a significant increase in percent waste from baseline to after the healthier meal was implemented ($P<.001$) and from baseline to four weeks follow-up ($P<.001$). No significant change was seen between the implementation of healthier meals and four weeks follow-up. Figure 3-2 shows a graphic representation of the mean percent breakfast waste from each school at each measurement.

The mean nutrients consumed at breakfast from each school are listed in Table 3-4. At School 1 the Independent Samples t tests showed a significant decrease in the amount of Calories, total fat, saturated fat, and cholesterol consumed ($P<.001$) as well as the amount of sodium consumed ($P=.039$) from baseline to after the healthier meal was implemented. In addition, a significant increase in the amount of dietary fiber and protein was seen ($P<.001$). At School 2 post hoc comparisons showed a significant decrease in the amount of Calories, total fat, saturated fat, cholesterol, sodium, fiber, and protein consumed from baseline to the initial healthier meal measurement ($P<.001$) and from baseline to follow-up ($P<.001$) with no changes seen from the initial healthy meal measurement to follow-up for Calories, total fat, saturated fat, cholesterol, sodium, fiber, and protein. Results from post hoc comparisons at School 3 showed no change in

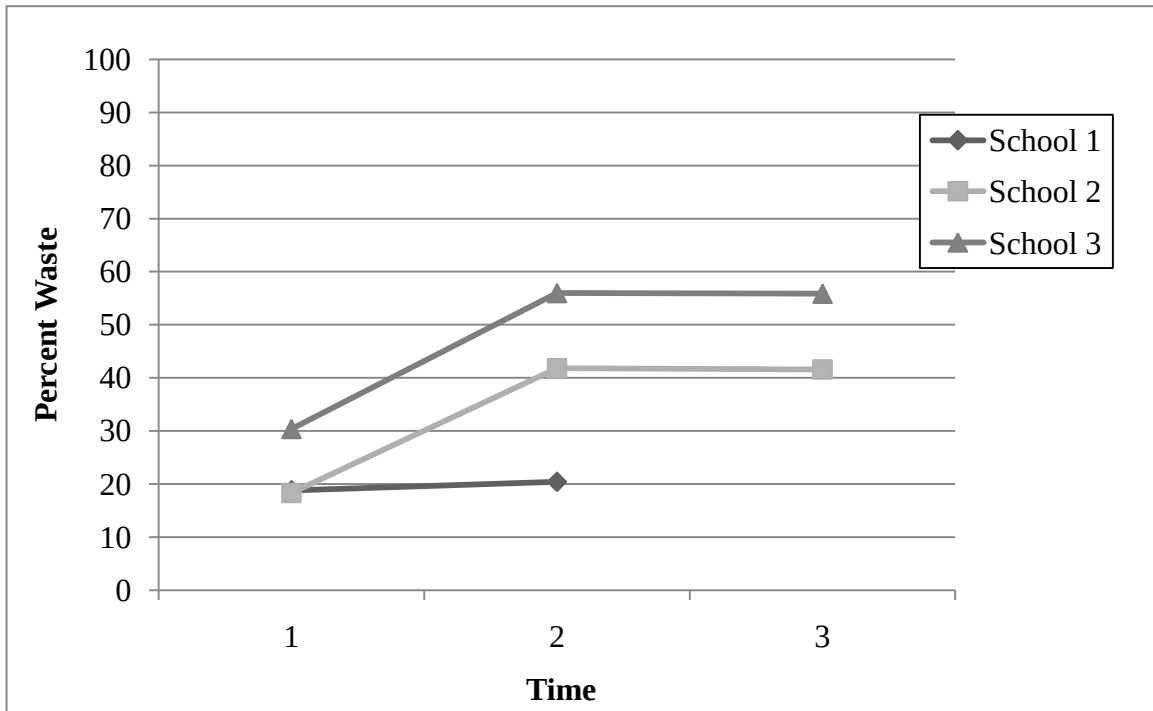


Figure 3-2. Percent Breakfast Plate Waste at Each School Across Each Measurement Point.

Table 3-4. Mean Amount of Nutrients Consumed at Breakfast.

	Baseline Measurement	Initial Healthier Meal Measurement	Follow-up Healthier Meal Measurement
School 1:			
Calories (kcal)	252	165 ^a	NA
Fat (g)	12.4	3.58 ^a	NA
Saturated Fat (g)	3.99	1.28 ^a	NA
Cholesterol (mg)	179	19.4 ^a	NA
Sodium (mg)	817	710 ^b	NA
Fiber (g)	0.81	2.39 ^c	NA
Protein (g)	6.49	12.7 ^c	NA
School 2:			
Calories (kcal)	311	104 ^a	105 ^d
Fat (g)	19.9	0.33 ^a	0.33 ^d
Saturated Fat (g)	5.99	0.08 ^a	0.08 ^d
Cholesterol (mg)	26.2	0.00 ^a	0.00 ^d
Sodium (mg)	812	134 ^a	134 ^d
Fiber (g)	1.63	0.0 ^a	0.0 ^d
Protein (g)	10.2	3.49 ^a	3.51 ^d
School 3:			
Calories (kcal)	99.6	96.4	96.7
Fat (g)	3.75	3.02	3.03
Saturated Fat (g)	1.10	1.30	1.31
Cholesterol (mg)	6.39	96.9 ^c	97.1 ^e
Sodium (mg)	242	146 ^a	147 ^d
Fiber (g)	0.34	1.32 ^c	1.30 ^e
Protein (g)	1.36	4.40 ^c	4.34 ^e

NA, Data not available due to weather related school closing

^aAnalysis of variance indicates that initial healthier meal measurement was significantly lower than the baseline measurement at $P < .001$.

^bAnalysis of variance indicates that initial healthier meal measurement was significantly lower than the baseline measurement at $P < .05$.

^cAnalysis of variance indicates that initial healthier meal measurement was significantly higher than the baseline measurement at $P < .001$.

^dAnalysis of variance indicates that follow-up healthier meal measurement was significantly lower than the baseline measurement at $P < .001$.

^eAnalysis of variance indicates that follow-up healthier meal measurement was significantly higher than the baseline measurement at $P < .001$.

the amount of Calories, total fat, and saturated fat consumed at each time point. The amount of cholesterol consumed from baseline to the initial healthy meal measurement ($P<.001$) and from baseline to follow-up ($P<.001$) increased significantly, with no change from the initial healthy meal measurement to follow-up due to the addition of eggs. A significant decrease was seen in the amount of sodium consumed from baseline to after the initial healthy meal measurement ($P<.001$) and from baseline to follow-up ($P<.001$) with no changes seen from the initial healthy meal measurement to the follow-up measurement. The amount of fiber and protein consumed from baseline to the initial healthy meal measurement ($P<.001$) and from baseline to follow-up ($P<.001$) increased significantly with no change from the initial healthy meal measurement to follow-up.

Lunch

The lunch participation rate trends are shown in Figure 3-3. The results showed no significant change in the participation rates at School 1. Schools 2 and 3 showed significant increases in participation rates ($P=.005$, $P=.002$, respectively). At School 2 post hoc comparisons with Fisher's LSD corrections showed that the participation rates for December were significantly lower than January ($P=.005$) and February rates ($P=.005$), yet no significant change was seen between January and February. At School 3 the participation rates from October were

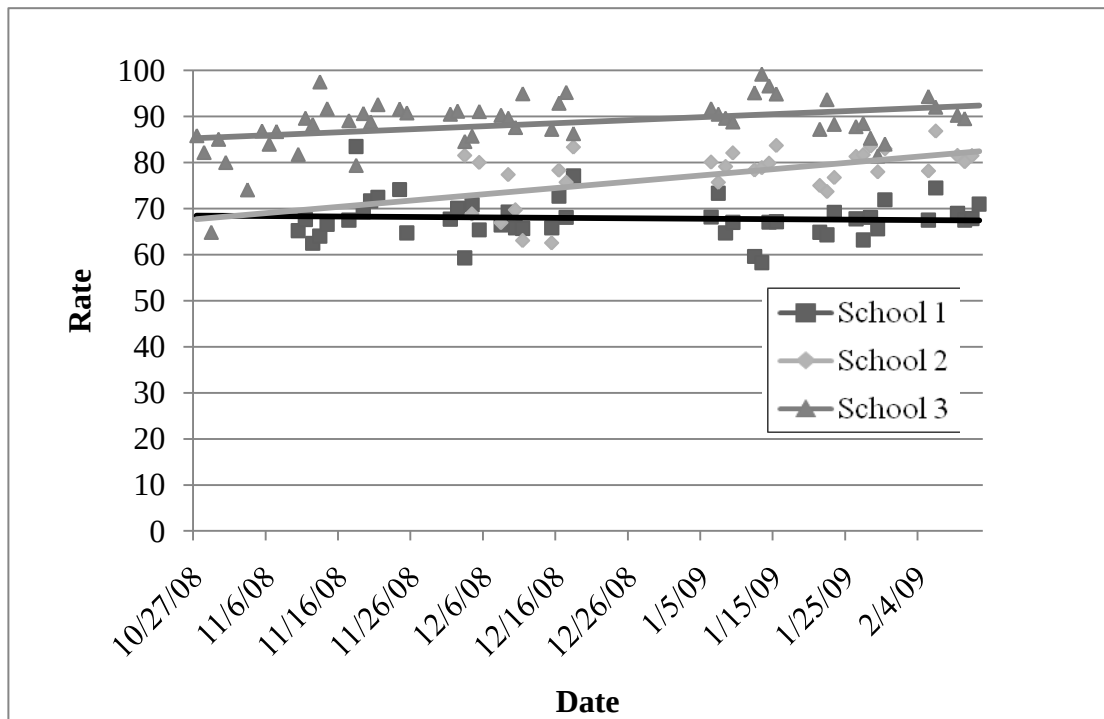


Figure 3-3. Lunch Participation Rates from October 2008 through February 2009.

significantly lower than all other months ($P>.005$). However there were no significant changes seen between the months of November, December, January, and February.

At lunch there were two options for the baseline meals and the healthier meals at each of the three schools. The nutrition analysis of the lunch meals is shown in Table 3-5 and includes the Calories, total fat, saturated fat, cholesterol, and sodium content for each meal. At School 1 the lunch meals were a choice of chicken salad or chicken soup with cheese toast and an iceberg tossed salad. These were replaced with a choice of chicken fajitas or chicken salad wrap with brown rice and glazed carrots. At baseline for lunch at School 2, students could choose a steak patty or a sausage patty served with an egg patty and a hash brown triangle. After healthier

Table 3-5. Comparison of Lunch Nutrients at Baseline and Healthier School Meals.

	Energy (kcal)	Fat (g)	Saturated Fat (g)	Cholesterol (mg)	Sodium (mg)	% Fat	% Saturated Fat
School 1:							
Baseline Lunch							
Option 1	456	17.4	7.47	102	626	3.83	1.64
Option 2	496	24.3	8.13	67.9	637	4.90	1.64
Healthier Lunch							
Option 1	517	11.6	2.48	51	1033	2.24	0.48
Option 2	441	12.5	2.74	58	1006	2.84	0.62
School 2:							
Baseline Lunch							
Option 1	461	26.5	12.3	311	769	5.75	2.67
Option 2	423	28.8	12.5	272	1037	6.80	2.95
Healthier Lunch							
Option 1	324	14.3	4.72	78.2	823	4.43	1.46
Option 2	206	7.28	1.84	31.0	779	3.53	0.89
School 3:							
Baseline Lunch							
Option 1	461	20.0	5.20	54.0	959	4.34	1.13
Option 2	449	14.9	4.41	59.0	490	3.33	0.98
Healthier Lunch							
Option 1	339	15.4	3.13	48.0	547	4.54	0.92
Option 2	409	15.4	6.35	36.0	756	3.78	1.55

menu items were implemented a choice of turkey or meatloaf with green beans and mashed potatoes was available. School 3 served a choice of a corndog or two mini hamburgers with oven fries and pork and beans for their baseline lunch meals. The healthier meal options included meat lasagna or chicken stir-fry with glazed carrots and mixed vegetables.

The first lunch plate waste analyses were performed on School 1 at baseline and after the healthier menu options were implemented. The results from lunch at School 1 showed a baseline mean meal waste of 44.3% and after healthier meals were implemented the mean was 39.8%. Independent Samples t tests results from lunch at School 1 showed no significant change in percent waste from baseline to after healthier meals were implemented. The combined main entrées at School 1 were then compared at baseline and after the healthier menu options were implemented. The mean combined entrée waste at baseline was 41.8% and the mean combined entrée waste after healthier meals were implemented was 26.3%. Independent Samples t test showed a significant decrease in percent waste of the healthy entrée when compared to the baseline entrée ($P=.004$). Due to inclement weather, School 1 was not evaluated for follow-up; therefore the other two schools were evaluated separately to include the follow-up data.

ANOVA analyses were conducted for Schools 2 and 3 to examine if differences occurred across the three time points. If differences were seen, post hoc comparisons with Bonferroni corrections were performed to determine where the differences occurred.

The results from lunch at School 2 showed mean plate wastes of 18.0%, 18.8%, and 22.0%, at baseline, after healthier meals were implemented, and at four weeks follow-up, respectively.

Post hoc comparisons revealed no change in percent meal waste across the three time points. Analyses to determine differences in plate waste percentages of the main entrée showed mean plate wastes of 5.95%, 19.3%, and 12.4% at baseline, after healthier meals were implemented, and at four weeks follow-up, respectively. Post hoc comparisons showed a significant increase between baseline and after healthier meals were implemented ($P<.001$), but no significant change after healthier meals were implemented to four weeks follow-up. However, there was no significant difference between baseline and four week follow-up.

The results from lunch at School 3 showed mean plate wastes of 40.5%, 59.2%, 58.8% at baseline, after healthier meals were implemented, and at four weeks follow-up, respectively. Post hoc comparisons showed a significant increase in percent waste from baseline to after healthier meals were implemented ($P<.001$) and from baseline to four weeks follow-up ($P<.001$). No significant differences were seen between the implementation of healthier meal options and four weeks follow-up. The main entrées at School 3 were then compared at each data collection point. The mean combined entrée wastes were 29.8%, 53.0%, and 51.7% at baseline, after healthier meals were implemented, and at four weeks follow-up, respectively. Post hoc comparisons showed a significant increase in percent waste of the healthy entrées when compared to the baseline entrées at both initial measurement ($P=.002$) and at four weeks follow-up ($P=.003$) with no significant change seen from initial healthy meal measurement to four weeks follow-up. Figure 3-4 depicts a graphic representation of the mean percent lunch waste at each measurement for each of the three schools.

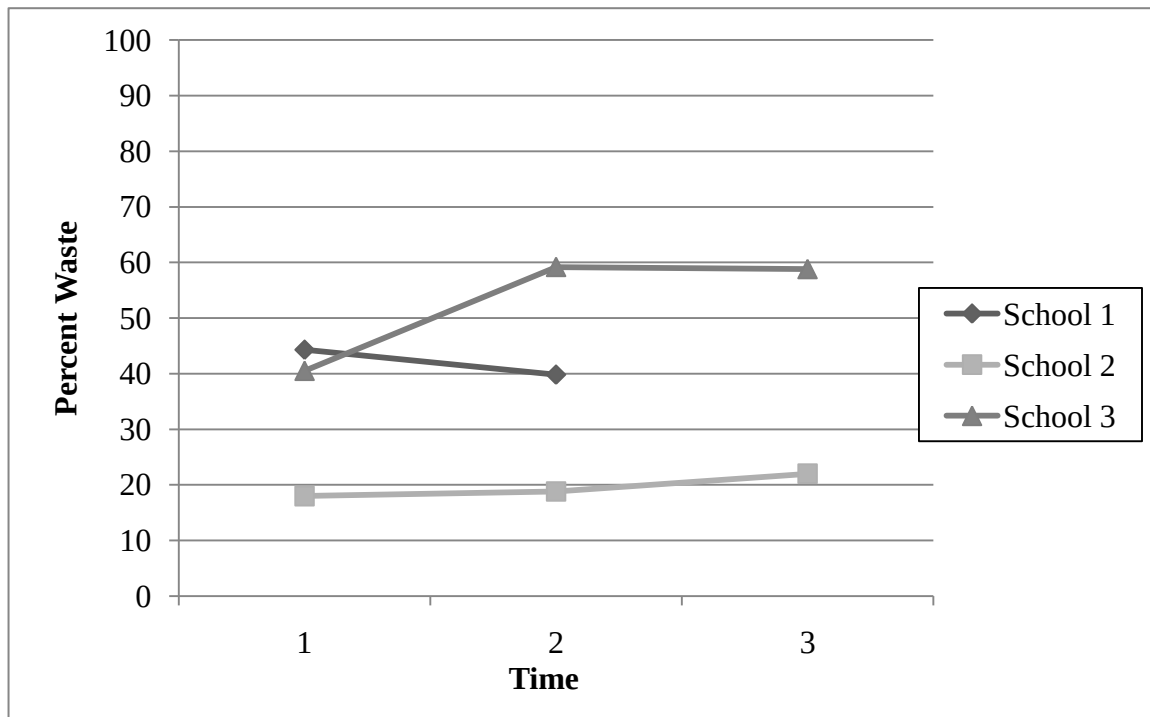


Figure 3-4. Percent Lunch Plate Waste at Each School Across Each Measurement Point.

The mean amount of nutrients consumed at lunch by the students from each school can be seen in Table 3-6. School 1 was analyzed using an Independent Samples t test and ANOVA analyses were used for Schools 2 and 3. The first analyses for nutrients consumed at lunch were calculated for School 1 at baseline and after the healthier meals were implemented. The results from School 1 were analyzed using an Independent Samples t test because there were only two collection times. At School 1, Independent Samples t test showed a significant increase in the amount of Calories consumed ($P=.032$) and sodium ($P<.001$). A significant decrease was seen in the amount of total fat, saturated fat, and cholesterol consumed ($P<.001$) and the amount of sodium consumed ($P=.040$) from baseline to after healthier meals were implemented. The other two schools were evaluated separately to include follow-up data and were analyzed using an

ANOVA analysis to determine if significant differences in nutrients consumed occurred across

Table 3-6. Mean Amount of Nutrients Consumed at Lunch.

	Baseline Measurement	Initial Healthy Menu Measurement	Follow-up Healthy Menu Measurement
School 1:			
Calories (kcal)	270	311 ^a	NA
Fat (g)	11.3	8.47 ^b	NA
Saturated Fat (g)	4.68	1.75 ^b	NA
Cholesterol (mg)	57.5	36.3 ^b	NA
Sodium (mg)	386	581 ^c	NA
School 2:			
Calories (kcal)	389	214 ^b	202 ^e
Fat (g)	24.8	8.67 ^b	7.98 ^e
Saturated Fat (g)	10.9	2.61 ^b	2.37 ^e
Cholesterol (mg)	255	43.3 ^b	40.9 ^e
Sodium (mg)	794	649 ^b	647 ^e
School 3:			
Calories (kcal)	297	176 ^b	170 ^e
Fat (g)	11.5	6.78 ^b	6.67 ^e
Saturated Fat (g)	3.28	2.64	2.47 ^f
Cholesterol (mg)	39.0	17.7 ^b	18.8 ^e
Sodium (mg)	424	312 ^b	289 ^e

NA, Data not available due to weather related school closing

^aAnalysis of variance indicates that initial healthier meal measurement was significantly higher than the baseline measurement at $P < .05$.

^bAnalysis of variance indicates that initial healthier meal measurement was significantly lower than the baseline measurement at $P < .001$.

^cAnalysis of variance indicates that initial healthier meal measurement was significantly higher than the baseline measurement at $P < .001$.

^dAnalysis of variance indicates that initial healthier meal measurement was significantly lower than the baseline measurement at $P < .05$.

^eAnalysis of variance indicates that follow-up healthier meal measurement was significantly lower than the baseline measurement at $P < .001$.

^fAnalysis of variance indicates that follow-up healthier meal measurement was significantly lower than the baseline measurement at $P < .05$.

the data collection times. Further post hoc comparisons with Bonferroni corrections were run to determine where the differences occurred.

Results at School 2 showed a significant decrease in the amount of Calories, total fat, saturated fat, cholesterol, and sodium consumed from baseline to the initial healthier meals measurement ($P<.001$) and from baseline to follow-up ($P<.001$) with no changes seen from the initial healthier meals measurement to the follow-up measurement. Results at School 3 showed a significant decrease in the amount of Calories, total fat, cholesterol, and sodium consumed from baseline to the initial healthier meals measurement ($P<.001$) and from baseline to follow-up ($P<.001$) with no changes seen from the initial healthier meals measurement to the follow-up measurement. There was no significant change seen in the amount of saturated fat from baseline to the initial healthier meals measurement and from the initial healthier meals to follow-up. However a significant decrease was seen from baseline to follow-up ($P=.018$).

Discussion

Each school served a different school meal at breakfast and lunch so the consumption of three healthy breakfast meals and three healthy lunch meals were analyzed. Students accepted two of the healthy lunch meals and one of the healthy breakfast meals. The acceptance of these meals was supported by the participation rates, which were not negatively impacted.

Key Results

School 1 was the largest school in the study with approximately 55% of the district's total student enrollment. Students from School 1 consumed the same percent of breakfast and lunch,

without a change in participation rates, at baseline and after the healthier menu items were implemented. The nutrient analysis showed a significant decrease in Calories, total fat, saturated fat, cholesterol, and sodium at breakfast, and a significant decrease in the amount of fat and sodium consumed at lunch. Because no change was seen in the amount of food wasted, the decrease can be related to the consumption of the healthier meals. The healthy breakfast, which was accepted by the students, was an English muffin with Canadian bacon, a lower-fat breakfast meat. A similar result was seen in another school breakfast intervention project, which found more low-fat breakfast meats were consumed by students than high-fat breakfast meats (11). The healthy lunch entrées were made with recipes from the USDA and were accepted by students. The entrées were a choice of chicken fajitas or chicken salad wrap. When the entrée items were looked at individually, the chicken fajitas was the most accepted item.

School 2 was the second largest school and contained around 30% of the district's student enrollment. The students at School 2 consumed significantly less of the healthy breakfast meal at both collection times. The participation rates from breakfast also decreased significantly from baseline to after the implementation of the healthier breakfast. These results showed that not only did fewer students receive the breakfast meal, but also those who received breakfast did not consume the healthy meal. However, it cannot be concluded that the decrease in participation rates was due to the healthy meals because of inclement weather during the study period. Some students may have come to school late during that time, causing them to miss breakfast. The nutrient analysis showed a significant decrease in the amount of Calories, total fat, saturated fat, cholesterol, and sodium consumed from the baseline breakfast to the healthy breakfast. However since the students were not eating the healthy breakfast, the decrease in nutrient consumption

may be related to the lack of consumption. The baseline breakfast item was a sausage biscuit and the healthy item was yogurt with a lightly buttered, toasted bagel. There was nothing served on the bagel, such as cream cheese or jelly. Perhaps if a low-fat cream cheese or jelly was offered, the children would have been more accepting of the item. A similar low acceptance rate was seen in a previous study when whole wheat toast with butter was served in place of white toast (11). The study found that enhancing the flavor and masking the color with a sweetened topping would have encouraged the acceptance of the item by the students (11).

The consumption of lunch at School 2 showed no significant change at all three measurements. This suggests that the significant decrease in Calories, total fat, saturated fat, cholesterol, and sodium consumed is a result of the healthier menu items, which were derived from USDA recommended recipes. The participation rates increased over the study period. This may have resulted from the lunch foods being more familiar to the children, a choice of meatloaf or turkey with green beans and mashed potatoes. When the main entrées were compared an initial significant increase was seen in waste from the baseline entrée to the initial healthy entrée measurement. However a decrease was seen in the amount of entrée wasted to show no significant change between the baseline entrée waste and the follow-up entrée waste. The acceptance of these particular foods has been seen in other studies. In a study by Marlette and colleagues, mashed potatoes had a high acceptance rate of 70% by students and the lowest percent waste, 19%, of offered vegetables (12). Green beans had the second lowest percent waste at 26%, yet were not accepted as often at a rate of 28% (12). Another study reported that when given a choice, 90% of students selected green beans and wasted only 4.9% (13). When turkey was measured for acceptance it received a rate of 71% with an average plate waste of

14% (12). The results from other studies confirm a choice of meatloaf or turkey with green beans and mashed potatoes is a preferred choice of students. Another studied found that the use of familiar foods with improved nutrient content had a positive impact on students' consumption of healthier menu items (11). Overall this showed that while the students at School 2 did not accept the healthy breakfast meal, they did accept the healthy lunch meal.

School 3 was the smallest of the three schools in the study with only 15% of the districts total student enrollment. During both breakfast and lunch, students consumed significantly less of the healthy meals at both collection times. This indicates that the amount of nutrients consumed cannot be attributed directly to the healthy meals. The main entrée items also saw a significant increase in waste without a decrease at follow-up. These results show that the menu items at this school were not accepted by the students and further evaluation is needed to determine if this was an isolated case within this school or if these recipes are generally not accepted by students in all schools.

Limitations

A limitation of this study was the lack of a control school. Working with a unique school district with a small number of schools did not allow for a control school to be found outside of the school district. Also, due to the small size of the district, a control school inside the same district was not feasible. To minimize the effects of these limitations baseline data were collected as the control.

Working with people in the community as opposed to a controlled environment was another limitation. The error provided from the environment may have included uneven portion sizes, the allowance for second helpings for some children but not others, the sharing of food between students, and the effects of weather on school closings. Part of the error was controlled for in the data analysis by discarding all trays with over 110% plate waste of any item. In addition, the use of a research team from outside the school district aided in minimizing the environmental error. Another limitation was the difficulty in comparing food items directly, due to variations that occurred in school menu planning. An additional limitation was the lack of availability of planned menu items in the school district. Whole wheat bagels, English muffins, and tortillas were not available from the food distributors in this school district. In order to incorporate these whole grain items, it is important to find suppliers who will offer these choices.

Conclusion

The National School Lunch Program and School Breakfast Program are gradually incorporating new recommendations for the meals served in their programs. Many schools must change their menus to comply with the new recommendations. The USDA provides recipes to schools that meet these new recommendations and incorporates the use of commodity foods. This study showed that the USDA entrée recipes for meatloaf, chicken fajitas, and chicken salad were accepted by students. However, the entrée recipes for meat lasagnas and chicken stir-fry had the highest waste and were not well accepted by students. Changes in meals, especially breakfast items, may need to be evaluated to determine if the students are actually consuming the meals. Further research on other recipes and healthy options will aid schools in choosing healthy and enjoyable options for their students.

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APPENDIX

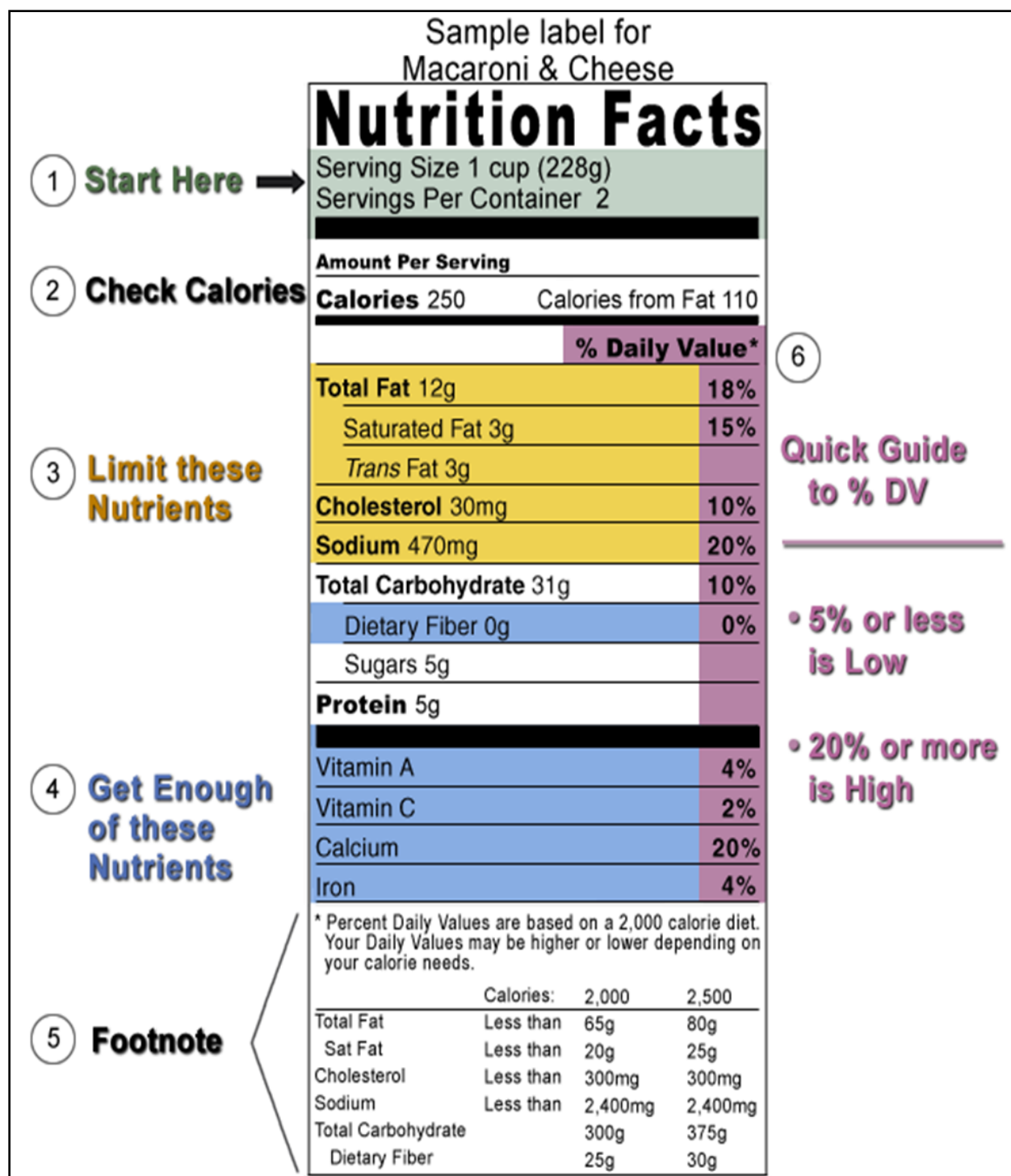


Figure A-1. Nutrition Facts Label Handout.

Source: Handout developed by Brenna Swanson, Registered Dietitian, for Cavalier County Memorial Hospital and Macine Lukach, Cavalier County Extension Agent, Nutrition, Food Safety and Health; Nutrition Education Agent, Family Nutrition Program.

Reading Labels Activity

(Name of Food)

1 _____

2 _____

3 _____

1) Which food has the most calories per serving? _____

2) Which food has the least amount of calories per serving? _____

3) Which food has the least amount of fiber? _____

4) Which food has the largest amount of fiber? _____

5) Which food has the largest percentage of total fat? _____

6) Which food has the least percentage of total fat? _____

7) Which food has the largest amount of saturated fat? _____

8) Which food has the least amount of saturated fat? _____

9) Which food has the largest percentage of sodium? _____

10) Which food has the most calcium? _____

11) Which food has the most iron? _____

12) Something to think about: How will reading labels help you to eat more nutritionally?

Figure A-2. Reading Labels Activity Worksheet.



MyPyramid.gov
STEPS TO A HEALTHIER YOU

MyPyramid Worksheet

Check how you did today and set a goal to aim for tomorrow

Write in Your Choices for Today	Food Group	Tip	Goal Based on a 2000 calorie pattern.	List each food choice in its food group*	Estimate Your Total
	GRAINS 	Make at least half your grains whole grains	6 ounce equivalents (1 ounce equivalent is about 1 slice bread, 1 cup dry cereal, or ½ cup cooked rice, pasta, or cereal)		_____ ounce equivalents
	VEGETABLES 	Try to have vegetables from several subgroups each day	2 ½ cups Subgroups: Dark Green, Orange, Starchy, Dry Beans and Peas, Other Veggies		_____ cups
	FRUITS 	Make most choices fruit, not juice	2 cups		_____ cups
	MILK 	Choose fat-free or low fat most often	3 cups (1 ½ ounces cheese = 1 cup milk)		_____ cups
	MEAT & BEANS 	Choose lean meat and poultry. Vary your choices—more fish, beans, peas, nuts, and seeds	5 ½ ounce equivalents (1 ounce equivalent is 1 ounce meat, poultry, or fish, 1 egg, 1 T. peanut butter, ½ ounce nuts, or ¼ cup dry beans)		_____ ounce equivalents
	PHYSICAL ACTIVITY 	Build more physical activity into your daily routine at home and work.	At least 30 minutes of moderate to vigorous activity a day, 10 minutes or more at a time.	*Some foods don't fit into any group. These "extras" may be mainly fat or sugar—limit your intake of these.	_____ minutes

How did you do today? ☐ Great ☐ So-So ☐ Not so Great

My food goal for tomorrow is: _____

My activity goal for tomorrow is: _____

Figure A-3. MyPyramid Food Groups Worksheet.

Source: MyPyramid. MyPyramid Print Materials page. Available at: http://www.mypyramid.gov/tips_resources/printmaterials.html. Accessed June 13, 2008.

Vegetable Dip Recipe

1 orange pepper

Baby Carrots

Fat-free or Low-fat Ranch dressing

1. Wash your hands.
2. Wash all vegetables.
3. With the help of an adult slice the top of the pepper off.
4. Use a spoon to carve out the inside of the pepper.
5. Pour a small amount of Fat-free or Low-fat Ranch dressing inside the pepper.
6. Dip your carrots in the dressing to enjoy your Vegetables.

Blueberry Yogurt Dip Recipe

Fat-free or Low-fat Vanilla Yogurt

Blueberries

Pineapple (canned pineapple chunks)

Bananas

1. Wash your hands.
2. Wash blueberries.
3. With the help of an adult cut up a fresh pineapple into bite-size pieces or carefully open a can of pineapple chunks.
4. Use a plastic knife to cut the banana into bite sizes pieces.
5. Dump the vanilla yogurt into a bowl with a handful of blueberries.
6. Mix and mush the blueberries in the yogurt.
7. On a plate place some fruit and blueberry yogurt dip.

Figure A-4. Fruit and Vegetable Recipes.

Too Much Salt?

Adapted from *Herbs and Spices*. Author: Ann A. Hertzler, Extension Specialist, Human Nutrition, Foods, and Exercise, Virginia Tech. Publication Number 348-907, posted July 1997. Available at: <http://www.ext.vt.edu/pubs/foods/348-907/sodium.html>

How you choose and prepare foods affects the amount of sodium in your diet. Check the box that best answers these questions:

How often do you -	Less than Once a Week	1 or 2 Times a Week	3 to 5 Times a Week	Almost Daily
Use cured or processed meats such as ham, bacon, sausage, frankfurters, and other luncheon meats?	☐	☐	☐	☐
Choose canned vegetables or frozen vegetables with sauce?	☐	☐	☐	☐
Use commercially prepared meals, main dishes, or canned or dehydrated soups?	☐	☐	☐	☐
Use processed cheese?	☐	☐	☐	☐
Use salted nuts, popcorn, pretzels, corn chips, or potato chips?	☐	☐	☐	☐
Add salt to cooking water for vegetables, rice, or pasta?	☐	☐	☐	☐
Add salt, salt-based seasoning mixes, salad dressings, soy sauce, or steak sauce to foods during preparation or at the table?	☐	☐	☐	☐
Add salt before sampling food?	☐	☐	☐	☐

How did you do?

The more checks you have in the last two columns, the higher the foods you prepare are likely to be in sodium. To cut back on sodium, choose lower sodium foods more often and balance higher sodium foods with those that are lower. For example, if you serve ham for lunch, plan to serve fresh or frozen vegetables cooked without added salt.

Figure A-5. Sodium and Herbs and Spices Activity.

Spice/Herb Quiz Key

When I use herbs and spices, I don't need to worry about following strict rules about combining certain herbs and spices with certain foods.

The correct answer is A. True .

The only rule is to trust your taste buds and to go easy at first until you know which flavors you prefer and which herbs and spices go well together.

The flavor of low-fat foods is enhanced by herbs and spices.

The correct answer is A. True .

When you cut down on the amount of fat in recipes, you will want to add more herbs and spices for the same amount of flavor.

If I cut back on the amount of salt I use, I'll be robbing my body of an important mineral.

The correct answer is B. False .

Sodium is an important mineral, but most of us consume more than we need.

Dried herbs and spices will keep indefinitely on my kitchen shelves.

The correct answer is B. False .

Herbs and spices do have a shelf life. For the best flavor, do not keep dried herbs and spices for more than a year.

Herb vinegar is useful for flavoring food.

The correct answer is A. true .

Herb vinegar can add flavor to many dishes. You can buy ready-made herb vinegars, or make your own.

Food without salt is bland and boring.

The correct answer is B. False .

The best thing about cutting back on salt is that you become reacquainted with the natural flavor of the foods you eat.

People are born with a taste for salt. It's natural to want to use it in our food.

The correct answer is B. False .

Salt is an acquired taste. Just as we learn the taste for salt, we can unlearn it.

Most of the sodium comes from processed foods.

The correct answer is A. True .

Much of the sodium we eat comes from processed foods. However, many reduced-sodium foods are now available.

Figure A-5. Continued.

Figure A-5. Continued.

Figure A-5. Continued.

Pretest: Using what you already know about spices, list 5 ways that you can lower the sodium, fat, and/or sugar in foods by using specific spices/herbs. For example to lower the amount of sodium in pasta sauce, you can use garlic and oregano to enhance the flavor.

- 1.
- 2.
- 3.
- 4.
- 5.

Posttest: Using some of the new things you have learned today, list 5 new ways you can lower the sodium, fat, and/or sugar in foods by using specific spices/herbs.

- 1.
- 2.
- 3.
- 4.
- 5.

Food Service Employee Workshop Questionnaire

Please take the time to fill out this survey. The survey will take about 15 minutes to complete and must be completed in one sitting. Thank you for your help!

1. Using the scale provided, please indicate your opinion on the level of importance for each item.

	Not at all important		Kind of Important		Very Important
a. How important is it to encourage elementary school children to eat a diet that is low in fat?	1	2	3	4	5
b. How important is it to encourage elementary school children to eat at least 5 fruits & vegetables a day?	1	2	3	4	5
c. How important is it to have children be active during the school day?	1	2	3	4	5
d. How important is it for cafeteria staff to participate in coordinated school health?	1	2	3	4	5

2. Please indicate your level of agreement with each item.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. Children who eat low-fat foods at school will be healthier than children who do not eat low-fat foods at school.	1	2	3	4	5
b. Children who eat fruits & vegetables at school will be healthier than children who do not eat fruits & vegetables at school.	1	2	3	4	5
c. Children who are overweight have more health risks than children who are normal weight.	1	2	3	4	5
d. What a child eats at home is more important to a child's diet than what I serve at school.	1	2	3	4	5
e. Children who are healthier now will be healthier as adults.	1	2	3	4	5
f. Schools that have coordinated school health will help prevent chronic diseases such as obesity, cardiovascular disease, and type 2 diabetes.	1	2	3	4	5

3. Please indicate your level of confidence with each item.

Figure A-6. Food Service Employee Workshop Questionnaire.

	Not at all Confident		Kind of Confident		Completely Confident
a. How confident are you that you can prepare healthy meals?	1	2	3	4	5
b. How confident are you that you know how to use food labels?	1	2	3	4	5
c. How confident are you that you can prepare school foods that are low in fat?	1	2	3	4	5
d. How confident are you that you can make more fruits & vegetables available as school foods?	1	2	3	4	5
e. How confident are you that you can prepare school foods that are lower in salt (sodium)?	1	2	3	4	5
f. How confident are you that you can make more whole grain food choices available as school foods?	1	2	3	4	5

4. Please indicate your how easy or difficult it has been to do the following:

	Very Difficult		Moderate		Very Easy
a. How easy has it been to implement a coordinated school health program in your school that includes health education, physical education, nutrition services, and parental involvement?	1	2	3	4	5

5. At your school, what makes it hard **TO PREPARE FOODS THAT ARE LOWER IN FAT**? Please mark your level of agreement with each item.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. Not enough time	1	2	3	4	5
b. Lack of ingredients	1	2	3	4	5
c. Low-fat foods are too expensive	1	2	3	4	5
d. Low-fat foods are harder to prepare	1	2	3	4	5
e. Student food preferences	1	2	3	4	5
f. Not enough parent support	1	2	3	4	5
g. Not enough classroom teacher support	1	2	3	4	5
h. Not enough Principal support	1	2	3	4	5
i. Not enough support at the district level	1	2	3	4	5
j. I'm not trained to prepare low-fat foods	1	2	3	4	5

Figure A-6. Continued.

6. At your school, what makes it hard **TO SERVE FRUIT AND VEGETABLES**?

Please mark your level of agreement with each item.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. Not enough time	1	2	3	4	5
b. Lack of availability of fruits & vegetables	1	2	3	4	5
c. Fruits & vegetables are too expensive	1	2	3	4	5
d. Foods with fruits & vegetables are harder to prepare	1	2	3	4	5
e. Student food preferences	1	2	3	4	5
f. Not enough parent support	1	2	3	4	5
g. Not enough classroom teacher support	1	2	3	4	5
h. Not enough principal support	1	2	3	4	5
i. Not enough support at the district level	1	2	3	4	5

7. Do children have enough time to eat lunch at your school? Yes No

8. Are parents, teachers, or students included in menu planning for your school? Yes No

9. Do you currently use any of these methods in preparing school meals?

Please indicate your level of agreement with each item.

	Never	Once in a while	Some- times	Most times	Always	Doesn't Apply
a. Follow recipes measuring all ingredients with standardized measuring utensils.	1	2	3	4	5	6
b. Serve menu items with standardized serving utensils.	1	2	3	4	5	6
c. Drain and rinse fat from cooked meat.	1	2	3	4	5	6
d. Offer skim, non-fat, or low-fat plain and flavored milk.	1	2	3	4	5	6
e. Increase use of fresh, frozen, canned, and dried fruits.	1	2	3	4	5	6
f. Increase use of fresh, frozen, or canned vegetables and salads.	1	2	3	4	5	6
g. Reduce or eliminate butter, oil, margarine, and animal fat added to vegetables.	1	2	3	4	5	6

Figure A-6. Continued.

	Never	Once in a while	Some- times	Most times	Always	Doesn't Apply
h. Reduce or eliminate butter, oil, margarine, and animal fat added to pasta and rice.	1	2	3	4	5	6
i. Reduce or eliminate butter and mayonnaise added to breads (e.g., sandwiches, toast, biscuits, rolls).	1	2	3	4	5	6
j. Use skim, low-fat, or non-fat dry milk in cooking.	1	2	3	4	5	6
k. Gradually reduce the amount of fat used in recipes.	1	2	3	4	5	6
l. Replace butter or shortening with vegetable oil or margarine whenever possible.	1	2	3	4	5	6
m. Use non-stick coating spray or pan liners instead of greasing pans.	1	2	3	4	5	6
n. Use herbs in place of salt	1	2	3	4	5	6
o. Use artificial sweeteners instead of sugar?	1	2	3	4	5	6

10. What year were you born? 19_____

11. Please circle one. Are you MALE or FEMALE?

12. Please circle all that apply. What ethnic/racial group do you consider yourself?

- a. White / Caucasian
- b. Black / African American
- c. Hispanic / Latino
- d. Asian
- e. Other (please explain) _____

13. What school are you working at now? _____

14. How many years have you been employed in this school? _____ years

15. How many years have you been employed in this school at your current position? ____ years

16. How many years have you been working in food service? _____ years

17. What is your job title at the school? _____

Figure A-6. Continued.

VITA

Nicole Lynn McGee received her Bachelor of Science in Dietetics from the University of Georgia in May 2007 where she was a recipient of the HOPE Scholarship. While at the University of Georgia she was the Coordinator for the Peer Nutrition Educators where she prepared and presented nutrition programs and health fairs along with coordinating meetings and programs for other educators. After graduation she continued her education at The University of Tennessee, Knoxville where she is working on her Masters of Science in Nutrition with a concentration in Public Health Nutrition and her Dietetic Internship. At The University of Tennessee, Nicole worked as a Graduate Teaching Assistant and taught discussion sections for Introduction to Nutrition classes. Nicole also interned at Open Hand Atlanta in the summer of 2008 where she provided medical nutrition therapy to low-income clients with HIV/AIDS, led multiple nutrition education sessions at Atlanta senior centers, and developed a quarterly nutritional news letter for adolescents. Her work as a Masters student has allowed her to work on a thesis on implementing healthier school meals in elementary schools, a Community Assessment of Knox County, an After-school Program Nutrition Curriculum, and a strategic plan of the Lisa Ross Breastfeeding Center. Upon graduation in August 2009, Nicole plans to work as a Registered Dietitian.