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An evaluation of the opinions of school nutrition professionals on the new meal pattern being implemented through the National School Lunch Program (NSLP) with a focus on the fruit and vegetable components

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AN EVALUATION OF THE OPINIONS OF SCHOOL NUTRITION PROFESSIONALS ON THE NEW MEAL PATTERN BEING IMPLEMENTED THROUGH THE NATIONAL SCHOOL LUNCH PROGRAM (NSLP) WITH A FOCUS ON THE FRUIT AND VEGETABLE COMPONENTS

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ABSTRACT

The National School Lunch Program (NSLP) is a federally supported school meal program. The Healthy Hunger Free Kids Act (HHFKA), 2010 based on the recommendations by Institute of Medicine (IOM) introduced new meal pattern that comply with the *Dietary Guidelines for Americans, 2010* and these are the major changes made in the past 15 years to school meal programs. The objective of the study was to evaluate the opinions of school nutrition professionals on the new meal pattern being implemented through the NSLP with a focus on fruit and vegetable components. A questionnaire was developed and distributed at strategic locations. The participants in the study were school nutrition professionals attending their Annual School Nutrition Association (SNA) conferences in New York (NY) and Mississippi (MS) and also a Major City training symposium in MS. The study was focused on evaluation of 6 cent reimbursement per lunch as a motivational factor to achieve the new meal pattern, practices to encourage fruit and vegetable consumption in schools and their perception of challenges in meeting the new fruit and new vegetable subgroup requirement. The study also determined if differences existed between the Northeast, Southeast and Major city schools in the frequency of serving, plate waste, availability, cost and storage for various types of fruits and vegetables. Percentages, means, t-test and One-way ANOVA analysis, post-hoc comparisons were used to analyze the data. The majority of participants were from school districts (71.6%) and are district directors (42.7%). More than 50% of participants considered the 6 cent reimbursement per lunch motivating for the achievement of the new meal pattern. Nutrition education was the widely used practice to encourage fruit and vegetable consumption. Significant differences were found in the

challenges for meeting new fruit and vegetable subgroup components and regional differences for the frequency of serving, plate waste, availability, cost and storage for some types of fruits and vegetables. Future research can be focused to evaluate the challenges of meeting other menu components and verify if the frequency of serving fruits and vegetables differ due to availability, cost and storage.

DEDICATION

I dedicate this thesis to my parents Mr.Chilaka Ram babu and Mrs.Chilaka Radha Rani and my husband Naresh Modepalli.

LIST OF ABBREVIATIONS AND SYMBOLS

NSLP	National School Lunch Program
USDA	United States Department of Agriculture
SMI	School Meals Initiative
NSMP	Nutrient Standard Menu Planning
FBMP	Food Based Menu Planning
HHFKA	Healthy Hunger Free Kids Act
IOM	Institute of Medicine
NFSMI	National Food Service Management Institute
CVD	Cardiovascular disease
SNA	School Nutrition Association
NY	New York
MS	Mississippi
U.S.	United States
FRAP	Ferric Reducing Anti-Oxidant Power
TEAC	Trolox Equivalent Antioxidant Capacity
TRAP	Total Radical-Trapping Antioxidant Parameter
FFVP	Fresh Fruit and Vegetable Program
FNS	Food and Nutrition Service
SBP	School Breakfast Program
SY	School Year

LIST OF ABBREVIATIONS AND SYMBOLS (CONTINUED)

OVS	Offer versus Serve
SFA	School Food Authorities
HUSSC	HealthierUS School Challenge
NYSNA	New York School Nutrition Association
MSSNA	Mississippi School Nutrition Association
ANOVA	Analysis of Variance
oz	Ounces
eq	equivalent
%	Percentage
no.	Number
%	Percentage
M	Mean
SD	Standard Deviation
F	Degree of Freedom
p	Level of Significance

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CHAPTER I: INTRODUCTION

The National School Lunch Program (NSLP) established under the National School Lunch Act in 1946, provides children with "nutritionally balanced, low-cost or free lunches" while at school. It is a federally supported meal program offered in public and non-profit private schools and child care organizations. The United States Department of Agriculture (USDA) provides cash reimbursements and USDA foods to the schools participating in the NSLP for each of the meals served that are compliant with the federal requirements (NSLP Fact Sheet, 2012).

The School Meals Initiative (SMI) for Healthy Children, 1995 required that the nutrition standards of the school meals must be in accordance with the 1990 *Dietary Guidelines for Americans* and established the three menu planning approaches that included nutrient standard menu planning (NSMP), assisted nutrient standard menu planning and a food-based menu planning system (FBMP). In the year 2000, the USDA expanded the menu planning methods to five options that included traditional and enhanced food-based menu planning (FBMP), nutrient standard menu planning and the assisted nutrient standard menu planning (NSMP), and one alternate approach that has modification of either FBMP or NSMP. The recommendations for the 2000 *Dietary Guidelines for Americans* did not have significant changes in the school meal pattern. In 2004, the Child Nutrition and WIC Reauthorization Act proposed a rule to update nutrition standards for the school meal programs according to the recent Dietary Guidelines (Nutrition Standards in the National School Lunch and School Breakfast Programs, 2011).

More recently, the Healthy Hunger Free Kids Act (HHFKA) of 2010 issued "regulations to update the meal patterns and nutrition standards for school lunches and breakfasts based on the recommendations issued by the Food and Nutrition Board of the National Research Council of the National Academies of Science, part of the Institute of Medicine (IOM)" (Nutrition Standards in the National School Lunch and School Breakfast Programs, 2012). The five menu planning systems including nutrient analysis were changed to one food based menu planning system and the new meal pattern requirements align with the *Dietary Guidelines for Americans, 2010.*

It is unclear whether these requirements will be achievable or will present challenges to the child nutrition programs. The National Food Service Management Institute (NFSMI), a federally funded national center dedicated to research, education, training and technical assistance for child nutrition programs has an interest in identifying barriers and challenges for the implementation of the new meal pattern to enable futuristic training for foodservice staff in schools. The purpose of the trainings is to improve menus, ordering appropriate foods and control costs to meet the requirements of the new meal pattern while maintaining quality. The current research questionnaire was developed to collect the opinions of school nutrition professionals on the new meal pattern implemented through the NSLP with a focus on the fruit and vegetable components. The NFSMI has assisted in the development and distribution of the questionnaire at strategic locations.

The evaluation serves as an important tool to analyze if new meal pattern requirements are effective. The nutrition, health and child advocates considered the age/grade grouping to be age-appropriate school meals and the grouping is consistent with the IOM's Dietary Reference Intake. The new meal pattern has different calorie ranges based on the grade levels in order to

reduce the rate of childhood obesity and provide children with nutritious meals within their calorie needs (Nutrition Standards in the National School Lunch and School Breakfast Programs, 2012).

For the menu components like meat/meat alternates and grains, minimum requirements were established. Meat/meat alternates as part of daily school lunch provide children with protein, B vitamins, vitamin E, iron, zinc and magnesium and help provide a more balanced meal (Nutrition Standards in the National School Lunch and School Breakfast Programs, 2012).

The whole grain requirements were developed to increase children's intake of whole grains and limit consumption of refined grains. Whole grains are a rich source of iron, magnesium, selenium, B vitamins and dietary fiber. Whole grains provide benefits like lowering body weight and reducing the risk of cardiovascular disease (CVD). The new meal pattern requires at least half of the grains offered to students in schools must be whole grains (Nutrition Standards in the National School Lunch and School Breakfast Programs, 2012).

The requirement for fluid milk is the same for all the grade levels. Flavored low-fat milk is not allowed in the NSLP as added sugars and fat increase the caloric and saturated fat intake (Nutrition Standards in the National School Lunch and School Breakfast Programs, 2012).

The vegetable and fruit components were separated as different groups and have daily and weekly requirements to promote consumption as per the recommendations of the *Dietary Guidelines for Americans, 2010*. The vegetable menu component has a weekly requirement for subgroups (dark green, red/orange, beans and peas, starchy and other vegetables) to encourage greater variety in vegetable consumption (Nutrition Standards in the National School Lunch and School Breakfast Programs, 2012).

Fruits and vegetables are important components of a healthy diet and contain physiologically active components that support and maintain health. It is important that schools meet the requirements for fruit and vegetables when planning lunch menus because research indicates that environmental factors (Blanchette & Brug, 1995, Baranowski et al., 1993, Cullen et al., 2001, Kirby et al., 1995), parental influence (Cullen et al., 2001; Fisher et al., 2002) may effect children's intake, or lack of intake of fruits and vegetables and these components are required to meet federal compliance standards. Hence, the present study is focused on evaluating the challenges being faced by school nutrition personnel in meeting the fruit and vegetable requirements of the new meal pattern.

The participants in this study were the school nutrition employees attending their Annual School Nutrition Association (SNA) state conferences in New York (NY) and Mississippi (MS) and also a major citiy training symposium being held at the NFSMI located in MS. Data was used to identify specific challenges experienced by schools in implementing the fruit and vegetable components of the new meal pattern. Findings will contribute valuable information for child nutrition program directors and determine if differences exist between Northeast, Southeast and Major city schools.

CHAPTER II: LITERATURE REVIEW

CVD, cancer and diabetes along with other chronic disease are among the top ten leading causes of death in United States (U.S) (Murphy et al., 2012). Oxidative stress is considered to be one of the major mechanisms involved in the risk for chronic diseases (Aruoma, 1998; Schaffer et al., 2006; Urquiaga & Leighton, 2000). The excessive production of reactive oxygen species from the endogenous and exogenous substances is the main factor involved in oxidative stress (Valko et al., 2006). Maintaining proper balance between oxidants and antioxidants in the body is important, as overproduction of oxidants leads to oxidative stress damaging macromolecules such as proteins, lipids and nucleic acids (Locatelli et al., 2003; Opara, 2006; Wilcox et al., 2004). Hence, scientific research began to identify physiologically active components present in fruits and vegetables that help in attenuating oxidative stress related chronic illness.

The antioxidants available in the diet are classified as non-nutritive (flavonoids, poly-phenols and terpenes) and nutritive (Vitamin E, Vitamin C and carotenoids). Dietary antioxidants include phytochemicals that reduce oxidative stress by enhancing repair enzyme activity, restricting free-radical formation, destroying free radicals, stimulating antioxidant enzyme activity, and repairing oxidative damage (Whitney & Rolfes, 2011).

The total antioxidant capacity varies widely for different types of fruits and vegetables based on the active components present in them. Among vegetables, spinach was identified to have the highest ferric reducing-antioxidant power (FRAP) and trolox equivalent antioxidant capacity (TEAC), asparagus has the highest total radical-trapping antioxidant parameter

(TRAP). The least FRAP, TRAP and TEAC were found in cucumber, pumpkin and endive respectively. Blackberry has the highest FRAP, TRAP and TEAC in fruits. Watermelon has low levels of FRAP and TRAP and bananas have the least levels of TEAC (Pellegrini et al., 2003).

Several studies have demonstrated that increased intake of fruit and vegetables may likely reduce the risk of CVD (Bazzano et al., 2003; Hung et al., 2004; Joshipura et al., 1999; Liu et al., 2000), some types of cancer (Block et al., 1992; Negri et al., 1991; Riboli & Norat, 2003; Steinmetz & Potter, 1996) and diabetes (Ford & Mokdad, 2001; Feskens et al., 1995; Liu et al., 2004). In addition, scientific research began focusing on the positive effects of fruits and vegetables in prevention of diseases such as chronic obstructive pulmonary disease (Miedema et al., 1993; Strachan et al., 1991), diverticulosis (Aldoori et al., 1998; Aldoori et al., 1994; Marlett, 1992) and cataract formation (Brown et al., 1999; Hankinson et al., 1992; Mares-Perlman et al., 1995).

During the period 2004-2009 children between 6-12 years improved their fruit consumption only by 7% and vegetable consumption by 2% where as children between 13-17 years decreased their fruit consumption by 2% and vegetable consumption by 6% (National Fruit and Vegetable Alliance, 2010). The Youth Risk Behavior Surveillance, 2011 reported that 4.8% of high school students had not eaten fruit or drank 100% fruit juices and 5.7% had not eaten vegetables during a week period (Eaton et al., 2012). Poor eating behaviors developed in childhood may be carried into adulthood resulting in unhealthy lifestyle behaviors which contribute to development of chronic diseases. The *Dietary guidelines for Americans, 2010* recommends Americans to increase the fruit and vegetable intakes based on calorie needs and consume a greater variety of vegetables especially dark green, red and orange vegetables, beans and peas.

Table I: *Fruit and vegetable recommendations for children of different age groups*

Fruit daily recommendation		
Children	4-8 years old	1-1 ½ cups
Girls	9 -13 years old	1 ½ cups
	14-18 years old	1 ½ cups
Boys	9 -13 years old	1 ½ cups
	14-18 years old	2 cups
Vegetable daily recommendation		
Children	4-8 years old	1 ½ cups
Girls	9 -13 years old	2 cups
	14-18 years old	2 ½ cups
Boys	9 -13 years old	2 ½ cups
	14-18 years old	3 cups

Note. Retrieved from http://www.choosemyplate.gov/foodgroups/vegetables_amount_table.html. United States Department of Agriculture. How many vegetables are needed daily or weekly?

Note. Retrieved from http://www.choosemyplate.gov/food-groups/fruits_amount_table.html . United States Department of Agriculture. How much fruit is needed daily?

The rates of childhood obesity in U.S. have been rising over the past 30 years. During the period of 1980-2010 the obesity of children aged 6-11 years increased from 7% to 18% and the percentage for adolescents aged 12-19 years increased from 5% to 18%. Obesity in childhood and adolescence are related to complications like type 2 diabetes, hypertension, and dyslipidaemia in later life (Batch & Baur, 2005). Findings from the research conducted on children reported that increased intake of fruits and vegetables were associated with lower levels of inflammation and oxidative stress in obese children (Kelishadi et al., 2007) and adolescents

(Holt et al., 2009). Besides their role in prevention of obesity, vegetable consumption during childhood is associated with reduced risk of CVD (Ness et al., 2005) and fruit consumption is associated with reduced cancer risk (Maynard et al., 2003), improved lung function (Cook et al., 1997) and intake fruits and vegetables together was related to lower pulse wave velocity in adulthood (Aatola et al., 2010). Considering the role of fruits and vegetables in disease prevention there is need to investigate various challenges faced by school nutrition professionals in meeting the requirements of fruit and vegetable components in their lunch menus.

Intervention programs conducted in schools have some positive influence on the dietary behaviors of school children (Arbeit et al., 1992; Gortmaker et al., 1999; Powers et al., 2005; Story et al., 2009; Sahota et al., 2001). The Fresh Fruit and Vegetable Program (FFVP), a pilot project under the Farm Security and Rural Investment Act of 2002 makes fresh fruits and vegetables available to school children. The schools participating in the FFVP are required to educate children regarding the benefits of eating fruits and vegetables as snacks. From the data reported from 252 schools, children participating in FFVP increased average fruit and vegetable intake by approximately one-quarter of a cup per day on FFVP days (FFVP Interim report, 2011).

The children in the schools participating in FFVP programs had increased consumption of fruits and vegetables (Jamalske & Bica, 2012) and the schools have increased availability of fresh fruits at lunch meals (Vachaspati et al., 2012) compared to the schools not participating in FFVP. Hence, there is evidence to support expanding programs like FFVP in schools might be related to the encouragement and increased consumption of fruit and vegetable components in the NSLP.

The National School Lunch Program

The NSLP is considered to be the second largest food and nutrition assistance program in the U.S. It is administered by the USDA Food and Nutrition Service (FNS) at the federal level and by the state education agencies at the state level. From the comparison studies conducted between the participants and non-participants of NSLP, school lunch participants were more likely to consume milk, fruit and vegetables and less likely to consume desserts, snack items, and beverages other than milk or 100% juice and included more of the vegetable consumption from starchy vegetables (Condon et al., 2009). The School Nutrition Dietary Assessment Study-IV reported that most schools offered and served NSLP lunches met the SMI minimum standards of the target nutrients in a typical school week and also increased the standards of meeting total fat requirement (Fox & Condon, 2012).

Taking into account the rates of childhood obesity and hunger, the HHFKA of 2010 updated the NSLP and School Breakfast Program (SBP) meal patterns based on the *Dietary Guidelines for Americans, 2010*. The new meal pattern was to be implemented from the school year (SY) 2012-2013 for the NSLP and SY 2013-2014 for the SBP and this has been the first time USDA made major changes to the school meals in the 15 years. The short time frame given to schools to implement the new meal pattern is also a concern. The new requirements of the NSLP include five components: meat/meat alternate, fruits, vegetables, grains and fluid milk.

Table II: *Comparison between New Meal Pattern and previous NSLP requirements*

Menu Component	Previous requirements (K-12)	Current requirements (K-12)	
Meat/meat alternate	1.5 – 2 oz eq (daily minimum)	Grades K-5:	8-10 ounces/week 1ounce daily
		Grades 6-8	9-10 ounces/week 1 ounce daily
		Grades 9-12	10-12 ounces/week 2 ounces daily
Grains	Whole grains encouraged. 8 servings per week (minimum of 1 serving per day)	Grades K-5:	8-9 oz eq weekly 1 oz per day minimum
		Grades 6-8	8-9 oz eq weekly 1 oz per day minimum
		Grades 9-12	10-12 oz eq weekly 2 oz per day minimum
		At least half of the grains must be wholegrain rich beginning July 1, 2012. Beginning July 1, 2014, all grains must be whole grain rich.	
Milk	1 cup daily. Variety of fat contents allowed; flavor not restricted.	1 cup daily, 5 cups/week Must be fat-free(unflavored/flavored) or 1% low fat (unflavored	
Fruits	½ - ¾ cup of fruit and vegetables combined per day.	Grades K-5:	2 ½ cups weekly ½ cup daily
		Grades 6-8	2 ½ cups weekly ½ cup daily
		Grades 9-12	5 cups weekly 1 cup daily
Vegetables		Weekly requirements of vegetable subgroups.	
		Grades K-5	3 ¾ cups weekly ¾ cups per day
		Grades 6-8	3 ¾ cups weekly ¾ cups per day
		Grades 9-12	5 cups weekly 1 cup per day

Note. From, "Recognizing a reimbursable meal: Meal pattern training". National Food Service Management Institute, 2012. University, MS: Author.

Fruit Component

- Pasteurized 100% juice can be offered no more than half of the weekly fruit offering.
- The minimum creditable serving of fruit is 1/8 cup and the frozen fruit served in NSLP should not contain any added sugars beginning school year SY 2013-2014. The creditable servings of fruit are the minimum and do not have any upper limit considerations except for juice.
- The reimbursable fruit component does not include any snack type fruit products that were credited previously by calculating the whole-fruit equivalency of the processed fruit.

Vegetable Component

- The new vegetable subgroup component is divided into five: dark green, red/orange, beans/peas, starchy and other vegetables. Weekly requirements of vegetable subgroups must be available to all students. School districts must prepare ample amounts to multiple students for compliance and small portions are not compliant with the law.
- Raw, dark green leafy vegetables are credited as half the volume served (1 cup raw vegetable equals ½ cup serving of dark green leafy vegetables).
- The requirement for “other vegetables” can be met by offering any additional amounts of dark green, red/orange, beans/ peas vegetable subgroups.
- Refer to Table III and IV for the vegetable subgroups weekly requirements and the qualifying vegetable subgroups list respectively.

Table III: *Weekly requirements of vegetable subgroups for different grade levels*

Vegetable Subgroups	Grades K-5	Grades 6-8	Grades 9-12
Dark green	½ cup	½ cup	½ cup
Red/Orange	¾ cup	¾ cup	1 ¼ cup
Beans/Peas	½ cup	½ cup	½ cup
Starchy	½ cup	½ cup	½ cup
Other	½ cup	½ cup	¾ cup
Additional vegetables to reach the weekly requirement	1 cup	1 cup	1 ½ cup

Note. From, "Recognizing a reimbursable meal: Meal pattern training". National Food Service Management Institute, 2012. University, MS: Author.

Table IV: *Classifications of various vegetables under different subgroups*

Dark green vegetables	Red/orange Vegetables	Beans/peas	Starchy vegetables	Other vegetables
Bok choy, Broccoli, Collard Greens, Dark Green, Leafy Lettuce, Kale, Mesclun, Mustard , Greens, Romaine Lettuce, Spinach, Turnip Greens, Watercress	Acorn Squash, Butternut Squash, Carrots, Hubbard Squash, Pumpkin, Red Peppers, Sweet Potatoes, Tomatoes, Tomato juice	Black Beans, Black-eyed Peas(mature, dry), Garbanzo beans, Chickpeas, Kidney Beans, Lentils, Navy Beans, Pinto Beans, Soy Beans, Split Beans, White Beans	Cassava, Corn, Fresh Cowpeas, Field Peas, or Black-eyed Peas (not dry), Green Bananas, Green Peas, Green Lima Beans, Parsnips, Plantains, Taro, Water Chestnuts, White Potatoes	Artichokes, Asparagus, Avocado, Bean Sprouts, Beets, Brussels Sprouts, Cabbage, Cauliflower, Celery, Cucumbers, Eggplant, Green Beans, Green Peppers, Iceberg (head) Lettuce, Mushrooms, Okra, Onion

Note. From, "Recognizing a reimbursable meal: Meal pattern training". National Food Service Management Institute, 2012. University, MS: Author.

Offer Versus Serve (OVS)

OVS is for the purpose of allowing students to choose the menu components and to reduce food waste. The senior high schools are required to have OVS for lunch and the local school food authorities (SFA's) can choose whether they participate in OVS for their elementary and middle schools. Under OVS students must be offered all the five menu components and can decline two of the five menu components, but the students are required to include either ½ cup of fruit or vegetable component to be in compliance with the federal law. If the students are offered less than the minimum requirements of a menu component the meal does not count for reimbursement. A single price is set for all meals independent of the menu components declined.

6 cent reimbursement per lunch

The HHFKA, 2010 also gave an additional 6 cents per lunch reimbursement to the SFA's certified by the state agency to be in compliance with the new meal pattern. Section 201 of the HHFKA made the 6 cent per lunch reimbursement available to SFAs beginning October 1, 2012. In order to attain the certification the SFAs are required to submit certification documentation to their respective state agency and the state agency makes the certification determination within 60 days.

HealthierUS School Challenge (HUSSC)

The HUSSC is a voluntary certification initiative to recognize schools that create a healthy environment through nutrition and physical activity. Each school level has four different levels of criteria and the schools attain financial rewards for the achieving level. The HUSSC criteria was updated recently based on the new meal pattern (USDA, 2012).

CHAPTER III: METHODOLOGY

The NFSMI provided assistance with the distribution of the questionnaires at the selected conferences to capture input from a national audience. This study was focused on evaluation of the fruit and vegetable components of the meal pattern and includes a question regarding the 6 cent incentive since there could be a relationship between this and challenges identified.

Participants

The participants in the study were the school nutrition employees attending their Annual SNA state conferences in NY and MS and also a major city training symposium held at NFSMI. The questionnaire used for this study does not include any personally identifiable information of the participant. The questionnaire was made available at the NFSMI booth at each conference. As completion of the questionnaire was voluntary, a separate informed consent was not required.

The first state conference was the 61st New York School Nutrition Association (NYSNA) Annual Conference at The Conference & Event Center Niagara Falls, NY from October 19-20, 2012. Approximately 400 participants attended the conference. The second state conference was the 43rd Mississippi School Nutrition Association (MSSNA) Annual Conference at the Bancorp South Arena and Conference Center, Tupelo, MS from November 1-4, 2012. Approximately 500 participants attended the conference. The major city training symposium was conducted with the title "Produce Safety University" at NFSMI, University, MS from November 5-9, 2012. Approximately 35 participants attended the conference. The participants were asked

to fill out the questionnaire at the conference booth or mail to the address provided on the envelope. A reminder was sent through an email with the attached questionnaire to the NYSNA and MSSNA attendees requesting that they mail the filled out questionnaire. For the purpose of this study participants from NYSNA were considered to represent the Northeast region of the U.S, where as participants from MSSNA to represent the Southeast region of the U.S. The participants of major city training symposium were representation from the forty largest districts in the U.S.

Instrument

A questionnaire was developed using specific criteria from the new meal pattern guidance documents developed by the NFSMI. This questionnaire was reviewed and approved by NFSMI personnel and was piloted by registered dietitians associated with school nutrition, school food service directors and managers working in the Lafayette County and Oxford City schools, both in the state of MS. The study was approved by the Institutional Review Board at The University of Mississippi, University, MS.

A brief introduction and directions for completion of the questionnaire were provided at the beginning to give a clear understanding of the research process to the participants. The questionnaire includes four sections. The first section contains questions about the demographics of the participant including their personnel designation (district director, site-level manager, registered dietitian, food service assistant, other), the organizational unit where they work (elementary school, middle school, high school, school district, state agency, other), state and the total district enrollment. The personnel designation allows researchers to determine if the perceptions of the new meal guidelines differ between personnel in different school nutrition

roles. Identifying the organizational unit will help determine if variations exist between different school meal delivery sites.

The second section contained questions regarding participation in the HUSSC Challenge, opinion on the 6 cent reimbursement per lunch incentive and perception of the challenges in meeting each menu component of the meal. The third section addresses questions on resources to create recipes for fruit and vegetable components, practices to encourage fruit and vegetable consumption, utilization of tomato sauce to meet the vegetable requirement and the use of OVS. The final section of the questionnaire includes rating for frequency of serving, plate waste challenge, availability, cost and storage for different types of fruits and vegetables.

SPSS version of 21.0 was used for data analysis and summarization. For each of the research questions the responses with double entries or missing values were excluded. Statistical evaluation of the research questions was conducted as follows:

The first research question was whether the 6 cent per lunch reimbursement is a motivating factor for schools to comply with the new meal regulations nationally. For this research question, the participants were asked a question “Do you consider the 6 cent per lunch reimbursement motivating in achieving the goals of the new meal pattern?” Answers were recorded as 1=Yes, and 0=No. The percentages of participants considering the 6 cent per lunch reimbursement as a motivating factor were determined for the total sample and for each region.

The second research question was to determine if schools are using nutrition education, gardening, and/or salad bars to encourage fruit and vegetable consumption. Two sets of questions were asked: “Does your food service operation implement any of the following practices to encourage fruit consumption?” and “Does your food service operation implement any of the following practices to encourage vegetable consumption?” with nutrition education,

gardening, and/or salad bars. Answers were recorded as 1=Yes and 0=No. The overall and regional percentages were determined for the use of nutrition education, gardening and salad bars to encourage fruit and vegetable consumption. For the first and second research questions, it was recorded as “2=No” in the questionnaire, but for the analysis it was considered as “0=No”.

The third research question was whether meeting the new vegetable subgroup requirements pose a greater challenge for schools than meeting the new fruit requirement. The question evaluates possible challenges participants perceive with implementing the new meal pattern guidelines for the vegetable and fruit components. For this research question, participants were asked to rate their agreement to each of the following two statements: “Meeting the requirements for the fruit component is challenging” and “Meeting the requirements for the vegetable subgroups is challenging” on a 5-point likert scale (1=Strongly disagree, 2=Disagree, 3-Neutral, 4=Agree, 5=Strongly agree). The overall percentages were determined. To compare the means between fruits and vegetables, paired sample two-tailed t-test was used. The level of significance was set at $p<0.05$. The following hypotheses were considered for the purpose of comparing means:

Null hypothesis: There are no differences between the challenges for meeting new vegetable subgroup requirements and the challenges for meeting new fruit requirements.

Alternate hypothesis: Differences exist between the challenges for meeting new vegetable subgroup requirements and the challenges for meeting new fruit requirements.

The fourth research question was to determine if differences exist between Northeast, Southeast and Major city schools in the frequency of serving, plate waste, availability, cost and storage for various types of vegetables and fruits. Questions were asked for various types of vegetables and fruits, such as fresh dark green vegetables, frozen dark green vegetables, canned

dark green vegetables, fresh red/orange vegetables, frozen red/orange vegetables, canned red/orange vegetables, fresh beans and peas, frozen beans and peas, canned beans and peas, fresh starchy vegetables, frozen starchy vegetables, canned starchy vegetables, other fresh vegetables, other frozen vegetables, other canned vegetables, fresh fruits, frozen fruits, canned fruits, dried fruits and fruit juices.[See Appendix to see the questions]

The questions were analyzed on likert assumption scale. The frequencies of serving for various types of vegetables and fruits were rated on a scale of (1=never, 2=rarely, 3=occasionally, 4=often). The frequencies of plate waste were rated for (1=do not serve, 2=never, 3=rarely, 4=occasionally, 5=often). To analyze plate waste the response for "1=do not serve" was considered as a missing value and the question was analyzed with a rating of (1=never, 2=rarely, 3=occasionally, 4=often). Availability and storage were rated on a scale of (1=not available, 2=limited, 3=very adequate). Cost was rated on a scale (1=low cost, 2=reasonable, 3=very expensive).

The overall rated percentages and mean responses for each of the three regions were determined. One-way analysis of variance (ANOVA) and post-hoc comparisons were used to determine if significant differences exist between Northeast, Southeast and Major city schools in the frequency of serving, frequency of plate waste, availability, cost and storage. A test for homogeneity of variance was computed to accurately determine the post-hoc comparisons. Welch's test for equality of means was used to identify the significance when the homogeneity of variance assumption was violated. The post-hoc tests used for the study were Tukey and Games-Howell comparisons. The level of significance was set at $p<0.05$. The following hypotheses were considered for the purpose of comparing means:

Null hypothesis: No difference exists between the three regions in relation to frequency of serving, frequency of plate waste, availability, cost and storage of various vegetables and fruits.

Alternate hypothesis: Differences exist between the three regions in relation to frequency of serving, frequency of plate waste, availability, cost and storage of various vegetables and fruits

CHAPTER IV: RESULTS

Participants

A total of 86 questionnaires were received. Of those, 16 (18.6%) were from Southeast region, 39(45.3%) from Northeast and 31(36%) from Major city schools. Of the participants, seven (9.5%) were employed at elementary schools, 2 (2.7%) were at middle schools, 3 (4.1%) were at high schools, 53 (71.6%) were employees of the school districts, 6 (8.1%) were employees of the state agencies, and 3 (4.1%) people responded using the other place of employment. Thirty-five (42.7%) were district directors, 13 (15.9%) were food service assistants, 4 (4.9%) were registered dietitians, 4 (4.9%) were site-level managers, and 26 (31.7%) described themselves as other designations. One of the district directors was a certified dietitian and nutritionist and two were registered dietitians. Two of the registered dietitians were training dietitians and operations specialists.

Table V: *Participants Characteristics*

Participants from each conference	N (%)
MSSNA	16(18.6%)
NYSNA	39(45.3%)
Major Cities	31(36%)
Total (N)	86
State	**N (%)**
America Somoa	1(1.3%)
Alaska	1(1.3%)
California	1(1.3%)
Colorado	2(2.5%)
Washington D.C	1(1.3%)
Florida	1(1.3%)
Guam	3(3.8%)
Illinois	1(1.3%)
Maryland	1(1.3%)
Minnesota	1(1.3%)
MP(US territories)	1(1.3%)
Mississippi	15(18.8%)
North Carolina	3(3.8%)
New Mexico	1(1.3%)
New York	35(43.8%)
Tennessee	3(3.8%)
Texas	5(6.3%)
Virginia	2(2.5%)
Virgin Islands	2(2.5%)
Total (N)	80
Place of employment	**N (%)**
Elementary school	7(9.5%)
Middle school	2(2.7%)
High school	3(4.1%)
School district	53(71.6%)
State agency	6(8.1%)
Other	3(4.1%)
Other Place of Employment:	
All	1(1.2%)
Corporate Office	1(1.2%)
FS office	1(1.2%)
Total (N)	74

Major Role	N (%)
District Director	35(42.7%)
Food service assistant	13(15.9%)
Registered dietitian	4(4.9%)
Site-level Manager	4(4.9%)
Other	26(31.7%)
Other roles:	
Area Supervisor	3(3.5%)
Assistant director	2(2.3%)
Central Production facility Supervisor	1(1.2%)
Certified Dietitian-Nutritionist	1(1.2%)
Chief Operating Officer	1(1.2%)
Compliance Manager	1(1.2%)
Cook	1(1.2%)
Executive chef	1(1.2%)
Food Safety	1(1.2%)
Food server	1(1.2%)
Foodservice helper	1(1.2%)
Foodservice worker	1(1.2%)
Menu Planner	1(1.2%)
NY Certified dietitian/Nutritionist SNA	1(1.2%)
Operations Manager	1(1.2%)
Operations Specialist	1(1.2%)
President of Management Company	1(1.2%)
Registered Dietitian	2(2.3%)
Senior Administrative assistant	1(1.2%)
State Administrator	1(1.2%)
State division director	1(1.2%)
Supervisor	4(4.7%)
Trainer	1(1.2%)
Training Dietitian	1(1.2%)
Total (N)	82

6 cent reimbursement per lunch

A total of 80 responses were analyzed to evaluate if the 6 cent per lunch reimbursement was motivating in achieving the goals of the new meal pattern. Forty-seven (58.8%) of the valid

respondents reported that the 6 cent per lunch reimbursement was motivating. Sixty-three percent of respondents from Southeast region, 44% from Northeast region and 73% from Major city schools considered that the 6 cent per lunch reimbursement was motivating in meeting the requirements of new meal pattern.

Table VI: *Overall percentages for 6 cent reimbursement per lunch*

Response	N (%)
(Yes=1)	47(58.8%)
(No=0)	33(41.3%)
Total (N)	80

Table VII: *Regional wise percentages for the 6 cent reimbursement per lunch*

Region	Total no. of respondents	% of respondents considering the 6 cent reimbursement per lunch motivating
Southeast	16	63%
Northeast	34	44%
Major city schools	30	73%

Practices to encourage fruit and vegetable consumption

Most of the facilities in the three regions were implementing nutrition education to encourage fruit (85.5%) and vegetable (87.5%) consumption. Only 37.7% and 46.8% of schools were using gardening and salad bars respectively to encourage fruit consumption. Gardening and salad bars were used by 40.8% and 47.3% of facilities respectively to encourage vegetable consumption.

The Major city schools have the highest percentage of using nutrition education (93%), gardening (59%), and salad bars (59%) to encourage fruit consumption compared to the Southeast and Northeast regions. Of the three regions, the Major city schools also have the highest percentage of using nutrition education (97%) and gardening (62%) to encourage vegetable consumption, but North east region (61%) have the highest rate of implementing salad bars.

Table VIII: *Percentages for the practices to encourage fruit and vegetable consumption*

		Nutrition education	Gardening	Salad bars
		N (%)	N (%)	N (%)
Practices to encourage fruit consumption	Yes = 1	71 (85.5%)	29 (37.7%)	36 (46.8%)
	No = 0	12 (14.5%)	48 (62.3%)	41 (53.2%)
Total (N)		83	77	77
Practices to encourage vegetable consumption	Yes = 1	70 (87.5%)	29 (40.8%)	35 (47.3%)
	No = 0	10 (12.5%)	45 (59.2%)	39 (52.7%)
Total (N)		80	71	74

Table IX: *Regional wise percentages for the practices to encourage fruit and vegetable consumption*

	Nutrition education		Gardening		Salad bars	
Region	Total no. of respondents	% using nutrition education	Total no. of respondents	% using gardening	Total no. of respondents	% using salad bars
Practices to encourage fruit consumption						
Southeast	16	88%	16	19%	16	6%
Northeast	37	78%	34	29%	34	56%
Major city schools	30	93%	27	59%	27	59%
Practices to encourage vegetable consumption						
Southeast	16	94%	15	13%	15	0%
Northeast	34	76%	30	37%	33	61%
Major city schools	30	97%	26	62%	26	58%

Meeting the requirements for the new fruit and vegetable component

Eighty-five participants rated their perceived challenges of meeting the new fruit and vegetable requirement. The descriptive statistics reported that on a 5-point scale, the mean for challenge of meeting fruit component requirement was 2.67 that lies between disagree and neutral. The mean for challenge of meeting vegetable subgroup component requirement was 3.16 that lie between neutral and agree. The paired sample two-tailed t-test reported that significant difference t (83) =-4.056, p<0.05 did exist in the challenges for meeting fruit and vegetable subgroup components.

Table X: *Percentage, Mean (M) and Standard deviation (SD) for the challenge of meeting new fruit and vegetable subgroups component*

	Meeting the requirements for the fruit component is challenging. N (%)	Meeting the requirements for the vegetable subgroups is challenging. N (%)
Strongly Disagree(=1)	19 (22.4%)	12 (14.1%)
Disagree(=2)	21 (24.7%)	14 (16.5%)
Neutral(=3)	24 (28.2%)	19 (22.4%)
Agree(=4)	11 (12.9%)	28 (32.9%)
Strongly Agree(=5)	10 (11.8%)	12 (14.1%)
Total(N)	85	85
M	2.67	3.15
SD	1.29	1.26
t-test	t = - 4.056 ***	

Note: Two-tailed paired t-test for N=84, *p<0.05, **p<0.01, ***p<0.001

Frequency of serving fruits and vegetables

The Levene test for homogeneity of variance assumption was violated for the frequency of serving fresh dark green vegetables, F (2, 79) =3.678, p=0.03, fresh red/orange vegetables, F (2, 78)=8.218, p=0.001, fresh starchy vegetables, F(2, 73)=4.054, p=0.021, canned starchy vegetables, F(2, 69)=3.580, p=0.033, canned other vegetables, F(2, 71)=4.723, p=0.012, fresh fruits, F(2, 81)=3.938, p=0.023, frozen fruits, F(2, 71)=6.673, p=0.012, canned fruits, F(2, 78)=7.809, p=0.001 and dried fruits, F(2, 69)=4.930, p=0.01.

The Welch tests for equality of means did not report any significant difference between the three regions for the frequency of serving fresh dark green vegetables, F(2, 35.692)=0.651, p=0.527, fresh red/orange vegetables, F(2, 32.663)=2.429, p=0.104, fresh starchy vegetables, F(2, 34.803)=3.155, p=0.055, canned starchy vegetables, F(2, 43.400)=2.261, p=0.116, canned other vegetables, F(2, 44.696)=1.827, p=0.173, frozen fruits, F(2, 42.916)=1.687, p=0.197,

canned fruits, $F(2, 35.336)=3.118$, $p=0.057$ and dried fruits, $F(2, 40.132)=1.850$, $p=0.170$. The level of significance between the three regions was not provided for fresh fruits.

One-way ANOVA analysis did not report significant difference between the three regions for the frequency of serving canned dark green vegetables, $F(2, 70)=0.901$, $p=0.411$, frozen red/orange vegetables, $F(2, 72)=2.611$, $p=0.08$, canned red/orange vegetables, $F(2, 72)=0.961$, $p=0.387$, fresh beans and peas, $F(2, 69)=0.354$, $p=0.703$, canned beans and peas, $F(2, 76)=0.565$, $p=0.571$, frozen starchy vegetables, $F(2, 75)=0.361$, $p=0.698$, fresh other vegetables, $F(2, 74)=0.427$, $p=0.654$, frozen other vegetables, $F(2, 73)=0.307$, $p=0.736$, and fruit juices $F(2, 76)=0.507$, $p=0.604$. The comparisons found a statistically significant difference between the regions for frozen dark green vegetables, $F(2, 76)=3.812$, $p=0.026$ and frozen beans and peas, $F(2, 72)=7.796$, $p=0.001$.

The Tukey post-hoc comparisons showed significant differences between Southeast ($N=16$, $M=3.63$) and Major city schools ($N=29$, $M=3.07$), $p=0.03$ for the frequency of serving frozen dark green vegetables. The post-hoc tests comparison revealed significant difference between Major city schools ($N=26$, $M=2.12$) with Northeast ($N=34$, $M=2.97$), $p=0.01$, and Southeast region ($N=15$, $M=3.40$), $p=0.001$, for the frequency of serving frozen beans and peas. Though, the Welch test for equality of means did not identify significant differences for the serving of canned fruit, post-hoc analysis identified differences between Northeast (N=36, $M=3.86$) and Major city schools ($N=29$, $M=3.48$), $p=0.047$.

Table XI: *Percentages for the frequency of serving*

	Never (=1)	Rarely (=2)	Occasionally (=3)	Often (=4)	Total
	N (%)	N (%)	N (%)	N (%)	N
Dark green vegetables					
Fresh	1(1.2%)	4(4.9)%	14(17.1%)	63(76.8%)	82
Frozen	2(2.5%)	5(6.3%)	37(46.8%)	35(44.3%)	79
Canned	25 (34.2%)	22(30.1%)	14(19.2%)	12(16.4%)	73
Red/orange vegetables					
Fresh	1(1.2%)	1(1.2%)	13(16%)	66(81.5%)	81
Frozen	2(2.7%)	8(10.7%)	32(42.7%)	33(44%)	75
Canned	12(16%)	14(18.7%)	21(28%)	28(37.3%)	75
Beans and peas					
Fresh	21(29.2%)	15(20.8%)	19(26.4%)	17(23.6%)	72
Frozen	19(25.3%)	6(8.0%)	24(32%)	26(34.7%)	75
Canned	1(1.3%)	5(6.3%)	23(29.1%)	50(63.3%)	79
Starchy vegetables					
Fresh	5(6.6%)	11(14.5%)	29(38.2%)	31(40.8%)	76
Frozen	1(1.3%)	1(1.3%)	25(32.1%)	51(65.4%)	78
Canned	10(13.9%)	15(20.8%)	25(34.7%)	22(30.6%)	72
Other vegetables					
Fresh	1(1.3%)	5(6.5%)	24(31.2%)	47(61%)	77
Frozen	2(2.6%)	7(9.2%)	34(44.7%)	33(43.4%)	76
Canned	6(8.1%)	13(17.6%)	32(43.2%)	23(31.1%)	74
Fruits					
Fresh	0	1(1.2%)	6(7.1%)	77(91.7%)	84
Frozen	8(10.8%)	16(21.6%)	35(47.3%)	15(20.3%)	74
Canned	1(1.2%)	3(3.7%)	16(19.8%)	61(75.3%)	81
Dried	14(19.4%)	28(38.9%)	21(29.2%)	9(12.5%)	72
Juices	11(13.9%)	8(10.1%)	24(30.4%)	36(45.6%)	79

Table XII: *Regional wise means for the frequency of serving*

	Southeast		Northeast		Major City schools		Total	
	N	Mean	N	Mean	N	Mean	N	Mean
Dark green vegetables								
Fresh	16	3.50	35	3.71	31	3.77	82	3.70
Frozen	16	3.63	34	3.41	29	3.07	79	3.33
Canned	16	2.50	32	2.09	25	2.08	73	2.18
Red/orange vegetables								
Fresh	16	3.75	34	3.91	31	3.65	81	3.78
Frozen	16	3.25	33	3.48	26	3.04	75	3.28
Canned	16	3.13	33	2.91	26	2.65	75	2.87
Beans and peas								
Fresh	15	2.27	28	2.57	29	2.41	72	2.44
Frozen	15	3.40	34	2.97	26	2.12	75	2.76
Canned	16	3.44	33	3.64	30	3.50	79	3.54
Starchy vegetables								
Fresh	16	3.06	32	3.41	28	2.86	76	3.13
Frozen	15	3.53	34	3.68	29	3.59	78	3.62
Canned	15	3.20	30	2.77	27	2.67	72	2.82
Other vegetables								
Fresh	15	3.40	32	3.59	30	3.50	77	3.52
Frozen	15	3.27	33	3.36	28	3.21	76	3.29
Canned	16	3.25	31	3.00	27	2.78	74	2.97
Fruits								
Fresh	16	4.00	37	3.89	31	3.87	84	3.90
Frozen	16	3.00	31	2.87	27	2.52	74	2.77
Canned	16	3.69	36	3.86	29	3.48	81	3.69
Dried	16	2.19	31	2.58	25	2.16	72	2.35
Juices	16	3.25	34	3.12	29	2.93	79	3.08

Table XIII: *One-way ANOVA results for the frequency of serving*

	p	F	Post-hoc regional differences	*P*
Dark green vegetables				
Fresh	0.527	(2, 35.692)=0.651		
Frozen	0.026**	(2, 76)=3.812	Southeast and Major city schools	0.03
Canned	0.411	(2, 70)=0.901		
Red/orange vegetables				
Fresh	0.104	(2, 32.663)=2.429		
Frozen	0.08	(2, 72)=2.611		
Canned	0.387	(2, 72)=0.961		
Beans and peas				
Fresh	0.703	(2, 69)=0.354		
Frozen	0.001**	(2, 72)=7.796	Major city schools and Southeast	0.001
			Major city schools and Northeast	0.01
Canned	0.571	(2, 76)=0.565		
Starchy vegetables				
Fresh	0.055	(2, 34.803)=3.155		
Frozen	0.698	(2, 75)=0.361		
Canned	0.116	(2, 43.400)=2.261		
Other vegetables				
Fresh	0.654	(2, 74)=0.427		
Frozen	0.736	(2, 73)=0.307		
Canned	0.173	(2, 44.696)=1.827		
Fruits				
Fresh	Welch test did not identify *p* and *F* values			
Frozen	0.197	(2, 42.916)=1.687		
Canned	0.057**	(2, 35.336)=3.118	Northeast and Major city schools	0.047
Dried	0.170	(2, 40.132)=1.850		
Juices	0.604	(2, 76)=0.507		

Note: **p<0.05

Plate waste

The assumption for homogeneity of variance was violated for the frequency of plate waste for fresh starchy vegetables, F (2, 66) =3.174, p=0.048, and frozen starchy vegetables, F (2, 62) =3.270, p=0.045. The test for equality of means did not identify a significant difference between the three regions for the frequency of plate waste for fresh starchy vegetables F (2, 41.848) =0.109, p=0.897 and frozen starchy vegetables, F (2, 40.128) =0.375, p=0.689.

One-way ANOVA comparisons did not show any significant differences between the three regions for the plate waste of fresh dark green vegetables, F (2, 64)=0.813, p=0.448, frozen dark green vegetables, F(2, 59)=0.604, p=0.550, canned dark green vegetables, F(2, 48)=0.806, p=0.453, fresh red/orange vegetables, F(2, 64)=0.424, p=0.657, frozen red/orange vegetables, F(2, 61)=2.120, p=0.129, canned red/orange vegetables, F(2, 55)=1.065, p=0.352, canned starchy vegetables, F(2, 58)=0.658, p=0.522, fresh other vegetables F(2, 62)= 1.953, p=0.150, frozen other vegetables, F(2, 60)= 2.777, p=0.07, canned other vegetables, F(2, 57)= 1.117, p=0.334, fresh fruits F(2, 68)=2.197, p=0.119, frozen fruits, F(2, 57)=3.094, p=0.053, canned fruits, F(2, 64)=0.919, p=0.404 and fruit juices F(2, 59)=0.242, p=0.786.

The analysis identified significant difference between the three regions for fresh beans and peas, F(2, 55) =6.694, p=0.003, frozen beans and peas F(2, 54)=3.347, p=0.043, canned beans and peas, F(2, 61)=3.906, p=0.025 and dried fruits F(2, 48)=3.992, p=0.025. The post-hoc comparisons reported significant difference between the Southeast and Northeast schools for the plate waste of fresh beans and peas, (N=10, M=2.40 and N=27, M=3.37), p=0.002, frozen beans and peas, (N=13, M=2.69 and N=25, M=3.36), p=0.039, canned beans and peas, (N=14, M=2.79 and N=25, M=3.38), p=0.022 and dried fruits, (N=11, M=2.36 and N=25, M=3.16), p=0.036.

Table XIV: *Percentages for the plate waste*

	Never (=1)	Rarely (=2)	Occasionally (=3)	Often (=4)	Total
	N (%)	N (%)	N (%)	N (%)	N
Dark green vegetables					
Fresh	1(1.5%)	12(17.9%)	36(53.7%)	18(26.9%)	67
Frozen	1(1.6%)	9(14.5%)	34(54.8%)	18(29%)	62
Canned	1(2%)	7(13.7%)	26(51%)	17(33.3%)	51
Red/orange vegetables					
Fresh	1(1.5%)	15(22.4%)	41(61.2%)	10(14.9%)	67
Frozen	1(1.6%)	16(25%)	35(54.7%)	12(18.8%)	64
Canned	1(1.7%)	12(20.7%)	32(55.2%)	13(22.4%)	58
Beans and peas					
Fresh	2(3.4%)	12(20.7%)	26(44.8%)	18(31%)	58
Frozen	1(1.8%)	13(22.8%)	23(40.4%)	20(35.1%)	57
Canned	1(1.6%)	12(18.8%)	25(39.1%)	26(40.6%)	64
Starchy vegetables					
Fresh	8(11.6%)	34(49.3%)	22(31.9%)	5(7.2%)	69
Frozen	7(10.8%)	35(53.8%)	18(27.7%)	5(7.7%)	65
Canned	4(6.6%)	28(45.9%)	24(39.3%)	5(8.2%)	61
Other vegetables					
Fresh	1(1.5%)	19(29.2%)	37(56.9%)	8(12.3%)	65
Frozen	2(3.2%)	15(23.8%)	38(60.3%)	8(12.7%)	63
Canned	2(3.3%)	15(25%)	36(60%)	7(11.7%)	60
Fruits					
Fresh	4(5.6%)	23(32.4%)	31(43.7%)	13(18.3%)	71
Frozen	4(6.7%)	26(43.3%)	23(38.3%)	7(11.7%)	60
Canned	4(6%)	28(41.8%)	28(41.8%)	7(10.4%)	67
Dried	4(7.8%)	14(27.5%)	20(39.2%)	13(25.5%)	51
Juices	14(22.6%)	26(41.9%)	17(27.4%)	5(8.1%)	62

Table XV: *Regional wise means for the plate waste*

	Southeast		Northeast		Major City schools		Total	
	N	Mean	N	Mean	N	Mean	N	Mean
Dark green vegetables								
Fresh	13	3.00	30	2.97	24	3.21	67	3.06
Frozen	13	2.92	27	3.15	22	3.18	62	3.11
Canned	11	2.91	19	3.21	21	3.24	51	3.16
Red/orange vegetables								
Fresh	13	2.77	30	2.97	24	2.88	67	3.90
Frozen	13	2.69	27	3.11	24	2.79	64	2.91
Canned	14	2.79	22	3.14	22	2.95	58	2.98
Beans and peas								
Fresh	10	2.40	27	3.37	21	2.90	48	3.03
Frozen	13	2.69	25	3.36	19	3.00	57	3.09
Canned	14	2.79	25	3.38	25	3.12	64	3.19
Starchy vegetables								
Fresh	14	2.29	31	2.35	24	2.38	69	2.35
Frozen	13	2.23	27	2.41	25	2.28	65	2.32
Canned	13	2.31	25	2.60	23	2.48	61	2.49
Other vegetables								
Fresh	12	2.50	29	2.79	24	2.96	65	2.80
Frozen	13	2.46	26	2.85	24	3.00	63	2.83
Canned	14	2.57	23	2.91	23	2.83	60	2.80
Fruits								
Fresh	14	2.57	32	2.97	25	2.56	71	2.75
Frozen	14	2.36	25	2.84	21	2.33	60	2.55
Canned	14	2.50	28	2.71	25	2.44	67	2.57
Dried	11	2.36	25	3.16	15	2.60	51	2.82
Juices	14	2.07	27	2.22	21	2.29	62	2.21

Table XVI: *One-way ANOVA results for the plate waste*

	p	F	Post-hoc regional differences	*P*
Dark green vegetables				
Fresh	0.448	(2, 64)=0.813		
Frozen	0.550	(2, 59)=0.604		
Canned	0.453	(2, 48)=0.806		
Red/orange vegetables				
Fresh	0.657	(2, 64)=0.424		
Frozen	0.129	(2, 61)=2.120		
Canned	0.352	(2, 55)=1.065		
Beans and peas				
Fresh	0.003**	(2, 55)=6.694	Southeast and North east regions	0.002
Frozen	0.043**	(2, 54)=3.347	Southeast and North east regions	0.039
Canned	0.025**	(2, 61)=3.906	Southeast and North east regions	0.022
Starchy vegetables				
Fresh	0.897	(2, 41.848) =0.109		
Frozen	0.689	(2, 40.128) =0.375		
Canned	0.522	(2, 58)=0.658		
Other vegetables				
Fresh	0.150	(2, 62)=1.953		
Frozen	0.07	(2, 60)=2.777		
Canned	0.334	(2, 57)=1.117		
Fruits				
Fresh	0.119	(2, 68)=2.197		
Frozen	0.053	(2, 57)=3.094		
Canned	0.404	(2, 64)=0.919		
Dried	0.025**	(2, 48)=3.992	Southern and North east regions	0.036
Juices	0.786	(2, 59)=0.242		

Note: **p<0.05

Availability

The Levene's test for homogeneity of variance was not met for the availability of fresh dark green vegetables, $F(2, 77)=3.378$, $p=0.039$, frozen dark green vegetables, $F(2, 71)=22.665$, $p<0.05$, canned red/orange vegetables, $F(2, 67)=4.053$, $p=0.022$, frozen beans and peas, $F(2, 66)=6.137$, $p=0.004$, canned beans and peas, $F(2, 68)=8.032$, $p=0.001$, fresh starchy vegetables, $F(2, 70)=5.149$, $p=0.008$, frozen starchy vegetables, $F(2, 66)=11.828$, $p<0.05$, canned starchy vegetables, $F(2, 63)=3.228$, $p=0.046$, fresh other vegetables $F(2, 72)=4.494$, $p=0.014$, frozen other vegetables, $F(2, 66)=3.156$, $p=0.049$, canned other vegetables, $F(2, 66)=4.037$, $p=0.022$, canned fruit, $F(2, 67)=11.234$, $p<0.05$ and fruit juices, $F(2, 65)=6.075$, $p=0.004$.

The tests for equality of means did not identify any significant differences between the three regions for the availability of fresh dark green vegetables, $F(2, 34.925)=1.434$, $p=0.252$, canned red/orange vegetables, $F(2, 41.706)=1.320$, $p=0.278$, canned beans and peas, $F(2, 32.705)=1.590$, $p=0.219$, fresh starchy vegetables, $F(2, 31.589)=1.965$, $p=0.157$, frozen starchy vegetables, $F(2, 33.038)=2.638$, $p=0.086$, canned starchy vegetables, $F(2, 37.462)=1.058$, $p=0.357$, fresh other vegetables, $F(2, 33.472)=1.076$, $p=0.352$, frozen other vegetables, $F(2, 33.113)=0.799$, $p=0.458$, canned other vegetables, $F(2, 32.794)=1.402$, $p=0.260$, canned fruit, $F(2, 29.729)=2.366$, $p=0.111$ and fruit juices, $F(2, 38.668)=1.616$, $p=0.212$.

One-way ANOVA comparisons did not show any significant differences between the three regions for the availability of canned dark green vegetables, $F(2, 68)=2.117$, $p=0.128$, fresh red/orange vegetables, $F(2, 77)=0.681$, $p=0.509$, frozen red/orange vegetables, $F(2, 71)=0.201$, $p=0.819$, fresh beans and peas, F $(2, 68)=2.075$, $p=0.133$, fresh fruit, $F(2, 71)=0.722$, $p=0.489$, frozen fruit, $F(2, 66)=1.040$, $p=0.359$ and dried fruits, $F(2, 62)=1.423$, $p=0.249$.

The Welch test for equality of means did not provide *p* and *F* values for the availability of frozen dark green vegetables but the post-hoc comparisons showed significant difference between Southeast schools (*N*=15, *M*=3.00) with Major city schools (*N*= 28, *M*=2.61), *p*=0.016 and Northeast (*N*=31, *M*=2.77), *p*=0.007. Significant difference between the regions were identified for frozen beans and peas, *F* (2, 42.395) =3.729, *p*=0.032 but the post-hoc analysis did not report any significant data.

Table XVII: *Percentages for Availability*

		Not available (=1)	Limited (=2)	Very adequate (=3)	Total
		N (%)	N (%)	N (%)	N
Dark green vegetables					
	Fresh	2(2.5%)	21(26.3%)	57(71.3%)	80
	Frozen	2(2.7%)	14(18.9%)	58(78.4%)	74
	Canned	13(18.3%)	24(33.8%)	34(47.9%)	71
Red/orange vegetables					
	Fresh	1(1.3%)	20(25%)	59(73.8%)	80
	Frozen	1(1.4%)	18(24.3%)	55(74.3%)	74
	Canned	5(7.1%)	16(22.9%)	49(70%)	70
Beans and peas					
	Fresh	11(15.5%)	31(43.7%)	29(40.8%)	71
	Frozen	6(8.7%)	23(33.3%)	40(58%)	69
	Canned	1(1.4%)	9(12.7%)	61(85.9%)	71
Starchy vegetables					
	Fresh	2(2.7%)	24(32.9%)	47(64.4%)	73
	Frozen	1(1.4%)	14(20.3%)	54(78.3%)	69
	Canned	2(3%)	13(19.7%)	51(77.3%)	66
Other vegetables					
	Fresh	3(4%)	25(33.3%)	47(62.7%)	75
	Frozen	2(2.9%)	19(27.5%)	48(69.6%)	69
	Canned	2(2.9%)	14(20.3%)	53(76.8%)	69
Fruits					
	Fresh	1(1.4%)	20(27%)	53(71.6%)	74
	Frozen	4(5.8%)	30(43.5%)	35(50.7%)	69
	Canned	0	12(17.1%)	58(82.9%)	70
	Dried	8(12.3%)	30(46.2%)	27(41.5%)	65
	Juices	1(1.5%)	12(17.6%)	55(80.9%)	68

Table XVIII: *Regional wise means for availability*

	Southeast		Northeast		Major City schools		Total	
	N	Mean	N	Mean	N	Mean	N	Mean
Dark green vegetables								
Fresh	15	2.47	36	2.78	29	2.69	80	2.69
Frozen	15	3.00	31	2.77	28	2.61	74	2.76
Canned	16	2.56	30	2.10	25	2.36	71	2.30
Red/orange vegetables								
Fresh	15	2.60	35	2.77	30	2.73	80	2.73
Frozen	15	2.80	31	2.71	28	2.71	74	2.73
Canned	15	2.80	30	2.63	25	2.52	70	2.63
Beans and peas								
Fresh	14	1.93	31	2.39	26	2.27	71	2.25
Frozen	15	2.80	29	2.41	25	2.40	69	2.49
Canned	15	2.87	30	2.93	26	2.73	71	2.85
Starchy vegetables								
Fresh	14	2.43	32	2.75	27	2.56	73	2.62
Frozen	15	2.80	29	2.90	25	2.60	69	2.77
Canned	15	2.80	28	2.82	23	2.61	66	2.74
Other vegetables								
Fresh	15	2.40	32	2.69	28	2.57	75	2.59
Frozen	15	2.60	29	2.76	25	2.60	69	2.67
Canned	15	2.80	29	2.83	25	2.60	69	2.74
Fruits								
Fresh	14	2.64	32	2.78	28	2.64	74	2.70
Frozen	14	2.64	32	2.44	23	2.35	69	2.45
Canned	14	2.79	30	2.93	26	2.73	70	2.83
Dried	13	2.08	30	2.43	22	2.23	65	2.29
Juices	14	2.93	31	2.81	23	2.70	68	2.79

Table XXI: *One-way ANOVA results for availability*

	p	F	Post-hoc regional differences	*P*
Dark green vegetables				
Fresh	0.252	(2, 34.925)=1.434		
Frozen	Welch test did not identify *p* and *F* values		Southeast and Major city schools	0.016
			Northeast and Major city schools	0.007
Canned	0.128	(2, 68)=2.117		
Red/orange vegetables				
Fresh	0.509	(2, 77)=0.681		
Frozen	0.819	(2, 71)=0.201		
Canned	0.278	(2, 41.706)=1.320		
Beans and peas				
Fresh	0.133	(2, 68)=2.075		
Frozen	0.032**	(2, 42.395)=3.729	Southeast and Northeast region schools	0.02
			Southeast and Major city schools	0.03
Canned	0.219	(2, 32.705)=1.590		
Starchy vegetables				
Fresh	0.157	(2, 31.589)=1.965		
Frozen	0.086	(2, 33.038)=2.638		
Canned	0.357	(2, 37.462)=1.058		
Other vegetables				
Fresh	0.352	(2, 33.472)=1.076		
Frozen	0.458	(2, 33.113)=0.799		
Canned	0.260	(2, 32.794)=1.402		
Fruits				
Fresh	0.489	(2, 71)=0.722		
Frozen	0.359	(2, 66)=1.040		
Canned	0.111	(2, 29.729)=2.366		
Dried	0.249	(2, 62)=1.423		
Juices	0.212	(2, 38.668)=1.616		

Note: **p<0.05

Cost

The test for homogeneity of variance was violated for the cost of frozen dark green vegetables, $F(2, 62)=4.008$, $p=0.023$, canned dark green vegetables, $F(2, 50)=5.157$, $p=0.009$, frozen red/orange vegetables, $F(2, 66)=8.728$, $p<0.05$, frozen beans and peas, $F(2, 60)=4.634$, $p=0.013$, fresh starchy vegetables, $F(2, 62)=5.916$, $p=0.004$, fresh fruits, $F(2, 65)=7.006$, $p=0.002$, and fruit juices, $F(2, 61)=3.757$, $p=0.029$.

The tests for equality of means did not find significant differences between the three regions for the cost of frozen dark green vegetables, $F(2, 40.645)=0.963$, $p=0.390$, frozen red/orange vegetables, $F(2, 41.518)=2.008$, $p=0.147$, frozen beans and peas, $F(2, 35.889)=0.750$, $p=0.479$, fresh starchy vegetables, $F(2, 31.284)=0.469$, $p=0.630$, fresh fruits, $F(2, 39.422)=1.695$, $p=0.197$, and fruit juices, $F(2, 35.632)=1.752$, $p=0.188$. The Welch test did not provide the p and F values for the cost of canned dark green vegetables.

One-way ANOVA comparisons did not show any significant differences between the three regions for the cost of fresh dark green vegetables, $F(2, 69)=1.970$, $p=0.147$, fresh red/orange vegetables, $F(2, 67)=0.602$, $p=0.551$, canned red/orange vegetables, $F(2, 57)=1.261$, $p=0.291$, fresh beans and peas, $F(2, 57)=0.444$, $p=0.644$, canned beans and peas, $F(2, 63)=0.007$, $p=0.993$, frozen starchy vegetables, $F(2, 66)=1.537$, $p=0.223$, canned starchy vegetables, $F(2, 63)=0.490$, $p=0.615$, fresh other vegetables, $F(2, 63)=0.368$, $p=0.694$, frozen other vegetables, $F(2, 62)=0.729$, $p=0.486$, canned other vegetables, $F(2, 59)=0.311$, $p=0.734$, frozen fruits $F(2, 59)=0.155$, $p=0.857$, and canned fruits $F(2, 62)=0.295$, $p=0.746$.

Significant differences between the three regions were identified for the cost of dried fruits, $F(2, 54) =3.658$, $p=0.032$. The Tukey post-hoc comparisons found significant differences

between Southeast (*N*=14, *M*=2.07) and Major city schools (*N*=18, *M*=2.61), p=0.027 for the cost of dried fruits.

Table XX: *Percentages for cost*

		Low cost (=1)	Reasonable (=2)	Very expensive (=3)	Total
		N (%)	N (%)	N (%)	N
Dark green vegetables					
	Fresh	0	30(41.7%)	42(58.3%)	72
	Frozen	1(1.5%)	53(81.5%)	11(16.9%)	65
	Canned	7(13.2%)	41(77.4%)	5(9.4%)	53
Red/orange vegetables					
	Fresh	0	39(55.7%)	31(44.3%)	70
	Frozen	0	57(82.6%)	12(17.4%)	69
	Canned	3(5.0%)	50(83.3%)	7(11.7%)	60
Beans and peas					
	Fresh	7(11.7%)	29(48.3%)	24(40%)	60
	Frozen	4(6.3%)	54(85.7%)	5(7.9%)	63
	Canned	12(18.2%)	51(77.3%)	3(4.5%)	66
Starchy vegetables					
	Fresh	2(3.1%)	45(69.2%)	18(27.7%)	65
	Frozen	3(4.3%)	59(85.5%)	7(10.1%)	69
	Canned	8(12.1%)	53(80.3%)	5(7.6%)	66
Other vegetables					
	Fresh	0	34(51.5%)	32(48.5%)	66
	Frozen	0	57(87.7%)	8(12.3%)	65
	Canned	10(16.1%)	46(74.2%)	6(9.7%)	62
Fruits					
	Fresh	0	18(26.5%)	50(73.5%)	68
	Frozen	3(4.8%)	35(56.5%)	24(38.7%)	62
	Canned	7(10.8%)	47(72.3%)	11(16.9%)	65
	Dried	3(5.3%)	28(49.1%)	26(45.6%)	57
	Juices	7(10.9%)	44(68.8%)	13(20.3%)	64

Table XXI*: Regional wise means for cost*

	Southeast		Northeast		Major City schools		Total	
	N	Mean	N	Mean	N	Mean	N	Mean
Dark green vegetables								
Fresh	16	2.69	31	2.45	25	2.68	72	2.58
Frozen	16	2.06	26	2.19	23	2.17	65	2.15
Canned	14	2.00	20	1.90	19	2.00	53	1.96
Red/orange vegetables								
Fresh	16	2.50	30	2.37	24	2.50	70	2.44
Frozen	16	2.06	29	2.14	24	2.29	69	2.17
Canned	16	1.94	24	2.08	20	2.15	60	2.07
Beans and peas								
Fresh	13	2.38	26	2.19	21	2.33	60	2.28
Frozen	16	1.94	26	2.00	21	2.10	63	2.02
Canned	16	1.88	28	1.86	22	1.86	66	1.86
Starchy vegetables								
Fresh	15	2.27	27	2.19	23	2.30	65	2.25
Frozen	16	2.00	29	2.00	24	2.17	69	2.06
Canned	16	2.00	27	1.89	23	2.00	66	1.95
Other vegetables								
Fresh	16	2.56	28	2.43	22	2.50	66	2.48
Frozen	16	2.06	28	2.11	21	2.19	65	2.12
Canned	16	1.94	25	1.88	21	2.00	62	1.94
Fruits								
Fresh	15	2.87	30	2.63	23	2.78	68	2.74
Frozen	15	2.27	28	2.36	19	2.37	62	2.34
Canned	15	2.00	26	2.04	24	2.13	65	2.06
Dried	14	2.07	25	2.44	18	2.61	57	2.40
Juices	15	2.07	28	1.96	21	2.29	64	2.09

Table XXII: *One-way ANOVA results for cost*

	p	F	Post-hoc regional differences	*P*
Dark green vegetables				
Fresh	0.147	(2, 69)=1.970		
Frozen	0.390	(2, 40.645)=0.963		
Canned	Welch test did not identify p and F value			
Red/orange vegetables				
Fresh	0.551	(2, 67)=0.602		
Frozen	0.147	(2, 41.518)=2.008		
Canned	0.291	(2, 57)=1.261		
Beans and peas				
Fresh	0.644	(2, 57)=0.444		
Frozen	0.479	(2, 35.889)=0.750		
Canned	0.993	(2, 63)=0.007		
Starchy vegetables				
Fresh	0.630	(2, 31.284)=0.469		
Frozen	0.223	(2, 66)=1.537		
Canned	0.615	(2, 63)=0.490		
Other vegetables				
Fresh	0.694	(2, 63)=0.368		
Frozen	0.486	(2, 62)=0.729		
Canned	0.734	(2, 59)=0.311		
Fruits				
Fresh	0.197	(2, 39.422)=1.695		
Frozen	0.857	(2, 59)=0.155		
Canned	0.746	(2, 62)=0.295		
Dried	0.032**	(2, 54)=3.658	Southeast and Major city schools	0.027
Juices	0.188	(2, 35.632)=1.752		

Note: **p<0.05

Storage

The assumptions for the homogeneity of variance was not met for the storage of canned dark green vegetables, $F(2, 61) = 4.627$, $p=0.013$, canned red/orange vegetables, $F(2, 61)=8.209$, $p=0.001$, canned beans and peas, $F(2, 66)=9.759$, $p<0.05$, and frozen starchy vegetables, $F(2, 67)=3.658$, $p=0.031$. The tests for equality of means did not find any significant difference between the three regions for the storage of canned dark green vegetables, $F(2, 40.142) = 1.610$, $p=0.213$, canned red/orange vegetables, $F(2, 39.854)=2.863$, $p=0.069$, canned beans and peas, $F(2, 41.590)=2.031$, $p=0.144$, and frozen starchy vegetables, $F(2, 37.068)=1.113$, $p=0.339$.

One-way ANOVA analysis did not identify significant difference for the storage of fresh dark green vegetables, $F(2, 70)=0.881$, $p=0.419$, frozen dark green vegetables, $F(2, 68)=2.532$, $p=0.087$, fresh red/orange vegetables, $F(2, 67)=0.514$, $p=0.600$, fresh beans and peas, $F(2, 61)=2.428$, $p=0.097$, fresh starchy vegetables, $F(2, 66)=1.015$, $p=0.368$, canned starchy vegetables, $F(2, 64)=0.174$, $p=0.841$, fresh other vegetables, $F(2, 63)=1.101$, $p=0.339$, frozen other vegetables, $F(2, 64)=0.304$, $p=0.739$, canned other vegetables, $F(2, 62)=0.547$, $p=0.582$, fresh fruits, $F(2, 64)=0.627$, $p=0.537$, canned fruits, $F(2, 64)=0.226$, $p=0.799$, dried fruits, $F(2, 57)=0.254$, $p=0.776$ and fruit juices, $F(2, 62)=1.666$, $p=0.197$.

Significant differences between the three regions were identified for storage of frozen red/orange vegetables, $F(2, 66)=4.573$, p=0.014, frozen beans and peas, $F(2, 63)=3.669$, $p=0.031$ and frozen fruits, $F(2, 61)=3.671$, $p=0.031$. The Tukey post-hoc comparisons found significant difference between Southeast ($N=16$, $M=2.63$) and Northeast schools ($N=29$, $M=2.21$), $p=0.011$ for the storage of frozen red/orange vegetables. Significant differences were also identified between Southeast ($N=16$, $M=2.63$) and Major city schools ($N=22$, $M=2.18$), $p=0.024$ for the storage of frozen beans and peas. The post-hoc tests reported significant difference between

Southeast (*N*=15, *M*=2.60) and Major city schools (*N*=22, *M*=2.18), *p*=0.031 for the storage of frozen fruits.

Table XXIII: *Percentages for storage*

		Not available (=1) N (%)	Limited (=2) N (%)	Very adequate (=3) N (%)	Total N
Dark green vegetables					
	Fresh	2(2.7%)	43(58.9%)	28(38.4%)	73
	Frozen	0	47(66.2%)	24(33.8%)	71
	Canned	2(3.1%)	19(29.7%)	43(67.2%)	64
Red/orange vegetables					
	Fresh	0	44(62.9%)	26(37.1%)	70
	Frozen	0	46(66.7%)	23(33.3%)	69
	Canned	2(3.1%)	23(35.9%)	39(60.9%)	64
Beans and peas					
	Fresh	3(4.7%)	34(53.1%)	27(42.2%)	64
	Frozen	1(1.5%)	39(59.1%)	26(39.4%)	66
	Canned	0	20(29%)	49(71%)	69
Starchy vegetables					
	Fresh	2(2.9%)	39(56.5%)	28(40.6%)	69
	Frozen	0	49(70%)	21(30%)	70
	Canned	0	23(34.3%)	44(65.7%)	67
Other vegetables					
	Fresh	2(3.0%)	42(63.6%)	22(33.3%)	66
	Frozen	1(1.5%)	44(65.7%)	22(32.8%)	67
	Canned	1(1.5%)	24(36.9%)	40(61.5%)	65
Fruits					
	Fresh	0	39(58.2%)	28(41.8%)	67
	Frozen	1(1.6%)	42(65.6%)	21(32.8%)	64
	Canned	0	19(28.4%)	48(71.6%)	67
	Dried	2(3.3%)	26(43.3%)	32(53.3%)	60
	Juices	0	35(53.8%)	30(46.2%)	65

Table XXIV: *Regional wise means for storage*

	Southeast		North east		Major City schools		Total	
	N	Mean	N	Mean	N	Mean	N	Mean
Dark green vegetables								
Fresh	16	2.31	31	2.45	26	2.27	73	2.36
Frozen	16	2.56	29	2.24	26	2.31	71	2.34
Canned	16	2.81	24	2.63	24	2.54	64	2.64
Red/orange vegetables								
Fresh	16	2.44	30	2.40	24	2.29	70	2.37
Frozen	16	2.63	29	2.21	24	2.29	69	2.33
Canned	16	2.81	27	2.44	21	2.57	64	2.58
Beans and peas								
Fresh	14	2.36	28	2.54	22	2.18	64	2.38
Frozen	16	2.63	28	2.39	22	2.18	66	2.38
Canned	16	2.88	29	2.69	24	2.63	69	2.71
Starchy vegetables								
Fresh	15	2.47	30	2.43	24	2.25	69	2.38
Frozen	16	2.44	30	2.30	24	2.21	70	2.30
Canned	16	2.69	28	2.68	23	2.61	67	2.66
Other vegetables								
Fresh	15	2.13	29	2.38	22	2.32	66	2.30
Frozen	15	2.40	30	2.30	22	2.27	67	2.31
Canned	15	2.53	28	2.68	22	2.55	65	2.60
Fruits								
Fresh	15	2.53	29	2.41	23	2.35	67	2.42
Frozen	15	2.60	27	2.26	22	2.18	64	2.31
Canned	15	2.73	28	2.75	24	2.67	67	2.72
Dried	14	2.43	27	2.56	19	2.47	60	2.50
Juices	15	2.67	28	2.39	22	2.41	65	2.46

Table XXV: *One-way ANOVA results for storage*

	p	F	Post-hoc regional differences	*P*
Dark green vegetables				
Fresh	0.419	(2, 70)=0.881		
Frozen	0.087	(2, 68)=2.532		
Canned	0.213	(2, 40.142)=1.610		
Red/orange vegetables				
Fresh	0.600	(2, 67)=0.514		
Frozen	0.014**	(2, 66)=4.573	Southeast and North east	0.011
Canned	0.069	(2, 39.854)=2.863		
Beans and peas				
Fresh	0.097	(2, 61)=2.428		
Frozen	0.031**	(2, 63)=3.669	Southeast and Major city schools	0.024
Canned	0.144	(2, 41.590)=2.031		
Starchy vegetables				
Fresh	0.368	(2, 66)=1.015		
Frozen	0.339	(2, 37.068)=1.113		
Canned	0.841	(2, 64)=0.174		
Other vegetables				
Fresh	0.339	(2, 63)=1.101		
Frozen	0.739	(2, 64)=0.304		
Canned	0.582	(2, 62)=0.547		
Fruits				
Fresh	0.537	(2, 64)=0.627		
Frozen	0.031**	(2, 61)=0.3671	Southeast and Major city schools	0.031
Canned	0.799	(2, 64)=0.226		
Dried	0.776	(2, 57)=0.254		
Juices	0.197	(2, 62)=1.666		

Note: **p<0.05

CHAPTER V: DISCUSSION

The majority of the respondents were from school districts, which provides some confidence that the sample group represents diverse opinions from different school levels (elementary, middle and high schools). The 6 cent reimbursement is considered less motivating for respondents from the Northeast. This could be due to schools across the nation feeling that implementation of the new meal pattern is required with or without additional funds.

Looking nationally, gardening has the lowest usage rates to encourage the fruit and vegetable consumption. The percentage of gardening in Major city schools was almost twice and three times that of Northeast and Southeast regions respectively. Surprisingly, the implementation of salad bars is very low in the Southeast region compared to Northeast and Major city schools. In two different surveys conducted on Arizona schools reported that space limitations, time constraints, lack of gardening knowledge and funding are considered to be the barriers in implementation of gardening in schools (Arizona School Gardens 2012). The restrictions for implementation of salad bars were cost, space, time, outside vendor, lack of equipment, staffing, sanitation and the concern with reimbursement (Arizona Salad bar Report). Some of these barriers could also explain the barriers experienced by schools in this study.

Research supported that development of gardening in schools improved children's attitudes towards fruits and vegetable consumption (Lineberger & Zajicek, 1999) and increased their nutrition knowledge (Morris & Zidenberg-Cherr, 2002). Similarly, implementation of salad bars in schools was reported to have increased fruit and vegetable consumption among children and lower levels of saturated fat and total fat intake (Slusser et al., 2007).

In comparison for meeting the requirements for the new fruit and vegetable subgroup components most of the participants considered that meeting the vegetable subgroup is more challenging (47%) compared to the fruit requirements (24.7%). Additional technical assistance may be needed to encourage schools to incorporate the vegetable subgroups in the menus.

Regional differences for the barriers were observed for frozen dark green vegetables, frozen beans and peas, fresh beans and peas, canned beans and peas, frozen red/orange vegetables, canned, dried and frozen fruits. The results imply that no difference existed between the regions for fresh produce except for the beans and peas.

The High School Youth Risk Behavior Survey, 2011 reported out of 1,732 Mississippi students 16.5% and from 12, 142 New York students 14.7% were overweight. 9.5% of 1,815 students from MS and 5.7% of 1,745 students from NY did not eat vegetable per day. 17% from MS and 13.7% from NY did not eat a fruit per day. Findings from this study provide new knowledge that can be incorporated into targeted training and resource allocation to schools in different regions to increase fruit and vegetable consumption by addressing the perceived barriers identified. Such initiatives should encourage continued improvement in consumption patterns of school children, specifically increased consumption of fruits and vegetables. Even small changes in consumption patterns nationally could result in positive decreases in obesity and numerous chronic diseases over time.

Several limitations of the study should be considered. The sample sizes for the three regions were not equal and Southeast has the lowest sample size compared to Northeast and Major city schools. The request for questionnaire responses was limited to a short period of time and the fact that the questionnaire was completed in the Fall could have affected the resources

regarding gardening. The size of each schools district can vary and could have impact on responses to individual questions.

Several limitations of the study should be considered. The sample sizes for the three regions were not equal and Southeast has the lowest sample size compared to Northeast and Major city schools. The request for questionnaire responses was limited to a short period of time and the fact that the questionnaire was completed in the Fall could have affected the responses regarding gardening. The size of each schools district can vary and could have impact on responses to individual questions.

CONCLUSION

Future research could be focused on identifying the reasons the 6 cent reimbursement was not viewed as a motivating factor for implementation of the new meal pattern. It would be very interesting to investigate the barriers for implementation of salad bars in the Southeast region. The new meal pattern for OVS requires that a fruit or vegetable be on each meal tray. More training can be developed for encouraging use of school gardens and salad bars as very useful methods for encouraging increased consumption of both fruits and vegetables. Research can be focused on evaluating the other menu components, compliance with the new HUSSC pattern, and preference of the menu components when schools have implemented offer versus serve. Although it was beyond the scope of analysis for my study, correlation coefficients can be performed to verify if the frequency of serving fruits and vegetables differ due to availability, cost and/or storage. Once these are determined, more training could be provided to help schools determine how to address the barriers that are appear to affect the largest number of school.

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APPENDIX

APPENDIX A: QUESTIONNAIRE

Dear Conference Attendee,

I am Sowjanya Chilaka, a graduate student in the Department of Nutrition and Hospitality Management at the University of Mississippi. I am doing a thesis research project entitled, "An evaluation of the opinions of school nutrition professionals on the new meal pattern being implemented by the National School Lunch Program (NSLP) with a focus on the fruit and vegetable components." I would appreciate you sharing your opinion by completing the attached questionnaire which should require only a few minutes of your time.

This questionnaire has been reviewed and approved by the National Food Service Management Institute (NFSMI) staff and faculty in the Department of Nutrition and Hospitality Management at the University of Mississippi. The completion of the survey is voluntary. No personally identifying data of the individuals or schools represented will be included in the results. The responses will be kept confidential. Findings will contribute valuable information for child nutrition program directors. If you have any further questions, please contact me by email at schilaka@go.olemiss.edu.

This study has also been reviewed by The University of Mississippi's Institutional Review Board (IRB). The IRB has determined that this study fulfills the human research subject protections obligations required by state and federal law and University policies. If you have any questions, concerns, or reports regarding your rights as a participant of research, please contact the IRB at (662) 915-7482.

Thank you for your time and participation.

Sincerely,

Sowjanya Chilaka
Principal Investigator, Graduate Student
Department of Nutrition and Hospitality Management
University of Mississippi

Please answer each of the following questions sincerely and to the best of your knowledge. All of the answers will be kept confidential. Thank you for your responses.

An evaluation of the opinions of school nutrition professionals on the new meal pattern being implemented by the National School Lunch Program (NSLP) with a focus on the fruit and vegetable components.

State: (_____)	**What is your major role:** *(Choose X only one)*				**Which of the following best describes your place of employment:** *(Choose X only one)*					
Total district enrollment: (_____)	☐	District director	☐	Foodservice assistant	☐	Elementary school	☐	Middle school	☐	High school
	☐	Registered dietitian	☐	Site-level manager	☐	School district	☐	State agency		
	☐	Other_____(Please describe)			☐	Other_____ (Please describe)				

New Meal Pattern *(Please circle, 1=Yes or 2=No)*	**Yes**	**No**
1.Has your school or school district participated in the HealthierUS School Challenge (HUSSC) program?	**1**	**2**
2.Has your school or school district previously received Gold award of distinction?	**1**	**2**
3.Now that the new meal pattern guidelines are being implemented, is your school or school district considering applying for a HUSSC award?	**1**	**2**
4.Has your school nutrition program applied to the state agency to receive the additional 6 cents per lunch reimbursement?	**1**	**2**
5.Do you consider the 6 cents per lunch reimbursement motivating in achieving the goals of the new meal pattern?	**1**	**2**

6. Please read the following statements and rate your level of agreement to be challenges in the menu planning for lunch with the new meal pattern by using the scale 5(Strongly agree) to 1(Strongly disagree).	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
Meeting the minimum and maximum requirements for calories is challenging.	**5**	**4**	**3**	**2**	**1**
Meeting the minimum and maximum requirements for meat/meat alternates is challenging.	**5**	**4**	**3**	**2**	**1**
Meeting the minimum and maximum requirements for grains is challenging.	**5**	**4**	**3**	**2**	**1**
Meeting the requirements for the fruit component is challenging.	**5**	**4**	**3**	**2**	**1**
Meeting the requirements for the vegetable subgroups is challenging.	**5**	**4**	**3**	**2**	**1**
Adding color contrasts to food on the lunch plate is challenging.	**5**	**4**	**3**	**2**	**1**

Fruit Component *(Please circle, 1=Yes or 2=No)*		**Yes**	**No**	**Vegetable Component** *(Please circle, 1=Yes or 2=No)*		**Yes**	**No**
7. Do you use any of the following resources to create the recipes for fruit components?	USDA recipes	**1**	**2**	8. Do you use any of the following resources to create the recipes for vegetable components?	USDA recipes	**1**	**2**
	Internet resources	**1**	**2**		Internet resources	**1**	**2**
	Cookbooks	**1**	**2**		Cookbooks	**1**	**2**
	Self-created	**1**	**2**		Self-created	**1**	**2**
9. Does your food service operation implement any of the following practices to encourage fruit consumption?	Nutrition education	**1**	**2**	10. Does your food service operation implement any of the following practices to encourage vegetable consumption?	Nutrition education	**1**	**2**
	Gardening in schools	**1**	**2**		Gardening in schools	**1**	**2**
	Salad bars	**1**	**2**		Salad bars	**1**	**2**
11. Did you use tomato sauce on pizza to fulfill the vegetable requirement on previous menus?						**1**	**2**
12. Do you use tomato sauce on pizza to fulfill the vegetable requirement now?						**1**	**2**
13. a) Does your school or school district utilize Offer Versus Serve?						**1**	**2**
b) Based on your observations with the requirement for students to take a fruit or vegetable for Offer Versus Serve, which component is chosen more often? *(Please check only one)* ☐ Fruit ☐ Vegetable ☐ Both fruit and vegetable equally ☐ Don't know ☐ Not applicable							

Please refer to the vegetable subgroup list attached.		14. Please rate how frequently you incorporate the following items into your lunch menus by using the scale 4 (Often) to 1 (Never).				15. Please rate how frequently you observe *plate waste* for the following items being: 5(Often) to 1(Do not serve).				
		Often	Occasionally	Rarely	Never	Often	Occasionally	Rarely	Never	Do not serve
Dark green vegetables	Fresh	4	3	2	1	5	4	3	2	1
	Frozen	4	3	2	1	5	4	3	2	1
	Canned	4	3	2	1	5	4	3	2	1
Red/orange vegetables	Fresh	4	3	2	1	5	4	3	2	1
	Frozen	4	3	2	1	5	4	3	2	1
	Canned	4	3	2	1	5	4	3	2	1
Beans and peas	Fresh	4	3	2	1	5	4	3	2	1
	Frozen	4	3	2	1	5	4	3	2	1
	Canned	4	3	2	1	5	4	3	2	1
Starchy vegetables	Fresh	4	3	2	1	5	4	3	2	1
	Frozen	4	3	2	1	5	4	3	2	1
	Canned	4	3	2	1	5	4	3	2	1
Other vegetables	Fresh	4	3	2	1	5	4	3	2	1
	Frozen	4	3	2	1	5	4	3	2	1
	Canned	4	3	2	1	5	4	3	2	1
Fruits	Fresh	4	3	2	1	5	4	3	2	1
	Frozen	4	3	2	1	5	4	3	2	1
	Canned	4	3	2	1	5	4	3	2	1
	Dried	4	3	2	1	5	4	3	2	1
	Juices	4	3	2	1	5	4	3	2	1

16. Please rate the following items based on: **Availability** (3-very adequate, 2-limited, 1-not available), **Cost** (3-very expensive, 2-reasonable, 1- low cost), **Storage** (3-very adequate, 2-limited, 1- not available).

Please refer to the vegetable subgroup list attached.		**Availability**			**Cost**			**Storage**		
		Very adequate	Limited	Not available	Very expensive	Reasonable	Low cost	Very adequate	Limited	Not available
Dark green vegetables	Fresh	3	2	1	3	2	1	3	2	1
	Frozen	3	2	1	3	2	1	3	2	1
	Canned	3	2	1	3	2	1	3	2	1
Red/orange vegetables	Fresh	3	2	1	3	2	1	3	2	1
	Frozen	3	2	1	3	2	1	3	2	1
	Canned	3	2	1	3	2	1	3	2	1
Beans and peas	Fresh	3	2	1	3	2	1	3	2	1
	Frozen	3	2	1	3	2	1	3	2	1
	Canned	3	2	1	3	2	1	3	2	1
Starchy vegetables	Fresh	3	2	1	3	2	1	3	2	1
	Frozen	3	2	1	3	2	1	3	2	1
	Canned	3	2	1	3	2	1	3	2	1
Other vegetables	Fresh	3	2	1	3	2	1	3	2	1
	Frozen	3	2	1	3	2	1	3	2	1
	Canned	3	2	1	3	2	1	3	2	1
Fruits	Fresh	3	2	1	3	2	1	3	2	1
	Frozen	3	2	1	3	2	1	3	2	1
	Canned	3	2	1	3	2	1	3	2	1
	Dried	3	2	1	3	2	1	3	2	1
	Juices	3	2	1	3	2	1	3	2	1

Additional comments: _____

Vegetable Subgroup List

Dark Green Vegetables	**Starchy Vegetables**
Bok choy Broccoli Collard Greens Dark Green Leafy Lettuce Kale Mesclun Mustard Greens Romaine Lettuce Spinach Turnip Greens Watercress	Cassava Corn Fresh Cowpeas, Field Peas, or Black-eyed Peas (not dry) Green Bananas Green Peas Green Lima Beans Parsnips Plantains Taro Water Chestnuts White Potatoes
Red/Orange Vegetables	**Other Vegetables**
Acorn Squash Butternut Squash Carrots Hubbard Squash Pumpkin Red Peppers Sweet Potatoes Tomatoes Tomato juice	Artichokes Asparagus Avocado Bean Sprouts Beets Brussels Sprouts Cabbage Cauliflower Celery Cucumbers Eggplant Green Beans Green Peppers Iceberg (head) Lettuce Mushrooms Okra Onions
Beans and Peas	
Black Beans Black-eyed Peas(mature, dry) Garbanzo beans, Chickpeas Kidney Beans Lentils Navy Beans Pinto Beans Soy Beans Split Beans White Beans	

APPENDIX B: IRB APPROVAL LETTER

REQUEST LETTER

Diane Lindley
Office of Research and Sponsored Programs
University of Mississippi
P.O. Box 1848
University, MS 38677

Re: IRB application for An evaluation of the opinions of school nutrition professionals on the new meal pattern being implemented by the National School Lunch Program (NSLP) with a focus on the fruit and vegetable components.

Dear Ms.Lindley,

I am Sowjanya Chilaka, a graduate student in the Department of Nutrition and Hospitality Management. Also, I have a graduate assistantship with the National Food Service Management Institute (NFSMI). As a result, I am doing a thesis entitled, "An evaluation of the opinions of school nutrition professionals on the new meal pattern being implemented by the National School Lunch Program (NSLP) with a focus on the fruit and vegetable components."

I would like to request that the IRB application for this project undergo expedited review. I am further requesting that the project be exempted from informed consent, as there will be no personal identification of individuals or schools gathered or reported in our findings. This study will focus on evaluating the challenges for implementing the fruit and vegetable components. The survey was developed with assistance from committee members, Dr.Teresa Carithers, Dr.Katie Wilson, and Dr.Yunhee Chang.

If approved, the NFSMI staff has agreed to distribute the questionnaire at the state annual conferences in New York, Mississippi, and the major city school district conference at NFSMI, beginning Oct 19, 2012. The completion of the survey will be totally voluntary, and thus will not require informed consent. No personally indentifying data will be collected on the individuals or schools represented by the survey responses. Also, data will be used to identify specific challenges experienced by schools in implementing various components of the new pattern. Findings will contribute valuable information for child nutrition program directors and determine if differences exist between northern, southern, or major city schools. If you have any further questions, please contact me by email at schilaka@go.olemiss.edu.

Sincerely,

Sowjanya Chilaka
Principal Investigator, Graduate Student
Department of Nutrition and Hospitality Management

cc: Dr.Teresa Carithers

IRB APPROVAL

Ms. Chilaka:

I added the IRB approval information to your cover letter. With that change, we can approve the protocol.

Diane W. Lindley
Research Compliance Specialist, Division of Research Integrity and Compliance
Office of Research and Sponsored Programs
The University of Mississippi
100 Barr Hall, P.O. Box 907
University, MS 38677
Tel.: (662) 915-7482 Fax: (662)915-7577
dlindley@olemiss.edu

Dear Conference Attendee,

I am Sowjanya Chilaka, a graduate student in the Department of Nutrition and Hospitality Management at the University of Mississippi. I am doing a thesis research project entitled, "An evaluation of the opinions of school nutrition professionals on the new meal pattern being implemented by the National School Lunch Program (NSLP) with a focus on the fruit and vegetable components." I would appreciate you sharing your opinion by completing the attached questionnaire which should require only a few minutes of your time.

This questionnaire has been reviewed and approved by the National Food Service Management Institute (NFSMI) staff and faculty in the Department of Nutrition and Hospitality Management at the University of Mississippi. The completion of the survey is voluntary. No personally identifying data of the individuals or schools represented will be included in the results. The responses will be kept confidential. Findings will contribute valuable information for child nutrition program directors. If you have any further questions, please contact me by email at schilaka@go.olemiss.edu.

This study has also been reviewed by The University of Mississippi's Institutional Review Board (IRB). The IRB has determined that this study fulfills the human research subject protections obligations required by state and federal law and University policies. If you have any questions, concerns, or reports regarding your rights as a participant of research, please contact the IRB at (662) 915-7482.

Thank you for your time and participation.

Sincerely,

Sowjanya Chilaka
Principal Investigator, Graduate Student
Department of Nutrition and Hospitality Management
University of Mississippi

VITA

Sowjanya C Chilaka
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FORMAL EDUCATION

Master of Science, Food and Nutrition Services
The University of Mississippi, MS, USA, 08/2010 – 08/2013
(GPA 3.38/4.00)

Bachelor of Science, Pharmaceutical Sciences
Acharya Nagarjuna University, India, 09/2005-05/2009
(GPA 3.00/4.00)

PROFESSIONAL EXPERIENCE

Graduate Assistant: National Food Service Management Institute (NFSMI), The University of Mississippi, 08/2010 – 05/2013

- Assisted with the development of web-based courses for child nutrition professionals in schools and child care centers
- Provided assistance in organizing face-to-face training sessions and analyzing feedback from the training participants
- Proof reading, editing the materials and other clerical duties

***Teaching Assistant*:** Allied health sciences, Department of Chemistry, University of Texas at San Antonio, 01/2010 – 05/2010

- Taught Allied Health Sciences laboratory to undergraduate students, graded and proctored exams

RESEARCH EXPERIENCE

Graduate thesis: An evaluation of the opinions of school nutrition professionals on the new meal pattern being implemented through the National School Lunch Program with a focus on fruit and vegetable components.

AWARDS

- Graduate Assistantship, The University of Mississippi, 08/2010-05/2013

CERTIFICATION

- *ServSafe Food Protection Manager Certification* (01/2012-01/2017), National Restaurant Association

LABORATORY TECHNIQUES

- Ability to perform nutrition assessments and screenings, anthropometric measurements, red and white blood cells count, blood pressure test, microscopic studies and determine body composition using Bod Pod

TECHNICAL SKILLS

- SPSS statistical software, Microsoft Office (Word, Excel, PowerPoint, Access, Picture Manager, Outlook, Project Manager), Adobe Flash

PROFESSIONAL MEMBERSHIPS

- Academy of Nutrition and Dietetics
- Mississippi Academy of Nutrition and Dietetics

PROFESSIONAL EDUCATION

- New Meal Pattern, NFSMI, Oxford, MS
- HealthierUS School Challenge, NFSMI, Oxford, MS
- Healthy Cuisines for Kids, NFSMI, Oxford, MS
- Financial Management, NFSMI, Oxford, MS
- Nutrition 101, NFSMI, Oxford, MS
- Norovirus, NFSMI, Oxford, MS
- Behavior Change Workshop, Mississippi Dietetic Association (MDA) Conference, 2013
- The Power of Plant based Nutrition, MDA Conference, 2013
- Let's Talk about Sweeteners: Separating the Science From the Nonsense, MDA Conference, 2013
- Healthy eating: Dietary Fats & Heart Health, MDA Conference, 2013
- Celiac Disease and Gluten-Related Disorders: Clearing Up the Clutter in a Gluten-Filled World, MDA Conference, 2013
- The New Look of School Meals, MDA Conference, 2013

LEADERSHIP AND VOLUNTARY EXPERIENCE

- Graduate senator in the Graduate Student Council representing the Department of Nutrition and Hospitality Management
- Student liaison for the Academy of Nutrition and Dietetics
- Represented National Food Service Management Institute at the Mississippi School Nutrition Association Conference-2013, Tupelo, MS
- Participated in the fundraising event for Oxford food pantry
- Volunteered for Oxford Film Festival, Oxford, MS