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# Exploring Strategies to Increase Fruit and Vegetable Consumption Among Students in a School Cafeteria

Abigail Furtner

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## ABSTRACT

### Exploring Strategies to Increase Fruit and Vegetable Consumption Among Students in a School Cafeteria

By

Abigail Rose Furtner

April 25, 2017

Childhood obesity has become a major public health concern and currently affects 17% of 2-19 year olds in the United States (Ogden, Carroll, Fryar, & Flegal, 2015). Children who are overweight or obese have higher odds of becoming overweight or obese as adults, thus putting these individuals at a higher risk for several health problems including heart disease, type two diabetes, hypertension, stroke, cancer, and asthma (Gordon-Larsen & Adair, 2010). A major component of preventing obesity is a healthy diet. Recently, data analyzed from NHANES found that children were not getting enough fruits and vegetables in their diet (Kim et al., 2014). The National School Lunch Program was designed to keep students healthy by providing balanced meals while the students are in school. This review of the literature examines evidence based strategies schools and communities have put in place to increase consumption of fruits and vegetables. The findings were that by increasing availability of fruits and vegetables and increasing awareness and promotion schools can increase student's consumption of fruits and vegetables.

Exploring Strategies to Increase Fruit and Vegetable Consumption  
Among Students in a School Cafeteria

by

Abigail Rose Furtner

B.S., GEORGIA STATE UNIVERSITY

A Capstone Submitted to the Graduate Faculty  
of Georgia State University in Partial Fulfillment  
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## Author's Statement Page

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Abigail Furtner

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## Introduction

Childhood obesity is a major problem in the United States. It is defined as a “body mass index (BMI) at or above the 95<sup>th</sup> percentile of the sex-specific CDC BMI-for-age growth charts” (Ogden, Carroll, Fryar, & Flegal, 2015). Childhood obesity currently affects 17% of 2-19 year olds in the United States. That equates to 12.7 million children in the United States who are affected (Ogden, Carroll, Fryar, & Flegal, 2015).

This serious problem follows many children into adulthood. Children who are overweight or obese have higher odds of becoming overweight or obese adults than their counterparts (Gordon-Larsen, The, & Adair, 2010). This puts children at a higher risk for several health problems including heart disease, type two diabetes, hypertension, stroke, cancer, and asthma (Gordon-Larsen, The, & Adair, 2010).

Although childhood obesity affects children across all demographics there are some disparities across racial and ethnic groups, age, sex, household income and education level (Ogden, Carroll, Fryar, & Flegal, 2015). Between 2011 and 2014 data from the National Health and Nutrition Examination Surveys (NHANES) states that childhood obesity rates were highest in Hispanic children with a rate of 21.9%. Non-Hispanic black children had a childhood obesity rate of 19.5% and non-Hispanic white children had a rate of 14.7%. Non-Hispanic Asian American children had the lowest rates or childhood obesity with 8.6% (Ogden, Carroll, Fryar, & Flegal, 2015). As children get older the rates also rise. Between 2011 and 2014 the overall rates for children ages 2 to 5 was 8.9%. Children ages 6 to 11 had an obesity rate of 17.5% and children ages 12 to 19 had an obesity rate of 20.5% (Ogden, Carroll, Fryar, & Flegal, 2015). Children who come

from low-income families are also at a higher risk for overweight and obesity than those from higher income households (Lees, 2014).

Preventing obesity from a young age is vital. The current trends in obesity prevalence in the United States are growing in both youths and adults. Data shows obesity rates rising between the 1999-2000 NHANES survey through the 2013-2014 NHANES survey (Ogden, Carroll, Fryar, & Flegal, 2015). However, between the 2011-2012 survey year and the 2013-2014 survey year no significant increase was seen.

Fruits and vegetables are a vital part of a balanced diet. A healthy diet needs to contain a variety of foods and provide a healthy energy balance. Obesity is caused by taking in more energy than an individual is exporting. Fruits and vegetables are lower in calories per cup than many other food groups and therefore eating a diet that is full of fruits and vegetables can decrease energy intake (USDA, 2016).

Fruits and vegetables also provide many nutrients and health benefits. Fruits and vegetables are low in fat and calories and provide fiber, which aids in feeling full, therefore decreasing energy intake (USDA, 2016). In addition to the feeling of fullness, dietary fiber helps to reduce cholesterol, lowers the risk of heart disease, and is needed for proper bowel function. Fruits and vegetables are also rich in potassium, which helps support healthy blood pressure, and folic acid, which is needed for the production of red blood cells. Fruits and vegetables also provide Vitamin C, which helps with tissue repair and is important for oral health. A diet that contains a variety of fruits and vegetables can also cut down on the risk of heart disease, some cancers, Type II diabetes, and obesity (USDA, 2016).



Recently, the Center for Disease Control analyzed 24 hour recalls from NHANES to understand how many fruits and vegetables children were eating. They found that although fruit intake had risen between 2003 and 2010 children were still not getting the recommended amount of fruits and vegetables. The authors measured the participants CEPC (cup-equivalent per 1,000 calories). The Healthy People 2020 target is .9 CEPC for vegetables and .8 CEPC for fruits (Kim et al., 2014). The average intake among children for fruit was .62 CEPC and the mean intake for vegetables is .53 CEPC. These numbers are noticeably far below the goals for Healthy People 2020.

This study found that as children grew disparities began to form between the age groups and sexes. Younger children, ages 2 to 5, had significantly higher fruit consumption than their older counterparts. The 2 to 5 group consumed an average of .97 CEPC while the 6 to 11 group consumed an average of .61 CEPC and the 12 to 18 group consumed an average of .46 CEPC. However, children ages 12 through 18 consumed significantly more vegetables than the younger children. Children in the 12 to 18 group consumed an average of .6 CEPC in vegetables while children in the 6 to 11 group and the 2 to 5 group consumed an average of .48 CEPC. It was also found that females consumed more vegetables than males with an average of .58 CEPC while males only had an average of .48 CEPC (Kim et al., 2014).

It has been shown that children's food preferences can be influenced by exposure to different varieties of foods, social experiences, and availability to the child, which is why school settings can play an important role in children's overall diet (Kim et al., 2014). Every year around 60 million children are exposed to meals in the school setting

so it is necessary that schools foster an environment that encourages children to choose a healthy diet.

Several programs and organizations, including the National School Lunch Program, have tried to find ways to stop this growing problem of obesity. The National School Lunch Program began in the early 1900s to prevent children from going hungry during school hours. In 1937 fifteen different states passed some type of legislation to allow school boards to operate school lunch programs (USDA). In 1933 and 1934 the Civil Works Administration and the Federal Emergency Relief Administration provided federal aid to 39 states to employ 7,442 women in various school lunch programs.

During the Great Depression farmers began to see a decline in earnings (USDA). Public Law 320 passed in 1936 to remove surplus foods from the market and use them without interfering with normal sales of product. By 1939 the Federal Surplus Commodities Corporation and the Federal Surplus Relief Corporation were distributing pork, dairy products, and wheat to 14,075 schools serving over 892,000 students.

Currently, children whose families are at or below 130 percent of the poverty line are eligible for free lunches while children whose families are between the 130 to 185 percent of the poverty line can receive reduced-price meals (National School Lunch Program, 2016). In 2012 the program provided free and reduced price lunches to over 31 million students (National School Lunch Program, 2016). Schools that choose to participate in the National School Lunch Program receive cash subsidies as well as USDA foods provided by the U.S. Department of Agriculture for every lunch they serve (National School Lunch Program, 2016).

In 2012 the National School Lunch Program went through some changes. The Healthy, Hunger-Free Kids Act of 2010 required schools to incorporate more fruits and vegetables, whole grains, and low and fat-free milk into meals. The act also established a limit for sodium, calories, and unhealthy fat (School Nutrition Association).

*Purpose of Capstone*

The National School Lunch Program is intended to keep students healthy by providing balanced meals while the students are in school. The purpose for this capstone is to review the National School Lunch Program and students' current consumption of fruit and vegetables, examine evidence based strategies schools and communities have put in place to increase consumption of fruits and vegetables, and determine what programs and strategies are most effective.

## **Approach Section**

This capstone sought to review evidence to inform the reader of how the National School Lunch Program can increase consumption of fruits and vegetables among elementary school children. The literature covered the current standards for the National School Lunch Program as well as programs being implemented across the country. These programs included changes in cafeteria fruit and vegetable offerings and ways in which these items were displayed in the cafeteria to Farm to School Programs and the impact salad bars have on children's lunch choices.

The search was conducted June 2016 through September 2016. Twenty-one studies were selected and were limited to studies that used children under 18 as the sample group, English studies, and studies that took place in a childcare setting or a school environment.

The databases used in this review were Galileo, EBSCO, PubMed, and Google Scholar. Additional resources were used including CDC statistics, National School Lunch Program websites and statistics, and articles from The Academy of Nutrition and Dietetics. Key words used for this capstone were "national school lunch program", "school gardens", "farm to school programs", "fruit and vegetable consumption", "children", "elementary schools", "cafeteria set up and display", and "school lunch policies".

## Literature Review

The CDC analyzed data from the National Health and Nutrition Examination Survey (NHANES) for children 2 to 18 years old. Data from the 2003-2004 survey was compared to data from the 2009-2010 surveys to measure changes. Total fruit intake and whole fruit intake increased while intake of fruit juice decreased. However, vegetable intake did not change (Kim et al, 2014). The only group of children who are reaching Healthy People 2020 goals for fruit consumption are 2 to 5 year olds while no group of children is reaching the Healthy People 2020 goals for vegetable consumption.

When looking to change health behavior it is important to understand the determinants of that behavior and focus on prevention. This literature review looks at fruit and vegetable consumption as a health behavior, explores what influences children to consume fruits and vegetables, and examines different ways to improve fruit and vegetable consumption among elementary school children. An average student consumes about 35% of his or her daily calories while at school. This percentage rises to about 47% if the student consumes breakfast at school (Gosliner,2014). However, we know that children are simply not getting enough fruits and vegetables in their diet. According to the CDC between 2007 and 2010, 60% of children did not consume their daily recommended fruit servings and 90% did not consume the daily recommended vegetable servings (CDC, 2014). In fact, the California Children's Healthy Eating and Exercise Practices Survey recently found that the average daily servings of vegetables for children nine to eleven years old residing in California was only 2.7 (Slusser, Cumberland, Browdy, Lange, & Neumann, 2007). Of the vegetables children consumed, over 30% were white potatoes, which are typically served fried (CDC, 2014).

Not only are fruits and vegetables important to create a well balanced diet but they are also rich in vitamins and nutrients that can benefit the student's health. The World Health Organization estimates that 19% of gastrointestinal cancer, 31% of heart disease, and 11% of strokes can be at least partially due to low fruit and vegetable intake (Slusser, Cumberland, Browdy, Lange, & Neumann, 2007). A healthy diet also plays a major role in preventing obesity. Considering 17% of children in the United States are considered obese, there needs to be an emphasis on fruit and vegetable consumption as part of obesity prevention (Ogden, Carroll, Fryar, & Flegal, 2015).

In 2005 the Institute of Medicine (IOM) came out with a report outlining prevention of childhood obesity. This report recommends childhood obesity be prevented using an ecological systems theory model as a framework for necessary changes. This theory lays out all of the layers of factors that will influence an individual's energy balance. These layers are family and home, school and peers, community, industry and government, and culture and society (Institute of Medicine, 2005). It is noted that the main factors that affect youths are the home, school, and community environment.

In 2012 a new IOM report came out that recommended a behavioral economic model for obesity prevention. Unlike the socio-ecological model used in the 2005 report that focused on "layers" individually, this model focuses on individuals' decision-making behavior and tries to explain why people engage in the health behaviors that they do. This theory assumes that consequences of any behavior are the primary motivation for that behavior. In other words, as the cost of any commodity goes up, this could be alcohol, drugs, or unhealthy foods, consumption of that commodity then decreases.

In behavioral economics small modifications can be used to help shape an individual's choices. These small modifications are referred to as 'nudges'. A nudge encourages a specific choice without changing the choice set as a whole. Studies have shown that a modification as small as moving a salad bar item into the middle row from a front row position or switching the serving utensil from a spoon to tongs can decrease the amount of that item chosen (Rozin et. al, 2011). In cases where a nudge is used the effort it takes to engage in that health behavior is considered the cost and as the amount of effort needed goes up people are less likely to engage in that behavior.

Interventions that use this framework focus on individuals rather than whole groups. This framework has two types of interventions. The Community Reinforcement Approach is macrocosmic and Contingency Management is microcosmic. The Community Reinforcement Approach reduces the value of one behavior while increasing the value of other behaviors. This approach focuses on changing the environment to encourage positive health behaviors and discourage negative health behaviors. Contingency Management increases the perceived value of positive behaviors with positive reinforcement. This approach focuses on the individual and rewards as opposed to altering the environment (DiClemente, Salazar, & Crosby, 2013).

An example of this model being used to plan an obesity prevention program is Shape Up Somerville. This program was a community based obesity prevention program implemented in Somerville, Massachusetts aimed at elementary school children (Institute of Medicine, 2012). The program changed the school environment to encourage physical activity and limit the availability of energy dense foods while

focusing on healthier options. The program then reached out to the community to reinforce these ideas by giving children additional opportunities for physical activity and healthy eating outside of school.

### **Healthy Hunger-Free Kids Act**

On July 1, 2012 the Healthy, Hunger-Free Kids Act took effect (School Nutrition Association). This act required the U.S. Department of Agriculture to update the federal nutrition standards for school lunches for the first time in fifteen years. The act requires more fruits and vegetables as well as whole grains to be served along while limiting sodium and unhealthy fats. It also requires calorie minimums and maximums, low-fat and fat free milk, and free water to be offered.

The new regulations require students to be offered fruits and vegetables with every meal. Specifically, the vegetables offered during lunch must include a weekly offering of legumes, dark green vegetables, and red or orange vegetables (School Nutrition Association). At least one cup of fruits and vegetables must also be offered at breakfast.

Several studies have examined different ways schools can increase fruit and vegetable intake during school lunch. These studies have examined several different factors from the ways in which fruits and vegetables are displayed, the number of choices and serving sizes, farm-to- school programs, and salad bars.

This capstone is guided by the health behavior theory. Much like the socio-ecological model this theory looks at the environment as a whole but focuses on prevention, mainly primary prevention. Primary prevention is to prevent a problem, for example obesity, before it ever occurs. This can be done by changing behaviors of



individuals that would lead to obesity, i.e. eating a healthy balanced diet and getting in enough physical activity (DiClemente, Salazar, & Crosby, 2013).

### **Cafeteria Set up and Display**

Several studies have shown the way a school cafeteria is set up and what is on display can influence students' food choices and increase students' willingness to choose and consume more fruits and vegetables (Cullen, Chen, Dave, & Jensen, 2015, Wansink, Just, Payne, & Klinger, 2012, Reicks, Redden, Mann, Mykerezzi, & Vickers, 2012, Cluss, Fee, Culyba, Bhat & Owen, 2014, Cotyigna, Manning, & Didomenico, 2012). This change can include attractive photographs of fruits and vegetables displayed on the walls, in the trays and in classrooms, creative names of foods, more fruits and vegetables offered, appealing displays of fruits and vegetables in the food line, and encouragement by staff.

One school increased student's vegetable consumption by adding photographs of vegetables into different compartments of elementary school lunch trays (Reicks, Redden, Mann, Mykerezzi, & Vickers, 2012). The intervention tested two photographs (carrots and green beans) and saw an increase of both vegetables being chosen and an increase of vegetables being consumed. The students were allowed to serve themselves preportioned servings of whatever vegetables they choose. Before the intervention only 6.3% of students choose green beans and 11.6% choose carrots. Once the photos were added to the trays those percentages rose to 14.8% of students selecting green beans and 36.8% of students selecting carrots. Both changes were statistically significant with  $P < .001$ . The amount of green beans actually consumed by children who selected them did not change on the intervention day but the mean amount of carrots consumed by children

who selected them was 3.9 grams higher on the intervention day, a statistically significant increase, with  $P < .001$ . This intervention is relatively cost effective as it only cost \$3 per 100 trays included.

A second study was able to decrease purchases of high calorie snacks while increasing purchases of fruits and vegetables in several different elementary schools (Cluss, Fee, Culyba, Bhat, & Owen, 2014). The schools were able to achieve this by offering a minimum of three types of fresh fruit and two entrée salads daily among a plethora of other changes. The schools also labeled the foods “Go”, “Slow”, and “Woah” to let the students know if each food item was considered a healthy choice and determine portion size. After implementing the changes the school district saw a 12% increase in fresh fruit purchases and discovered that students would choose fresh fruit over canned fruit. This study also found that when less healthy foods were eliminated children continued to purchase school lunches regardless, so the changes did not negatively impact lunch participation rates.

A third study also found that by changing the cafeteria set up and display students choose more fruits and vegetables with their lunch (Cullen, Chen, Dave, & Jensen, 2015). In this study the intervention schools, both elementary and intermediate, offered a variety of fruits and vegetables daily in the lunch line. A fresh fruit option, a raw vegetable option, canned fruit, and a cooked vegetable were all offered daily. The students were allowed to select one fruit and two vegetables per meal. In addition, the intervention schools provided teachers with information and pictures to display in their classrooms. Additionally, colored photographs were displayed at the entrance of the cafeteria line showing the lunch being served that day with two vegetables and one fruit on the tray. A

sign was placed at the beginning of the line instructing students how many servings of fruits and vegetables they were to select. At the conclusion of the study a statistically significant ( $P < .001$ ) amount more students were selecting vegetables and fresh fruit than at the beginning of the study. The mean serving of fruit for the intervention group was .29 cups while the control group was .26 cups. The mean serving of vegetables for the intervention elementary group was .32 cups while the control group was .22 cups. The intervention elementary students not only selected more fruits and vegetables but consumed more as well. The mean amount of fruit consumed was .2 cups for the intervention group and .18 for the control group. The mean amount of vegetables consumed was .14 cups for the intervention group and only .1 cups for the control group. The students in the intervention group also consumed less total energy than the students in the control group.

As the students got older the differences grew. 45% of intermediate students in the intervention group selected fruit compared to just 21% of the control group. This is a statistically significant difference with a p-value of  $P < 0.001$ . The intervention students selected a mean of .25 cups of fruit while the control group only selected .12 cups of fruit. The mean serving of vegetables for the control group was .23 cups while the control group had a mean of .14. The intermediate student intervention group also consumed more fruits and vegetables than the control group. Overall, although the proportion of fruits and vegetables not consumed during the study was the same in both groups, and therefore the proportion of fruits and vegetables wasted did not change between the two groups.

Changing the display of fruits and vegetables in line is shown to be one effective way to increase student's selection and consumption of fruits and vegetables. However, some studies show by simply changing the name of the fruits and vegetables that are already offered can have an impact on student's consumption (Wansink, Just, Payne, & Klinger, 2012). In two related studies students renamed common vegetables "x-ray vision carrots", "power punch broccoli", and "silly dilly green beans". The first attempt at getting students to select and consume more vegetables was to name carrots "x-ray vision carrots". The results of this intervention showed that the simple name change did not have an impact on how many students selected the food but did have a statistically significant,  $p < 0.05$ , change on the amount of carrots consumed. Children consumed 65.9% of carrots selected when they had an attractive name and only 32% of carrots taken when they were not given an attractive name.

The authors went on to perform a longitudinal study giving all three separate vegetables an attractive name. The study found that once the attractive names were introduced students choosing at least one vegetable in the lunch line increased by 99%. Students selecting broccoli and green beans showed a statistically significant increase, with broccoli selection increasing by 109.4% ( $p < 0.001$ ) and selection of green beans increasing by 176.9% ( $p < 0.001$ ). The selection of carrots increased by 30.2% but was not statistically significant. This intervention was extremely cost effective because the creative names were given by a high school volunteer and not tested by focus groups before the intervention.

**School wide programs** One school district found that changing several environmental factors of a school, including making changes to the cafeteria, led to a

statistically significant increase in student's fruit intake (Perry et al, 2004). This randomized control trial included 26 elementary schools in Minnesota and aimed to test how increasing opportunities to eat more fruits and vegetables, providing role models who emphasized the importance of fruit and vegetable intake, and increasing social support would affect the students' overall consumption. The program was named Cafeteria Power Plus and involved daily activities within the school as well as special events. The daily activities included increasing the availability and appeal of fruits and vegetables offered to the students on the school lunch line as well as snack cart and having the cafeteria workers encourage the students to choose the fruits and vegetables. The special events occurred throughout the school year and included a two-week "kickoff" of the program, monthly sampling of fruits and vegetables that were later included in the school lunches, a school play featuring healthy eating, and a midyear "challenge week".

At the end of the intervention students showed a statistically significant increase in fruit and vegetable consumption, with a p value of  $p=0.03$ . The group had increased servings of fruits and vegetables between .14 and .17 during school lunch. Verbal encouragement by the cafeteria workers and the number of fruits and vegetables offered in the lunch line were shown to be the biggest differences between the control and intervention schools. These two things were shown to be significantly associated with student's consumption of fruits and vegetables, however, verbal encouragement showed a stronger association with increasing consumption of fruits and vegetables. This is an extremely cost effective way to increase consumption because it is free to implement and requires little to no training for staff.

## **Farm to School**

Farm to school programs (FTS) form a connection between schools and local farms with locally grown crops and usually include different activities such as nutrition education and exposure to a variety of fresh fruits and vegetables (Taylor and Johnson, 2013). The National Farm to School Network describes the programs as “a program that connects schools (K-12) and local farms with the objectives of serving healthy meals in school cafeterias, improving student nutrition, providing agriculture, health and nutrition education opportunities, and supporting local and regional farmers” (National Farm to School Network, 2012).

The programs began in the 1990s in order to improve options at school lunches as well as support local farmers (Taylor & Johnson, 2013). Recently, the Healthy, Hunger-Free Kids Act of 2010 increased national support by providing \$40 million to go towards FTS programming over the span of eight years. During the 2009-2010 school years 33.1% of public schools and 25.4% of private schools participated in a FTS or school garden program. As of 2012 over 2500 school districts began participating in some type of FTS program (Taylor & Johnson, 2013).

Several studies examined the effects farm to school programs or a school garden have on increasing student’s consumption of fruits and vegetables (Joshi, Azuma, & Feenstra, 2008, Nicholson, Turner, Schneider, Chriqui, & Chaloupka, 2014, Parish 2011, Taylor & Johnson, 2013, Vo & Holcomb, 2011, Yoder, Foecke, & Schoeller, 2015). However, farm to school programs offer far more benefits than simply providing schools with fresh produce. Typically, farm to school programs offer activities in addition to providing schools with fresh fruits and vegetables. These activities can include taste tests,

the addition of a school garden, field trips, food preparation lessons, and salad bars (Taylor & Johnson, 2013). Students who work with fruits and vegetables through farm to school programs tend to get multiple exposures to the same produce. This leads to an increased preference to that food (Taylor & Johnson, 2013). These programs also lead to an increased variety of fruits and vegetables being served, which has shown increases in consumption levels among students.

One study in particular sought to examine if schools located in states with farm to school laws increased availability to the students (Nicholson, Turner, Schneider, Chriqui, & Chaloupka, 2014). The study examined public elementary schools from across the country and found that fruit and vegetable availability was an average of more than 20% higher in schools located in states with farm to school laws, 13% of this can be linked to FTS programs. This result is statistically significant with a p value of  $p < 0.01$ . It was also discovered states that have laws in place either requiring or encouraging farm to school programs have a significantly higher rate of FTS participation among schools.

Farm to school programs not only give students better access to fresh produce, they also have the ability to change students knowledge and attitudes about new fruits and vegetables. One elementary school in California participates in a “Harvest of the Month” program that is an element of their FTS program. The students learn about new fruit or vegetable every month and get to taste the new item. The students will then see this food available on their salad bar during lunch (Joshi, Azuma, & Feenstra, 2008). Programs similar to this help raise exposure of fruits and vegetables to children as well as increasing availability.

**Salad bars.** One of the main benefits of farm to school programs is the majority of programs offer salad bars or improve existing salad bars, so often FTS are associated with salad bars. However, many schools are adding salad bars to their lunch options without participation in a FTS program. The addition of salad bars are seen to increase participation in school lunches and, because they tend to be self-serve, decrease plate waste. In particular, one study found that 7 out of every 8 schools that participated in a farm to school program provided the students with a salad bar, Additionally, schools that participated in farm to school programs saw between a 3% and 16% increase in school lunch participation (Nicholson, Turner, Schneider, Chriqui, & Chaloupka, 2014).

In 2010 First Lady Michelle Obama's Let's Move initiative has a public-private partnership with an organization called Let's Move Salad Bars to Schools. This partnership focused on increasing student's fruit and vegetable intake during school lunches by introducing salad bars. In 2014 the program provided 3,481 salad bars to schools (Adams, Cruening, & Ohri-Vachaspati, 2015). Additionally, in 2013 the USDA Food and Nutrition Service sent a memo to state and regional directors of Child Nutrition Programs that stated "Schools with salad bars offer a wider variety of vegetables and fruits than other schools. Salad bars have the potential to improve nutrition and encourage the consumption of fruits, vegetables, and legumes. In addition to nutritional benefits, salad bars may lower plate waste in school feeding programs" (Adams, Cruening, & Ohri-Vachaspati, 2015).

One of the reasons salad bars are effective at increasing students' consumption of fruits and vegetables is that they offer variety. Students consume more fruits and vegetables when there are more to choose from, either via salad bar or in the traditional



hot lunch line. One study sought to determine if adding a salad bar to elementary student's lunch options would reduce plate waste and therefore increase fruit and vegetable consumption. The study found that variety of the salad bars and hot lunch side options led to greater consumption rather than the salad bar alone. Students who's cafeteria had a salad bar in it took a mean of 112 grams of fruits and vegetables while students who did not have a salad bar option took a mean of 104 g of fruits and vegetables, however that variance is not statistically significant. It was also found that the two groups consumed about the same amount of fruits and vegetables (Adams, Pelletier, Zive, & Sallis, 2005).

The same study did find that by increasing variety, consumption of fruits and vegetables also increased. One salad bar only offered 4 items while a second salad bar offered 7. The students who ate from the first salad bar took a mean of 117 g of fruits and vegetables but only consumed a mean of 36 g. The students who ate from the second salad bar took a mean of 107 g fruits and vegetables but consumed a mean of 61 g (Adams, Pelletier, Zive, & Sallis, 2005). This study shows that salad bars by themselves may not raise the amount of fruits and vegetables consumed but the variety they bring to the cafeteria could cause an increase in consumption of fruits and vegetables.

Typically, in school lunchrooms the salad bar line that provides the most variety. One group of researchers looked at 1,232 public schools across the country and found that the average high school salad bar offered an average of 6.3 different types of vegetables daily, excluding lettuce and tomato, with an average of 3.9 servings of raw vegetables. It was found that salad bars offered a better range of orange and dark green vegetables as well (Schmidt & McKinney, 2004). An average of 1.7 types of fruit were

also offered daily at salad bars and it was found that schools with salad bars offered a greater variety of fruits than those without. One thing to be noted is that elementary school salad bars offered far less variety, with only an average of 4.8 types of vegetables daily, with an average of 3.1 raw vegetables (Schmidt & McKinney, 2004).

In contrast, some studies found that regardless of the hot lunch produce options students who selected the salad bar for lunch consumed significantly more fruits and vegetables than students who chose hot lunches. One study found that students who selected the salad bar over the traditional hot lunch option took 58% to 100% more servings of fruits and vegetables than the students who chose the traditional hot lunch (Taylor & Johnson, 2013).

An additional study found that after a salad bar had been added to a school lunch cafeteria the mean daily serving of fruits and vegetables grew from 2.97 to 4.09. This is a statistically significant difference with a p value of  $p < 0.001$  (Slusser, Cumberland, Browdy, Lange, & Neumann, 2007). The intervention included adding a salad bar into three school cafeterias, hosting an assembly teaching students how to serve themselves from a salad bar and how to select the proper number of fruits and vegetables, advertising the new salad bars using students' artwork in the cafeteria, and field trips to farmer's markets or farms for exposure to different types of fruits and vegetables. A 24-hour recall was used to compare base line to results after the intervention. The study found that not only did the mean servings of fruits and vegetables show a statistically significant increase, but that 84% of that increase was due to an increase in consumption of fruits and vegetables during school lunch. The study also found that after the intervention the

amount of students who choose the traditional hot meal was almost equal to the number of students who chose to eat from the salad bar.

Salad bars not only increase fruit and vegetable consumption but have also been shown to decrease plate waste. In particular, one farm to school program found that students who chose the salad bar had a 26% plate waste while students who ate a hot lunch had a 51% plate waste (Taylor & Johnson, 2013). A different school participating in a farm to school program found that students who chose the salad bar had a 26% plate waste while students who ate a hot lunch had a 51% plate waste (Taylor & Johnson, 2013). This decrease in plate waste helps the school with the cafeteria budget, which in turn could benefit the student's food options.

**School Gardens** School gardens can be included as part of a farm to school program or as a separate program. They are used to help provide fresh produce for the school cafeteria along with adding nutrition education. School gardens are a great way to expose students to new fruits and vegetables, encourage taste tests, and give students hands on learning opportunities they may not be able to get else where. One study stated, “Interventions that encourage hands-on experience and include home-grown produce have shown to increase consumption beyond that of an intervention that merely increases fruit and vegetable availability” (Namenek-Brouwer & Benjamin-Neelon, 2013).

Often school gardening is considered a fun experience and students get excited about related activities. One study found that children who enjoy gardening have a higher preference for a variety of vegetables and consume more than children who either do not enjoy gardening or have not been exposed to gardening (Evans, Ranjit, Fair, Jennings, & Warren, 2016). This study surveyed third graders from twenty-eight low-income

elementary schools in Texas and looked at how their gardening experience and enjoyment, and preference, exposure, and consumption of vegetables related to each other. The results showed that children who had higher levels of gardening experience consumed vegetables an average of 3.5 times on their 24 hour recall while children with no gardening experience only consumed vegetables an average of 1.7 times on their 24 hour recall. The same group also had a greater exposure and preference to vegetables in comparison to children with no gardening experience. Both results are statistically significant with a p value of  $p < 0.001$ . Children who enjoyed gardening also showed a greater preference and had higher exposure to vegetables than children, and consumed more vegetables than children who did not enjoy gardening. Results also stated that children who had gardening experience but did not enjoy gardening still consumed more fruits and vegetables than children who had no gardening experience.

A separate study looked at the affects of adding a school garden program into three elementary schools in Delaware. Students in the intervention group participated in a school garden program that involved classroom lessons as well as learning to plant, tend, and harvest vegetables in the school garden. Some of the produce from the school garden was then used in salads offered in the cafeteria during lunch. A sign was hung up on days the produce was used to inform the students. The students' lunch choices were observed three times over the course of the intervention. There was a statistically significant increase among the intervention students choosing a salad during school lunch on the third observation when compared to the first observation in two of the schools with  $p < 0.05$ . The percentages of students who choose a salad a lunch during the first observation were 22.1%, 17.4%, and 22.2%. The percentage of students who chose a

salad on the third observation rose to 25%, 28.4% and 61.3% (Cotugna, Manning, & Didomenico, 2012). One thing this study did not evaluate was plate waste.

An additional study looked at the relationship between food literacy and healthy food choices and school gardens. The study used a program known as Slow Food Denver's Seed-To-Table School food program and it aimed to not only improve student's diets but also provide the surrounding community with access to fresh fruits and vegetables (Nowak, Gigia, Schneyer, & Roberts, 2012). The program allows students to participate year round in activities ranging from gardening, harvesting, cooking, and "taste education". This program contained an additional program aimed at helping educate children through working in school gardens to produce fresh fruits and vegetables for the school salad bar. Students would participate in a gardening program weekly with a "Garden Leader". The program also helped students develop a Youth Farmer's Market that taught them how to promote a small business while providing opportunities for local residents to purchase fresh fruits and vegetables. However, although this program offers some great resources the researchers did not have the means to collect any data on the effects of the program.

One pilot study named Watch Me Grow tested the effect a garden based-intervention would have on the number of fruits and vegetables children in child care centers consumed. The program helped child care centers build raised garden beds and grow lettuce, strawberries, spinach, and broccoli. The program also included focus on a crop of the month and relevant curriculum focused around each crop. During the lessons the children were encouraged by the child care provider to taste the produce while the child care provider said positive things about each crop. After the completion of the

program children in the intervention group consumed a larger proportion of the vegetables they were served than the children in the control group and increased their total vegetable intake for the day by an average of  $\frac{1}{4}$  cup (Namenek-Brouwer & Benjamin-Neelon, 2013).

An additional study tested how various components of a garden-based intervention in a school increased vegetable consumption. The intervention, Sprouting Healthy Kids, launched in four separate middle schools and consisted of in-class lessons, an after school gardening program, a farm-to-school program, farmer's visits to the school, taste testing, and field trips to local farms. The main outcome the program aimed at changing was increasing fruit and vegetable intake. However, the program also aimed at increasing student's self-efficacy towards eating fruits and vegetables as that has been shown to have a positive impact on the amount of fruits and vegetables actually consumed. The students completed a questionnaire at baseline and after the one-semester intervention was completed. Out of the six components of the program, 59% of students participated in at least two of the components. Students who were exposed to at least one of the components scored statically significantly higher, with a p value of  $p=0.02$ , on the knowledge portion of the post-intervention survey when compared to the control group. Students who were exposed to two components or more of the intervention scored statistically significantly higher, with a p value of  $p<0.05$ , on fruit and vegetable intake, self-efficacy, and knowledge measures than students who were in the intervention group but exposed to less than two components of the program (Evans et al. 2012).

When each component was looked at to determine the component's individual effects of fruit and vegetable intake none of the changes were significant. However, fruit

and vegetable intake increased by a mean of .352 servings for every component that a student was exposed to. This shows that garden-based interventions may work better when students are exposed to multiple components (Evans et al. 2012).

A cluster randomized controlled trial tested if a teacher could lead a school garden intervention to increase students' knowledge and attitudes towards fruits and vegetables or if a gardening specialist would be a better fit for garden based programs. This study measures knowledge of fruits and vegetables and predicated what would directly correlate with student's consumption, as well as actual fruit and vegetable consumption. The students involved in the intervention filled out a pre and post questionnaire testing their knowledge and attitudes of fruits and vegetables and a 24-hour food diary. After being adjusted for different factors, including socioeconomic status, there were not statistically significant differences between the outcomes of the two groups. However, students in the teacher led groups were more willing to try new fruits and eat more fruit overall (Hutchinson, Christian, Louise-Evans, Nukjaer, Hancock, & Cade, 2015). This indicates that additional staff are not needed.

## **Summary and Recommendations**

A review of literature shows that students will consume more fruits and vegetables when they are given a wider variety to choose from, on both the hot lunch line as well as salad bars, and when schools make an effort to promote the benefits of consuming more fruits and vegetables. However, the literature is mixed on whether some of the interventions used to increase consumption leads to more plate waste. This paper identifies three recommendations. These are to increase availability, increase awareness and promotion, and decrease plate waste.

### **Increase availability**

Many studies found that when given more options children consumed more fruits and vegetables. Schools can do this through increasing variety in the main lunch line and providing a salad bar to the students.

Increasing the variety of fruits and vegetables can be costly so schools will need to find ways to overcome the cost. Many grants are available to help increase the health of students (USDA, 2016). The Healthy Hunger Free Kids Act also has a program that encourages schools to participate in farm to school programs and create salad bars, both of which increases variety of produce and subsequently increases students' consumption.

It was also shown that when school lunches increased variety and added salad bars to the menu school lunch participation increased. By increasing the amount of students participating in school lunches schools increase their budget with reimbursable lunches as well as ala carte.

One school garden program overcame budget concerns by having the students create a small farmers market (Nowak, Gigia, Schneyer, & Roberts, 2012). This not only



gave the students a chance to learn how to run a small business but also raised additional funds that could be put towards increasing variety of fruits and vegetables in the lunch line.

### **Increase awareness and promotion**

Many of the studies found that by promoting the selection and consumption of fruits and vegetables students consumed more (Cullen, Chen, Dave & Jensen, 2015, Perry et al, 2004, Reicks, Redden, Mann, Myerezi, & Vickers, 2012). Many programs have had success with displaying visuals in both the school cafeteria as well as classrooms. It is recommended to display visuals that include the correct number of servings of fruits and vegetables along with the correct portions sizes. Attractive posters or photographs should be placed somewhere where students can see them.

Exposing student's to new fruits and vegetables multiple times is key to getting them to try the new food. Many schools have found that by offering the same new food item multiple times along with encouraging students to try the new food children will eventually try the new item (Evans et al., 2012).

Farm to school programs and school gardens also help increase exposure of fruits and vegetables. Students who have participated in these programs grow familiar with the new foods. These programs typically also include activities like taste tests and produce of the month that encourages students to try the new items.

### **Decrease plate waste**

Whether changes implemented to improve fruit and vegetable intake increases plate waste is unclear. This may be due to different interventions having different outcomes regarding plate waste. However, many of the measurements used in studies are

inconsistent. The first recommendation to decrease plate waste is to come up with a consistent system to measure consumption and plate waste. Some studies measure if a student selects an item but not if that item is consumed while others measure the proportion eaten from a serving given. Many studies stated that if a child eats half of the serving of a vegetable portion served to him or her regardless of the portion size served schools can increase intake by increasing serving size without increasing plate waste (Cullen, Chen, Dave, & Jensen, 2015, Wansink, Just, Payne, & Klinger, 2012). However, even though the proportion of food wasted is the same the volume of food waste is higher. When researchers test an intervention aimed at increasing consumption it is important to look at the actual amount consumed rather than amount taken because students could very well be throwing away some of the food.

One school has created a program to decrease waste by allowing students to put food they may not want to eat but are required to take into a cooler inside the cafeteria and letting other students take that food for free. For example, if a student is required to take a fruit he may choose an apple and then put it aside into a cooler after he purchases his lunch. A second student may take the apple that would have been otherwise thrown away and eat later on in the day or as an afterschool snack.

Some studies have also suggested that when students are allowed to select from a larger variety of fruits and vegetables they are more likely to consume a greater proportion of what they selected (Cullen, Chen, Dave, & Jensen, 2015). It is recommended that schools offer a variety of fruits and vegetables daily to decrease plate waste.

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## Discussion

The literature has shown that there are a variety of ways to increase student's consumption of fruits and vegetables. By using information gathered from the literature and applying a behavioral economics approach school cafeterias can help increase student's consumption of fruits and vegetables and improve their health behaviors going forward. Schools can do this by increasing variety of fruits and vegetables offered, offering activities to familiarize students with fruits and vegetables, and increasing accessibility.

School cafeterias can use the recommendations of this capstone, increase availability, increase awareness and promotion, and decrease plate waste while using 'nudges' from the behavioral economics approach to further help guide students into consuming more fruits and vegetables. Nudges can include small changes such as putting fruits and vegetables in areas of the lunch line that are easier to access while making it slightly more difficult for students to access foods that may not be the best choice. One example of a nudge would be to put the vegetables on a salad bar at the front row so students have easier access to them while placing other items, like cheese, croutons, and nuts in the middle row. A second example would be to place vegetables uncovered on the line so students can easily access them while covering less healthy items with a lid, which would require more effort to get to. With a combination of more options and more accessibility it will be far easier for students to select fruits and vegetables while going through the lunch line.

Policy changes have been made to help increase student's consumption of fruits and vegetables and school districts have been working with local governments and farms

to help increase consumption as well. However, there is a lot of work that still needs to be done.

According to data from NHANES 2009-2010 children today are still not getting enough fruits and vegetables. However, the Healthy Hunger Free Kids Act of 2010 has helped some students. According to the USDA more than 90% of schools have been meeting the new standards and that school lunch revenue has increased by about 200 million dollars (USDA). In fact, the USDA stated that children are eating 16% more vegetables and 23% more fruit during school. However, given that the act is relatively new there is limited data on the effects it is having on student's overall diet or fruit and vegetable consumption.

The USDA required all school districts to establish a local school wellness policy for the school year 2006-2007. These policies showcase the school's efforts for promoting student's health and wellbeing. Each policy has to include a section about nutrition promotion and education and nutrition guidelines for all food sold on the school campus, including school meals and snacks as well as food advertisements that are displayed in the schools. The local educational agency that came up with the policy is also required to release annual progress reports and assessments every three years. These policies are currently being revised and school districts must have them updated by June 30, 2017 (USDA, 2017). This is a perfect opportunity for school districts to incorporate fruit and vegetable goals for students as well as strategies to help reach these goals. For example, one school district may make a goal to incorporate a salad bar two days a week to increase vegetable variety while a second school district that has already incorporated salad bars would benefit from making a goal to increase variety on the salad bars.

Some schools are facing challenges with funding. Many schools do not have the resources needed for all of the changes. These resources include storage space for fresh produce, the proper equipment to prepare fruits and vegetables in a healthy way, or the manpower to clean and prepare all of the additional fruits and vegetables being offered. The UDSA and The Healthy Hunger Free Kids Act of 2010 offers a variety of grants and funding that can help (USDA). In addition to this schools that have begun offering more fruits and vegetables (through a salad bar or in the hot lunch line) have seen an increase in lunch sales (USDA).

Given this information, schools should continue to conduct studies on student's fruit and vegetable consumption to learn more about the effects the Healthy, Hunger Free Kids Act is having on the students. Schools need to continue to find ways to help increase consumption of fruits and vegetables without increasing plate waste. Many schools have turned to the students to help make decisions about the foods that will be the most popular and what foods end up being thrown away. Once there is more data to analyze schools can continue to make changes needed to improve students fruit and vegetable intake.

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## **Limitations**

There were a few limitations in the research used for this capstone.

The first limitation was that the measurements used in the studies were not consistent. Some studies looked at student's consumption while other studies simply measured if students were taking the foods but did not measure if they were being eaten (Cluss, Fee, Culyba, Bhat, & Owen, 2014, Cullen, Chen, Dave, & Jensen, 2015). Some interventions mandated that students took a certain number of servings of fruits and vegetables or increased serving sizes (Cullen, Chen, Dave, & Jensen, 2015). However, this does not mean that those foods were consumed.

A second limitation was that the majority of the studies used schools or school districts near each other that had the same demographics (Cullen, Chen, Dave, & Jensen, 2015, Perry et al, 2004). This means that the findings of one study may not be transferable to other regions. For example, an intervention that may work in the Northwest may not work in the South due to demographics and cultural differences.

Finally, one study used a 24-hour recall to measure fruit and vegetable consumption (Evans, Ranjit, Fair, Jennings, & Warren, 2016). 24-hour recalls may not always be accurate because children may give answers that they feel are desirable when recalling their diet.

## **Conclusion**

Childhood obesity continues to be a major concern in the United States. This stems from poor diet and lack of physical activity. Children can consume up to almost half of their daily calories at school. The school setting can play a major role in shaping the diets of children and school programs can help to increase fruit and vegetable consumption in children. Which, in turn can have a lasting positive effect throughout their lives.

Based on the literature available, schools can increase fruit and vegetable consumption among children by using the health behavior theory to guide changes to the environment that encourage higher consumption of fruits and vegetables. This includes increasing variety offered to the children through the hot lunch program and on salad bars, displaying attractive photographs of a variety of fruits and vegetables in the schools for the students to see, encouraging students to choose fruits and vegetables in line, and having hands on Farm to School or school garden based activities. These can include taste tests, field trips to local farms, or class gardening projects where children get to learn how their food grows.

The Healthy Hunger Free Kids Act of 2010 is relatively new and promotes some of the findings in the literature. More studies need to be completed in order to gain knowledge on the effect the Act has on students' diets and what can be done to continue to improve the fruit and vegetable consumption of students today.

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