

# When Fruits and Vegetables Are Optional, Elementary School Children Choose Processed over Whole Offerings

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*Please note that this study was published before the SY2014-15 implementation of the Smart Snacks Nutrition Standards for Competitive Food in Schools, as required by the Healthy, Hunger-Free Kids Acts of 2010. As such, certain research relating to food in schools may not be relevant today.*

## ABSTRACT

### Purpose/Objectives

Increasing children's fruit and vegetable (FV) consumption is an important goal for the National School Lunch Program (NSLP). In 2012 the NSLP began requiring students to select a FV. The objective of this study was to compare children's FV choices in two school cafeteria environments a year before these new USDA regulations took effect.

### Methods

Elementary school (grades 3-5) children's FV choices were measured during Spring 2011 at two northeast schools (NES-A and NES-B) using three validated dietary assessment methods. NES-A had a self-serve salad bar, whereas NES-B served pre-portioned FV and pizza daily.

### Results

Of 555 trays assessed (n=284 NES-A, n=271 NES-B), 15.3% (n=85) had no FV selected. A higher percentage of trays from NES-A had no FV (23.6%, n=67) in comparison to NES-B (6.6%, n=18) ( $p<0.0001$ ). On average children selected more processed FV (PFV) (80.8g) than whole FV (WFV) (40.5g,  $p<0.001$ ). The mean amount of FV selected was lower in NES-A (111.4g) than NES-B (131.5g,  $p<0.01$ ). When trays without a FV were removed, quantities selected were not significantly different between schools ( $p=0.46$ ). For PFV, 100% fruit juice was on 41.4% of trays (n=230) and pizza was on 42.1% of NES-B trays (n=114). Trays with pizza or 100% fruit juice were less likely to have a WFV ( $p<0.001$ ,  $p<0.0001$  respectively).

### Applications to Child Nutrition Professionals

Children selected larger amounts of FV in a cafeteria environment that offered pre-portioned FV and pizza daily. Children were more likely to select juice and pizza than WFV. Promoting school children's selection and consumption of whole rather than processed FV may help school nutrition programs comply with NSLP sodium and saturated fat requirements. Identifying healthier PFV recipes and understanding what WFVs students prefer are strategies schools can use to improve FV choices.

**Keywords:** school; children; fruits; vegetables; choices

## INTRODUCTION

The childhood obesity epidemic is unquestionably among the top public health issues facing the U.S. (Centers for Disease Control and Prevention [CDC], 2012b). In recent years however, areas of the country have seen slightly decreased rates of childhood obesity (Robert Wood Johnson Foundation [RWJF], 2012). By implementing comprehensive plans that include the school food environment, selected cities and states have demonstrated that steadfast efforts are integral to reducing this epidemic (RWJF, 2012).

Fruit and vegetable (FV) consumption is a central focus of efforts to support healthy dietary behaviors in children. FVs confer health benefits, including intake of essential nutrients, reduced risk of chronic diseases, and weight maintenance (U.S. Department of Agriculture [USDA] & U.S. Department of Health and Human Services, 2010). Unfortunately, the majority of children do not consume the recommended amounts of FVs (CDC, 2012a). Children's preferences for FVs in the school cafeteria are an important determinant of consumption (Baxter & Thompson, 2002). To improve children's consumption of FVs, interventions should

focus on meals served in schools since children may consume up to half of their calories in this setting (Schanzenbach, 2009).

Participation of more than 30 million children in the National School Lunch Program (NSLP) provides an opportunity to shape healthier food choices (Turner & Chaloupka, 2012). NSLP participants consume higher amounts of fruits or 100% fruit juice as well as vegetables (though predominantly potatoes) compared to non-program participants (Story, Nannery, & Schwartz, 2009). In Fall 2012, the NSLP implemented new regulations. Revisions included calorie maximums and changes to the "Offer Versus Serve" (OVS) rule. In the past, students were permitted to decline any two of the five meal components, including a fruit or vegetable (USDA, 2013). Students are now *required* to select a fruit or vegetable in an effort to increase FV consumption (USDA, 2012b).

During the initial implementation period, the new NSLP regulations were met with some resistance. The USDA/Food and Nutrition Service (USDA/FNS) sought feedback from school nutrition experts, who reported operational challenges related to regulations for meat/meat alternates and grains (USDA, 2012a). The USDA/FNS responded by repealing weekly maximums for grain and proteins while maintaining the calorie limits (USDA, 2012a). There were additional concerns regarding how the guidelines may affect children's FV consumption and plate waste. Therefore, the impact of schools' and students' adjustment to the new regulations on future policy changes remains uncertain. It is important to understand FV choices among school children who voluntarily selected FVs because this provides insight into what students prefer. This information is timely and can help inform what schools offer for FV under the new regulations.

The objective of this study was to evaluate children's FV choices in an "Offer versus Serve" cafeteria environment at two Northeast elementary schools (grades 3-5) using three validated dietary assessment methods.

## METHODOLOGY

### Sample

School nutrition directors from two Northeast school districts were contacted during October 2011 and two elementary schools (NES-A and NES-B) within those districts (grades 3-5) were recruited for the study. The districts and schools were selected based on their varied demographics and cafeteria environments (Table 1). The University of Vermont Institutional Review Board designated the protocol as exempt since cafeteria trays were the unit of analysis and no identifying information on school children was collected. FV choice data were gathered in 2012 between January and May. Any student participating in the school lunch program was eligible to be included in the study. Students who brought lunch from home were not included. A total of 555 trays (n=284 NES-A, n=271 NES-B) were assessed across ten school visits (five visits per school).

### Data Collection

Children's FV choices were measured as part of a feasibility and validation study comparing three dietary assessment methods: direct observation (DO), digital imaging (DI), and weighed plate waste (WPW) (Taylor, 2013; Taylor, Yon, & Johnson, 2013a; Taylor, Yon, & Johnson, 2013b). Feasibility, reliability, and validity of digital imaging were separately assessed as FV choice data were collected. Prior to collecting these data, digital imaging had not yet been validated in the school cafeteria setting. FV choice data were collected by a research team comprised of two graduate and 19 trained undergraduate students. DI and DO were validated in the cafeteria environment against the gold standard WPW method prior to FV choice assessment. DI and DO estimations for group mean fruit, vegetable, and combined FV consumption per tray were within three grams of WPW, and, with the exception of DO estimations for fruit ( $p < 0.05$ ), were not significantly different from WPW (Taylor, 2013; Taylor, Yon, & Johnson, 2013a; Taylor, Yon, & Johnson, 2013b).

Before each school visit, colored stickers with a unique identification code were adhered to lunch trays. Fifty to 80 trays were distributed with a target of collecting 30-40 trays (10-20 trays per lunch period) for data collection purposes (Graves & Shannon, 1983; Templeton, Marlette, & Panemangalore, 2005). More trays were distributed than the target sample size because it was anticipated that, given challenges of collecting trays in a busy school environment, some of these trays would not be successfully collected. FV offerings were identified by checking school menus and consulting with cafeteria staff. Baseline FV weights for pre-portioned items, were determined using an average weight of five randomly selected samples of each food item. For items served in variable portion sizes, weights were determined for typical serving sizes (e.g., one-half cup). For combination or processed foods, recipes were obtained from the foodservice staff and the percentage of FV was calculated by weight.

Children's selections of pre-portioned items were counted, and selections of items with variable portion sizes were weighed to the nearest gram (while using WPW) or visually estimated to the nearest one-quarter cup (while using DO or DI). Research staff stood near exits to the food service area to record food selections or collect images of trays. While using DI, images were taken with Canon PowerShot ELPH 300 HS digital cameras (Canon, Melville, NY) held at approximately 75° and 18-24 inches above the lunch tray, without the assistance of tripods, while children held their trays. Research staff visually estimated selections after they were familiarized with standard volumes of each FV item, which were viewed in real-time (using DO) or digitally within a library of reference images (using DI). Selection estimations using DO or DI were averaged when items were assessed by more than one staff member.

### FV Choices and Amount Selected

Research team members determined FV choices and the weight (g) selected for each food item using baseline FV data. FVs were further categorized based on whether they were a whole FV (WFV) or a processed FV (PFV). PFVs (pizza, tomato-based entrees, soup) were defined in this study as 100% fruit juice and those that were prepared by cooking the FV with additional ingredients. WFV categories including steamed vegetables, alternating salad bar vegetables, etc. were further assigned as appropriate. Trays that had no FV selected were coded as no FV.

### Statistical Analyses

Descriptive statistics were used to characterize FV selection at both schools. FV choices were assessed as the percent of trays with a specific food item present, among those items served during the majority of visits (>3, Fig. 1). Grams of FVs (WFV, PFV, and total FV) were calculated by multiplying the number of units or cups selected of each FV item by its respective weight. To further assess FV choices, two-sample *t*-tests were used to compare grams of WFV and PFV selected between the two schools. The data were analyzed using Stata/SE (Version 12, 2011, College Station, TX) with  $p=0.05$  for significance.

## RESULTS AND DISCUSSION

The cafeteria environments of the two schools varied in several distinctive ways including, 1) the presence of a salad bar (NES-A), 2) FV serving style (NES-A self-serve, NES-B pre-portioned) and, 3) how often pizza was served (NES-A weekly, NES-B daily) (Table 1). Of 555 trays assessed ( $n=284$  NES-A,  $n=271$  NES-B), 15.3% ( $n=85$ ) had no FV selected. A higher percentage of trays from NES-A had no FV (23.6%,  $n=67$ ) in comparison to NES-B (6.6%,  $n=18$ ) ( $p<0.0001$ ). The mean amount of FV selected was lower in NES-A (111.4g) than NES-B (131.5g,  $p<0.01$ , Table 2). When trays without a FV were removed, quantities selected were not significantly different between the two schools ( $p=0.46$ ).

<b>Table 1. Demographic and Cafeteria Environment Characteristics of Two Northeast Elementary Schools</b>		
<b>Demographic Characteristics</b>	<b>NES-A<sup>a</sup></b>	<b>NES-B<sup>b</sup></b>
Grade 3-5 enrollment (n)	160	467
Student eligibility for free or reduced price lunch (%)	35	52
<b>Demographics (%)</b>		
White	84	91
Non-white <sup>c</sup>	16	9
Farm-to-school program	Yes	No
<b>Cafeteria Environment Characteristics</b>		
Entrée stations	<b>Featured entrée, cold sandwiches</b>	<b>Featured entrée, pizza, deli, entrée salad, grill</b>

<b>Table 1. Demographic and Cafeteria Environment Characteristics of Two Northeast Elementary Schools</b>		
Salad bar	Yes	No
FV serving style	Self-served	Pre-portioned
Pizza	Served weekly <sup>d</sup>	Served daily

<sup>a</sup> NES-A = Northeast Elementary School-A

<sup>b</sup> NES-B = Northeast Elementary School-B

<sup>c</sup> Non-white = Hispanic, Asian, Other

<sup>d</sup> Pizza was a once-per-week entrée option but was not served during any data collection days

<b>Table 2. Comparison of Fruit and Vegetable Selections between Two Northeast Elementary Schools</b>				
	<b>NES-A (n=284)<sup>a</sup> M ± SE</b>	<b>NES-B (n=271)<sup>b</sup> M ± SE</b>	<b>t</b>	
Total fruits and vegetables (g)	111.4 ± 5.6	131.5 ± 4.2	2.9*	
Whole fruits and vegetables (g)	36.2 ± 3.4	44.9 ± 3.5	1.8*	
Processed fruits and vegetables (g)	75.2 ± 4.7	86.6 ± 4.1	1.8*	
	<b>NES-A (n=217)<sup>a, c</sup> M ± SE</b>	<b>NES-B (n=253)<sup>b, c</sup> M ± SE</b>	<b>t</b>	
Total fruits and vegetables adjusted (g)	145.8 ± 5.5	140.9 ± 3.9	0.75	
Whole fruits and vegetables adjusted (g)	47.4 ± 4.2	48.1 ± 3.7	0.12	
Processed fruits and vegetables adjusted (g)	98.4 ± 5.2	92.8 ± 4.1	0.85	

<sup>a</sup> NES-A = Northeast Elementary School A

<sup>b</sup> NES-B = Northeast Elementary School B

<sup>c</sup> Excludes trays with no FV selected (67 trays at NES-A and 18 trays at NES-B)

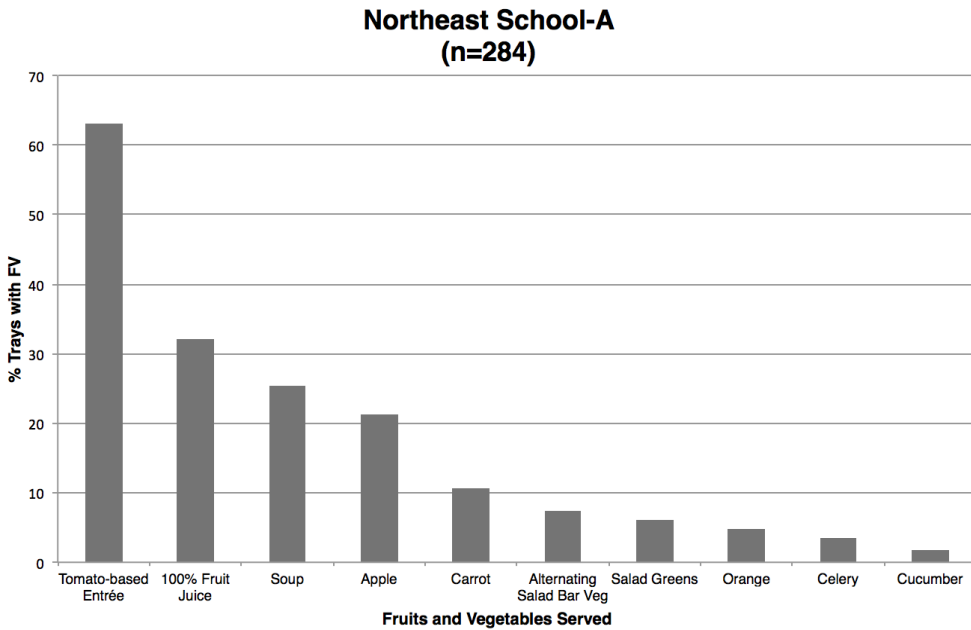
\* $p < 0.05$

\*\* $p < 0.001$

Recently, there have been efforts made to introduce salad bars in schools to promote FV selection and consumption (Harris et al., 2012). Self-serve salad bars do not necessarily improve FV selection when compared to pre-portioned FV serving style (Adams, Pelletier, Zive, & Sallis, 2005). Adams et al. (2005) found no significant difference between mean FV selections in cafeterias that served pre-portioned FV (112±70g) and self-serve salad bars (104±86g). In this study, fewer students at the self-serve salad bar cafeteria selected FVs compared to the students in the pre-portioned FV cafeteria. It is important to consider the role that the cafeteria environment has in children's FV choices.

Children selected more PFV on average (80.8g) than WFV (40.5g,  $p < 0.001$ ). Students at NES-A chose fewer WFV (mean=36.2g) compared to students at NES-B (mean=44.9g,  $p < 0.05$ , Table 2). The highest percentages

of WFV selected at NES-A included: apples (21%), carrots (11%), and alternating salad bar vegetables (7%). The most popular WFV choices in the NES-B cafeteria were steamed vegetables (15%), fruit cups (12%), and vegetables with dip (8%) (Fig.1). The manner in which fruits and vegetables are presented influences children's preferences (Olsen, Ritz, Kramer, & Møller, 2012; Swanson, Branscum, & Nakayima, 2009; Wansink, Just, Hanks, & Smith, 2013). Olsen et al. (2012) found that children preferred cut vegetables and vegetables served with dip. Slicing fruits such as oranges (Swanson et al., 2009) and sometimes apples (Swanson et al., 2009; Wansink et al., 2013) instead of serving them whole can increase students' fruit selection and consumption. In this study the students' preferences for WFVs such as carrots, vegetables with dip, and alternating salad bar vegetables underscores the importance of serving FVs that are prepared in a way that students prefer (Cullen et al., 2003).



**Figure.** Percent of Elementary School Lunch Trays with a Fruit or Vegetable Selected during the Majority of Trip Visits (>3 times) for NES-A<sup>a</sup> and NES-B<sup>b</sup>

<sup>a</sup> NES-A = Northeast Elementary School-A

<sup>b</sup> NES-B = Northeast Elementary School-B

<sup>c</sup> Tomato-based entrees included meat sauce and lasagna (each served two times total)

<sup>d</sup> Alternating Salad Bar Veg included broccoli, mushrooms, black beans, chickpeas, root vegetables, peppers.

<sup>e</sup> Steamed Veg included corn, broccoli, cauliflower, peapods. <sup>f</sup> Other Whole Fruit included grapes, pears, kiwis, bananas.

PFV choices were also lower in NES-A compared to NES-B at 75.2g and 86.6g, respectively ( $p < 0.05$ , Table 2). The highest percentage of FV choices overall were PFV in the form of 100% fruit juice and pizza/tomato-based entrees (Figure). One hundred percent fruit juice was present on 41% of trays ( $n=230$ ). During two of the trips to NES-A, tomato-based entrees (lasagna and meat sauce) were on 63% ( $n=74$ ) of the trays. Across all five of the NES-B visits, pizza was on 42% ( $n=114$ ) of trays. Pizza and tomato-based entrees were significant contributors to children's FV selection. Strategies to reduce childhood obesity should focus on replacing energy-dense foods with fiber-rich, less energy dense foods (Gidding et al., 2006). Tomato paste in pizza and tomato-based entrees can contribute to recommended servings of vegetables (USDA, 2012b). However, these foods are often also sources of excessive saturated fat, sodium and calories, conflicting with the positive benefits that FVs offer in addressing childhood obesity.

PFV selection was associated with other mealtime FV choices. Students who selected pizza ( $n=114$ ) were less likely to also select a WFV (mean=31.1g) compared to students who did not select pizza ( $n=157$ , mean=54.6g,  $p < 0.001$ ). At both schools, mean WFV selection among students who did not select 100% fruit juice ( $n=325$ ) was twice (mean=51.5g) that of students who selected juice ( $n=230$ , mean=24.8g,  $p < 0.0001$ ). Compared to whole fruits, 100% fruit juice is not nutritionally superior nor does it contain fiber (Committee on Nutrition, 2001). Giddings et al. (2006) recommended that children between 7 and 18 years of age limit their 100% fruit juice consumption to 8 to 12 oz. per day. Moreover, consistent consumption of 100% fruit juice in place of whole fruit does not encourage dietary behaviors promoting whole fruits (Committee on Nutrition, 2001). In this study, PFV constituted the majority of children's FV selection. If children are required to select a FV at lunch, it is important to identify ways to help children develop preferences for WFV (USDA, 2012b).

## CONCLUSIONS AND APPLICATION

The objective of this study was to compare children's FV choices in two school cafeteria environments a year before new USDA regulations took effect. As part of the updated meal pattern, students are now required to select a FV at lunch. In a FV-optional meal environment, 15% of children did not select a FV. A significantly higher number of students did not choose a FV in the school that had a salad bar, was self-serve, and served pizza weekly. FV choices were primarily driven by PFV in the form of 100% fruit juice, pizza, and tomato-based entrees. Lunch trays with those items selected were also less likely to have a WFV present.

There were a few limitations that affect the generalizability of this study's findings. First, because this study was conducted at two schools where the majority of the children were Caucasian, the study findings might not be applicable to schools with more ethnically diverse populations. Data collection days were conducted on a consistent day during the week. Therefore, children's FV choices on non-data collection days could be different than the days the research team visited the schools. However, the study findings are strengthened by the number of data collection days (five visits per school).

While children are now required to select a FV during lunch, they may continue to select processed over whole varieties. Identifying alternative PFV recipes (i.e. pizza and lasagna) that deliver nutritional value without excess saturated fat, sodium and calories could be an effective strategy to incorporate FVs into children's diets. The new NSLP regulations offer schools and food service providers an opportunity to reformulate pizza recipes and still address students' preferences. The benefits of school pizza reformulations that meet the USDA's Healthier US School Challenge (HUSSC) criteria on nutrient intake include significantly decreased levels of daily energy, carbohydrate, total fat, saturated fat, cholesterol and sodium in children and adolescents (Hur, Marquart, & Reicks, 2013). Additionally, commercial pizza companies have made a concerted effort to offer pizza for school use with lower sodium cheese and crusts containing higher percentages of whole-wheat flour.

Understanding which WFVs children prefer, as well as how those WFVs are offered (cut versus whole) can prevent waste. While salad bars are thought to promote school children's selection and consumption of WFVs, the overall cafeteria environment may be important to take into consideration. Simple strategies can be incorporated to make healthy foods more convenient and appealing, such as placing fresh fruits next to the cash register or labeling vegetables with descriptive names (Hanks, Just, & Wansink, 2013). Promoting school children's selection and consumption of whole rather than processed fruits and vegetables may help school nutrition programs comply with the NSLP sodium and saturated fat requirements.



Schools can explore programs such as Farm to School and school gardens to complement their meals. Farm to School has gained national recognition for its potential to positively influence children's eating behaviors and offers promising tools to increase children's FV consumption (National Farm to School Network, 2013; Vermont FEED, 2011). School nutrition professionals can apply these findings to their cafeteria operations and consider the variety and presentation of FVs offered to students, as well as recipes used, to support children's selection and consumption of FVs.

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