Impact of the National School Lunch Program on Fruit and Vegetable Selection in Northeastern Elementary Schoolchildren, 2012–2013

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ABSTRACT

Increasing children's fruit and vegetable (FV) consumption is an important goal of the U.S. Department of Agriculture's (USDA's) National School Lunch Program. Since 2012, the USDA's requirement that children select FVs at lunch as part of the reimbursable school meal has been met with concern and evidence of food waste. We compared elementary schoolchildren's FV selection, consumption, and waste before (10 school visits, 498 tray observations) and after (11 school visits, 944 tray observations) implementation of this requirement using validated dietary assessment measures. More children selected FVs in higher amounts when FVs were required compared with when they were optional (0.69 cups vs. 0.89 cups, $p<0.001$); however, consumption decreased slightly (0.51 cups vs. 0.45 cups, $p=0.01$) and waste increased (0.25 cups vs. 0.39 cups, $p<0.001$) when FVs were required compared with when they were optional. More exposure to FVs in schools through programmatic efforts and in the home environment may help familiarize children with FV offerings and encourage consumption.

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The majority of U.S. children do not consume recommended amounts of fruit and vegetables (FVs).[1] Increasing children's consumption of FVs is an important goal of the National School Lunch Program, which feeds nearly 31 million children each school day.[2] As of the 2012 school year, the U.S. Department of Agriculture (USDA) requires schoolchildren to select either a fruit or a vegetable with a reimbursable meal.[3] Implementation of this requirement raised concerns among school nutrition professionals surrounding operational challenges, FV waste, and increased costs.[4] Two years later, school districts and states reported increased waste by students.[5,6] In a recent survey completed by 240 school nutrition directors, more than 80% subjectively reported an increase in the amount of FVs (especially vegetables) wasted by students.[6] However, a limited number of studies exist that used rigorous, validated dietary assessment methods to measure schoolchildren's FV selection, consumption, and waste.[7,8] Such studies are critical to inform and evaluate interventions aimed at increasing children's FV consumption. We aimed to compare schoolchildren's FV selection, consumption, and waste using validated dietary assessment methods when FVs were optional compared with when they were required with school lunch by the USDA.

METHODS

Two northeastern elementary schools were enrolled in the study; both had student bodies that were 84%–90% white. Both schools had 40%–60% of children qualifying for free or reduced meals, a marker for low socioeconomic status. We collected data as part of a larger study to validate the use of digital imaging to accurately measure children's FV consumption.[9] We collected random samples of lunch trays from third-, fourth-, and fifth-grade children with no identifying information gathered from students. We adhered uniquely numbered and colored stickers to all lunch trays and observed one color at each visit. These stickers helped identify trays from third- through fifth-grade students that may have been mixed with ones from students in other grades and to randomly select trays from the target sample for the feasibility of data collection. We objectively measured students' selection, consumption, and waste of FVs using validated methods (i.e., digital imaging, direct observation, and weighed plate waste)[9] when FVs were optional in spring 2012 (10 visits, 498 tray observations) and the following school year in spring 2013 after the USDA implemented the new rule requiring FVs (11 visits, 944 tray observations). We measured FV consumption based on food selections (i.e., serving weights) and plate waste for each FV item per tray. We included all FVs offered on the lunch menu in these estimates (i.e., whole FVs; 100% fruit juice; and FVs in mixed dishes, such as lasagna, pizza, and soup). The feasibility, reliability, and validation of the three dietary assessment methods have been previously published.[9]

For weighed plate waste, we weighed FVs to the nearest gram and converted this measurement to cups. For direct observation and digital imaging, we used a six-point scale to estimate the percentage consumed.[10] We estimated the FV selections by counting the number of servings selected of each FV item served in standardized portions, such as vegetable soup or baby carrots. We also weighed FV items served in variable portion sizes (e.g., salad greens) and converted the weight to cups (using weighed plate waste) or estimated to the nearest one-quarter cup (using direct observation and digital imaging). For weighed plate waste and direct observation, the research associates determined the children's FV selections before they exited the lunch line. With digital imaging, researchers coded the children's FV selections by referencing images of FVs in various portion sizes.

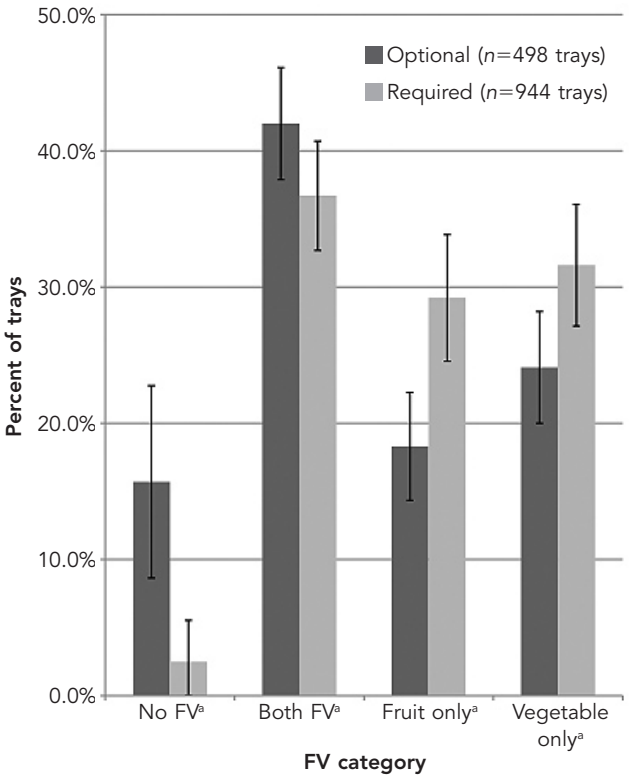
To help with estimating FV selection and percentage consumed for the direct observation method, research associates stood near the cashier stations and observed the amount of FVs selected on targeted trays by counting the number of servings taken of FV items offered in standardized portions and visually estimating selections of salad greens to the nearest one-quarter cup. With digital imaging, research associates compared tray selections and plate waste to reference images of standard serving sizes of each FV item. They also calculated selection, consumption, and waste for all FVs on each student's tray.

We used chi-squared tests to compare children's selection of no FVs, both FVs, fruit only, and vegetable only. We also conducted independent sample t-tests to compare children's total FV selection, consumption, and waste before and after the new USDA rule. All analyses were two-tailed tests performed using SPSS® version 21.0.[11]

RESULTS

When FVs were optional, 15.7% (95% confidence interval [CI] 8.6, 22.8) of lunch trays did not contain FVs, compared with 2.5% (95% CI –0.5, 5.5) when FVs were required ($p<0.001$) (Figure). When students were required to select FVs, the mean amount of FVs on children's trays increased by 0.20 cups ($p<0.001$). When we excluded trays where children did not select

Figure. Percentage of elementary schoolchildren's (grades 3–5) lunch trays with fruit and/or vegetables when optional (spring 2012, *n*=498) vs. when required (spring 2013, *n*=944) at two northeastern elementary schools



[a]The lines that extend from each bar show the 95% confidence intervals.

FV = fruit and vegetable

any FVs (pre- and post-new rule), the mean amount of FVs that children selected increased once required by 0.09 cups (p=0.001) (Table).

Research associates could not determine consumption for 2% and 9% of lunch trays before and after the new rule, respectively, due to missing evidence from inedible food portions or visual obstructions on the trays. While the amount of FVs selected increased when the USDA required schoolchildren to include them on their lunch trays, more children did not consume any of their selections (4% FV optional vs. 12% FV required, p<0.001). On average, children consumed fewer FVs (0.06 cup or about 1 tablespoon, p=0.01) and wasted more FVs (0.14 cup or about 2 tablespoons, p<0.001) when FVs were required compared with when they were optional (Table).

DISCUSSION

Children consumed fewer FVs and wasted more FVs during the school year immediately following implementation of the USDA rule that required them to take one fruit or vegetable at lunch. Average waste increased from one-quarter cup to more than one-third of a cup/tray, with about one-eighth cup/tray more FVs discarded, or a total of about 56 cups/day/school (based on an average of 400 lunches served/day). In the current study, 2.5% of students did not have an FV on their tray under the new requirements. It is possible that a few students may have proceeded through the lunch line without the cafeteria personnel reminding them to go back and select an FV.

Previous studies of elementary schoolchildren's food consumption have corroborated the increased FV waste[12,13] and decreased FV consumption[8] following the new USDA rule. However, there have been some promising findings regarding the impact of the new USDA rule on schoolchildren's FV consumption, including an increased percentage of students who consumed at least one serving of FVs in a sample of three schools (20% FV optional vs. 28% FV required, p<0.01).[13] The new USDA regulations not only require schoolchildren to select an FV, but also require schools to offer a greater variety of vegetables.[3] Cohen and colleagues reported that although the percentage of trays with a vegetable did not increase in third- through eighth-grade elementary schoolchildren after implementation of the new rule, vegetable consumption increased (0.13 cup vs. 0.30 cup, p<0.001).[7] Children entering elementary school under the new USDA rule may respond better to the FV requirement. Under the new requirement, younger children (grades 1–3) were found to consume more FVs when required compared with older children (grades 4–5).[8] Adjustment to the new requirement may take time, especially because older children were accustomed to having the option of whether or not to choose an FV.

Limitations

This study was subject to several limitations. One limitation of this study was that it only assessed differences in mean FV selection, consumption, and plate waste, but not individual consumption. However, our research is consistent with other studies that assessed the impact of the USDA rule on changes in students' school meal consumption behaviors.[7,8,12,13] Researchers may consider conducting future studies to better understand how to impact individual-level responses to changes in FV offerings. Second, although the research team made every effort to unobtrusively collect tray data and not

disturb the cafeteria environment, the presence of the research team may have biased students' FV selection and consumption behavior. Third, we assessed FV consumption behavior in two northeastern elementary schools; therefore, the results may not be generalizeable to schools in different regions of the country. Lastly, other characteristics (e.g., sociodemographic and cafeteria environmental factors) also may affect FV consumption behaviors.

CONCLUSIONS

In the current study, children's increased selection of FVs may have been influenced by having more choices. However, while children were willing to select FVs in larger portions, it may take time and repeated exposure to the new foods for them to become familiar with and develop preferences for the FV offerings.[14] Because more children did not even taste the FVs they chose at lunch when required in the current study, school nutrition professionals need strategies to encourage children to try the unfamiliar FVs they select. It is important to ensure the availability of FV offerings that children may already enjoy.[15] However, because children prefer FVs in the form of 100% fruit juice or mixed dishes, such as pizza or lasagna,[15] one should consider additional factors, such as the types of whole FVs offered and how the cafeteria staff prepares them.[16–19] Cutting up vegetables and serving them with dip[16,17] and slicing fruit, such as oranges[18] and apples,[18,19] can positively influence students' FV selection and consumption by making FVs more accessible and appealing.

Changes to school meal policies may reinforce positive behaviors in children, such as the "Smart Snacks in Schools" policy, which sets limits on the amount of calories, salt, sugars, and fat contained in school snacks

Table. Elementary schoolchildren's (grades 3–5) selection, consumption, and waste of fruit and vegetables at two northeastern elementary schools during school lunch before (spring 2012) and after (spring 2013) implementation of updated National School Lunch Program regulations

Variable	*Spring 2012* N *(percent)*	*Spring 2013* N *(percent)*	*Percentage-point change*	P-*value*
Total trays observed	498 (100)	944 (100)		
Trays with any FVs	419 (84)	919 (97)	13.3	<0.001
FV CBD trays[a]	38 (2)	85 (9)	NA	NA
	Cups[b] *Mean (95% CI)*	*Cups*[b] *Mean (95% CI)*	*Percent change*	P-*value*
All trays				
FV selected[c]	0.69 (0.63, 0.73)	0.89 (0.85, 0.92)	29.0	<0.001
FV consumed[d]	0.51 (0.47, 0.54)	0.45 (0.42, 0.47)	−11.8	0.01
FV wasted[d]	0.25 (0.21, 0.28)	0.39 (0.36. 0.42)	56.0	<0.001
Only trays with any FV selected[e]				
FV selected[f]	0.82 (0.76, 0.86)	0.91 (0.87, 0.94)	11.0	0.001
FV consumed[g]	0.52 (0.48, 0.54)	0.45 (0.42, 0.47)	−13.5	0.004
FV wasted[g]	0.25 (0.22, 0.28)	0.39 (0.36, 0.42)	56.0	<0.001

[a]CBD represents trays for which data could not be determined due to missing evidence from inedible food portions or visual obstructions on the trays.

[b]Because consumption and waste were unable to be determined for 2%–9% of lunch trays, the summed value in cups does not equal the selected amount of FVs.

[c]Includes all observed lunch trays with and without FVs selected (498 trays before and 944 trays after implementation of updated National School Lunch Program [NSLP] regulations)

[d]Includes all observed lunch trays with and without FVs selected (417 trays before and 862 trays after implementation of updated NSLP regulations)

[e]Excludes lunch trays with no FV selections

[f]Includes only lunch trays where children selected FVs (419 trays before and 919 trays after implementation of updated NSLP regulations)

[g]Includes only lunch trays where children selected FVs (410 trays before and 862 trays after implementation of updated NSLP regulations)

FV = fruit and vegetable

CBD = could not be determined

NA = not applicable

and promotes FVs as one of the main ingredients.[20] Beyond the cafeteria, schools can explore programs, such as Farm to School, to complement their meals. Farm to School has gained national recognition for its potential to positively influence correlates of children's FV consumption behaviors, such as attitudes, knowledge, and exposure, through strategies that include gardening, cooking, or taste testing.[21,22] Exposure to Farm to School programming was associated with increased FV consumption among participants who initially had the lowest FV intake.[22]

Public health practitioners should also consider strategies extending to the home because more frequent exposure to FVs at home may result in children consuming a variety of FVs at school.[23] Our research findings, that children selected more FVs but consumed less and wasted more after the new regulations were in place, support the importance of public health practitioners addressing the environmental, home, and personal factors that encourage children's FV consumption. While these data from one geographic area may not be generalizable to other regions, we based the measures of consumption and waste on validated, objective measures.[9] Furthermore, the findings are consistent with those from other parts of the country where requiring a child to select an FV also corresponded with decreased consumption[8] and increased food waste.[12,13] Future research should explore barriers to consuming FVs during school lunch and how offerings could better align with children's taste preferences.

The University of Vermont's Institutional Review Board approved the study and waived written consent; however, the authors notified teachers, staff, school administrators, and parents at the participating schools of the study.

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