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Impact of the USDA Fresh Fruit and Vegetable Program on Children's Consumption

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Please note that this study was published before the implementation of Healthy, Hunger-Free Kids Act of 2010, which went into effect during the 2012-13 school year, and its provision for Smart Snacks Nutrition Standards for Competitive Food in Schools, implemented during the 2014-15 school year. As such, certain research may not be relevant today.

ABSTRACT

Purpose/Objectives
The United States Department of Agriculture initiated its Fresh Fruit and Vegetable Program (FFVP) in 2002. This study investigates the impact of the FFVP on children's fruit and vegetable consumption.
Methods
Participants were fourth- and fifth- graders from two program schools (n = 124) and two control schools (n = 134) in Wisconsin. There were approximately equal numbers of girls and boys. Seventy-six percent were White, 13.5% Asian American, with roughly equal representation of Hispanic/Latino, African American, and American Indian students.

Program schools served students free fruit and vegetable snacks for morning snack at school. A pretest measuring fruit and vegetable intake at morning snack was administered before the FFVP began, followed by two posttests at two and six months of program implementation. Pretest and posttest data were compared across program and control schools using repeated measures analysis of variance. All data were collected by researchers in classrooms with assistance from trained research assistants and teachers.

Results
Program students experienced a significant increase in fruit and vegetable intake for morning snack compared to control students. Positive effects of the FFVP were present early on, with no gains resulting from additional months of participation. The program effect is somewhat limited as students did not bring fruit and vegetables from home to eat on days when free snacks were not provided.
Applications to Child Nutrition Professionals
Participants in this study typically report eating the free fruit and vegetable snacks served at school. This finding reinforces the importance and effectiveness of schools as a setting for providing children access to nutritious foods. Additional research should explore the persistence of and mechanisms behind this positive effect, as well as how to expand the reach of the FFVP beyond the immediate impact of providing free access to fruit and vegetable snacks at school.

INTRODUCTION

Rates of childhood obesity have risen dramatically over the past three decades, from 6.5% to 17% among children aged 6 to 11 and 5% to 17.6% among adolescents aged 12 to 19 (Ogden, Carroll, & Flegal, 2008; Ogden, Flegal, Carroll, & Johnson, 2002). Obese youth are much more likely than non-obese youth to become obese adults and to suffer from chronic diseases across the lifespan (Guo &

Chumlea, 1999; Krebs & Jacobson, 2003). Substituting fruit and vegetables for foods that are higher in fat and added sugars is an important component of a successful obesity prevention strategy (Howerton et al., 2007). Given the relatively low caloric content and high fiber and water content of fruit and vegetables, consumption is associated with increased satiety and reduced overall calorie intake (Rolls, Ello-Martin, & Tohill, 2004). Moreover, experts and advocates recognize the school environment as a fundamental setting for providing children and adolescents access to nutritious food and opportunities to learn about the importance of lifelong healthy eating (Davison & Birch, 2001). In response, the United States Department of Agriculture (USDA) initiated its Fresh Fruit and Vegetable Program (FFVP) in 2002.

FFVP Background

The FFVP began as a pilot through the Farm Security and Rural Investment Act of 2002 and was expanded in 2004 and 2006, eventually expanding nationwide in 2008 through the Conservation and Energy Act of 2008 (U.S. Department of Agriculture [USDA], 2011). Funding is allocated for selected schools to provide students with free fruit and vegetable snacks outside of school lunch. The program is designed to identify and develop best practices for increasing consumption of fruit and vegetables in schools to improve nutrition and combat childhood obesity. Although initially open to all schools, the 2008 expansion of the FFVP limited participation to elementary schools with at least 50% of students qualifying for free/reduced price school meals. Budget guidelines stipulate spending a range of $50 to75 per student per year, including up to 10% for necessary labor and capital expenses. Schools can choose how many days per week and when and where to serve the free snacks, as well as how much, if any, nutrition education to include.

Fruit and Vegetable Program Research

A number of researchers have investigated the effects of different school-based programs promoting fruit and vegetable consumption (Burchett, 2003; Howerton et al., 2007; Knai, Pomerleau, Lock, & McKee, 2006). However, the literature specifically examining the impact of providing increased access to fruit and vegetables as snacks outside of school lunch is limited. In one study conducted in Norway, Bere, VeierØd, Bjelland, and Klepp (2006) found that a no-cost subscription to the Fruits and Vegetables Make the Marks program increased fruit and vegetable intake for sixth- and seventh-grade students. Another study reported finding positive changes in Canadian elementary school-aged childrens' fruit and vegetable consumption at school, as a result of participating in the Northern Fruit and Vegetable Pilot Program (He et al., 2007).

Concerning the USDA FFVP specifically, two studies have examined the implementation processes of purchasing and serving free fruit and vegetable snacks in schools, but these studies contain only anecdotal evidence regarding consumption (Bai, Feldman, Wunderlich, & Aletras, 2011; Potter et al., 2011). Three studies have assessed the impact of the FFVP on student consumption of fruit and vegetables. Coyle et al. (2009) found increased fruit, but not vegetable, intake for 8th and 10th grade students in Mississippi after one year of participation in the FFVP. This study did not include a control group for comparison. In another study, Jamelske, Bica, McCarty, and Meinen (2008) found an increased likelihood of combined fruit and vegetable intake after one year of the FFVP for participating Wisconsin fourth-, seventh-, and ninth-grade students who reported low fruit and vegetable consumption at the pretest compared to a control group. This effect was largest for fourth grade students. A third study, involving Houston high school students, found higher incidences of eating fruit, drinking 100% fruit juice, and eating vegetables among intervention students compared to control students (Davis, Cullen, Watson, Konarik, & Radcliffe, 2009).

These findings suggest it is possible to increase fruit and vegetable consumption for children through school-based fruit and vegetable snack programs. To this point, effects have been relatively small and the persistence and mechanism of change is largely unknown. The nationwide expansion of the FFVP significantly increased funding from $18.9 million (2007-08) to $50 million (2008-09), with additional increases in the following three years (USDA, 2011). Given this sizeable resource commitment, it is important to ascertain how well the FFVP has achieved the stated purpose/goals. In particular, it is vitally important to conduct research examining the effects of the FFVP on U.S. elementary school students' consumption of fruit and vegetable. This is the purpose of the current study.

In this study, we evaluated the impact of the 2008-09 FFVP on fruit and vegetable intake among fourth- and fifth-grade students in two Wisconsin elementary schools at two months and six months of program implementation. We hypothesized program students would experience increased fruit and vegetable intake during the morning snack period compared to control students. This difference would result from program students eating the free snacks served through the FFVP, and bringing and eating fruit/vegetables from home on days when one was not provided for free.

METHODOLOGY

Participants

The Wisconsin Department of Public Instruction (WI DPI) was awarded $900,000 and selected 56 schools with approximately 17,000 students to participate in its 2008-09 FFVP (Wisconsin Department of Public Instruction, 2011). Participants in this study were fourth- and fifth-grade students from two FFVP schools (n = 124) and two matched control schools (n = 134). All four schools were in the same district. Program and control samples were similar with respect to gender and age distributions (see Table 1). The majority of students from both samples self-identified as white; however, the percentage was larger in control schools. With the exception of Hispanic/Latino students, there was greater representation from all ethnic minority groups in program schools. Another difference between program and control schools was the percent of students qualifying for free/reduced price school meals. We do not have individual student data for this variable, but overall rates were 75% for Program School 1, 53% for Program School 2, and 42% for control schools.

Table 1. *Participant Demographic Information by Group at Pretest*

	Group		
	Program School 1 FFVP 4 days/week (n = 51)	Program School 2 FFVP 3 days/week (n = 73)	Control Schools No FFVP (n = 134)
Mean age in years (SD)	9.7 (.64)	9.5 (.53)	9.7 (.71)
Gender (% boys)	51.0	41.1	49.3
Race/ethnicity (%)			
White	70.6	75.3	84.3
Asian American	17.6	16.4	9.0
African American	3.9	2.7	1.5
Latino(a)	2.0	1.4	3.0
American Indian	5.9	4.1	2.0

Materials

To measure fruit and vegetable consumption for school snacks, students answered an open-ended question about what they ate during the morning before lunch. This question measured the incidence of fruit and vegetable intake. Students were not asked portion sizes, nor did we assess the nutrient content of foods consumed. Students also provided responses to demographic questions about gender, race/ethnicity, and age.

All fourth- and fifth-grade teachers at the two program schools completed a monthly report during the study, including estimates of how many students ate the free snacks on a typical day and how

many days teachers ate the snacks themselves. Teachers also indicated if they engaged in any nutrition education and if parents were involved in the FFVP. All materials and procedures used in this study, including obtaining parental consent, were approved by the University of Wisconsin-Eau Claire Institutional Review Board.

Fruit and Vegetable Distribution

The FFVP began in both program schools the second week of October 2008. Program School 1 provided free snacks four days a week, serving a total of 85 snacks (53 fruit and 32 vegetable) during the study. Program School 2 provided free snacks three days a week, serving a total of 64 snacks (41 fruit and 23 vegetable). The snacks served were the same in both schools on some days and different on other days. The snacks were purchased through normal distribution channels. Although whole fruit and vegetables were occasionally used, most items were served pre-cut and in single-serving containers. The snacks were prepared in the school kitchen and distributed to classrooms in the morning. Teachers and students did not break from classroom activities to eat the snack as a group. Instead, students were permitted to take the fruit or vegetable during a window of time before the lunch period as they went about their classroom activities. Although classrooms sometimes shared an organized morning snack period, this was a relatively infrequent occurrence. Students were allowed to bring snacks from home on non-FFVP days, as was the case before the program began. Control students could also bring snacks from home to eat in the classroom throughout the study.

Data Collection

Pretest data were collected in the mornings over three consecutive weekdays at all four schools before the start of the FFVP. On the first day, students provided demographic information and reported what they ate for morning snack the day before. On the second and third days, students just reported what they ate for the previous day's snack. Researchers administered pretest surveys in classrooms assisted by teachers and trained student assistants. A researcher gave instructions to the class while others circulated offering assistance to help students remember what they ate for snack the previous day. Students were allowed to talk to one another during the survey. Researchers administered posttest surveys at two months and six months of program implementation, following the same procedures. Data collection for both posttests in Program School 2 was structured such that students reported consumption for two days when snacks were provided for free through the FFVP, and one day when no free snack was provided through the FFVP. This approach allowed us to investigate whether students from this school brought fruit or vegetables from home on non-FFVP days. Teachers at both program schools completed monthly reports, which were returned using self-addressed, stamped envelopes provided by researchers.

Statistical Analyses

Univariate analysis of variance (ANOVA) was used to examine fruit and vegetable intake between program and control schools at the pretest. Repeated measures ANOVA was used to examine the effect of the FFVP on fruit and vegetable intake between schools and across time (i.e., pretest through posttests). Post hoc analyses were conducted using paired samples t-tests. All analyses were completed using SPSS 18.0.

RESULTS AND DISCUSSION

Average fruit and vegetable intake at morning snack was calculated for each school (Program School 1, Program School 2, control) and for all three testing periods (pretest, posttest 1, posttest 2). Specifically, average intake was the mean for each individual student across the three survey days, averaged again across all students within a school. For example, to calculate fruit intake on the pretest, each student was assigned a score of 1 if they reported eating a fruit during morning snack on particular day and a 0 if they did not. This series of 1s and 0s was then averaged across the three days to obtain the mean for each individual student. The group mean for program and control students was then calculated as the average across all students in each respective group. The same procedure was followed for vegetable intake on the pretest as well as fruit and vegetable intake on both posttests.

A univariate ANOVA was conducted to investigate average fruit and vegetable intake during morning snack at the pretest. There were no significant differences between Program School 1 (M = .05, SD = .22), Program School 2 (M = .04, SD = .15), and control schools (M = .03, SD = .12) for fruit consumption, F(2, 255) = 0.62, p = .540, ?2 = .01 (see Table 2). There also was no difference between Program School 1 (M = .00, SD = .00), Program School 2 (M = .01, SD = .08), and control schools (M = .00, SD = .00) for vegetable consumption, F(2, 255) = 1.27, p = .283, ?2 = .01.

Table 2. *Fruit and Vegetable Intake at the Pretest*

	Group					
Variable	Program School 1		Program School 2		Control	
	M	SD	M	SD	M	SD
Fruit Intake	.05	.22	.04	.15	.03	.12
Vegetable Intake	.00	.00	.01	.08	.00	.00

Fruit Intake

To examine the effect of the FFVP on students' average fruit and vegetable intake, two separate 3 (school: Program School 1, Program School 2, control) x 3 (time: pretest, posttest 1, posttest 2) repeated measures ANOVAs were conducted, with school as a between-subjects factor and time as a repeated factor. There was a significant main effect for time and a significant interaction between school and time for fruit intake (see Table 3). Post hoc analyses indicated that for Program School 1, average fruit intake during morning snack at posttest 2 (M = .57, SD = .17) was higher than posttest 1 (M = .46, SD = .27), t(50) = 2.42, *p* = .019, and intake at posttest 1 was higher than the pretest (M = .05, SD = .22), t(50) = 9.49, *p* < .001 (see Table 4). For Program School 2, fruit intake at posttest 2 (M = .35, SD = .24) was not significantly different than posttest 1 (M = .37, SD = .24), t(72) = .60, *p* = .550; however, intake at posttest 1 was higher than the pretest (M = .04, SD = .15), t(72) = 10.46, *p* < .001. For control schools, fruit intake at posttest 2 (M = .07, SD = .20) was not significantly different from posttest 1 (M = .05, SD = .17), t(133) = .74, *p* = .462, and there was no difference between posttest 1 and the pretest (M = .03, SD = .12), t(133) = 1.58, *p* = .116. Combining results across both program schools and both posttests, the average incidence of fruit intake at morning snack increased by .39 from the pretest, compared to just .04 for control students.

Table 3. *Analysis of Variance for Fruit Intake at Morning Snack*

Source	df	F	SS	$?^2$
Time	1	322.48*	9.36	.56
Time x School	2	80.59*	4.68	.39
Error	255			

Note. *$p < .001$

Table 4. *Fruit Intake Across Testing Periods*

Group	Testing Period			
	Pretest		Posttest 1	
	M	SD	M	SD

Group	Testing Period			
Program School 1***	.05	.22	.46	.27
	Posttest 1		Posttest 2	
Program School 1*	.46	.27	.57	.17
	Pretest		Posttest 1	
	M	SD	M	SD
Program School 2***	.04	.15	.37	.24
	Posttest 1		Posttest 2	
Program School 2	.37	.24	.35	.24
	Pretest		Posttest 1	
	M	SD	M	SD
Control School	.03	.12	.05	.17
	Posttest 1		Posttest 2	
Control School	.05	.17	.07	.20

Note. *$p < .05$, **$p < .01$, ***$p < .001$

To better understand changes in fruit intake, one must consider the snacks served during each of the three-day testing periods. For Program School 1, increased fruit intake on posttest 2 compared to posttest 1 resulted from having greater access to fruit. Students at this school received fruit on two of three posttest 1 survey days (a vegetable was served the other day). One of these days, oranges were served and 82.4% of students reported eating the snack. The other day, the papaya that was served had been damaged from freezer storage. As a result, only 52.9% of students ate the snack that day. Program School 1 also served fruit on two of the three posttest 2 survey days, but with no food quality issues. One of these days, 90.2% of students reported eating the watermelon snack, while 80.4% reported eating the apple snack the other day.

Snack distribution patterns were a reason fruit intake at Program School 2 did not differ between posttests 1 and 2. Students at this school were served fruit on two of three survey days during posttest 1 (no snack was served the other day). One day, 87.7% of students reported they ate the pineapple that was served. The other day, these students were also served damaged papaya and only 17.8% reported eating the snack that day. In contrast, Program School 2 only served fruit on one day during posttest 2 (a vegetable and no snack were served the other days). The grapes that were served that day were eaten by 84.9% of the students. In addition, 12.3% of students reported eating leftover grapes the next day when a free vegetable was served.

Vegetable Intake

In terms of average vegetable intake during morning snack, the ANOVA revealed a significant main effect for time, and a significant interaction between school and time (see Table 5). Post hoc analyses indicated that for Program School 1, vegetable intake at posttest 2 (M = .25, SD = .15) was higher than posttest 1 (M = .18, SD = .17), $t(50) = 3.34$, $p = .002$, and intake at posttest 1 was higher

than the pretest (M = .00, SD = .00), t(50) = 7.50, $p < .001$ (see Table 6). For Program School 2, vegetable intake at posttest 2 (M = .22, SD = .17) was higher than posttest 1 (M = .01, SD = .04), t(72) = 10.78, $p < .001$; however, there was no difference between intake at posttest 1 and the pretest (M = .01, SD = .08), t(72) = .45, $p = .658$. For control schools, vegetable intake at posttest 2 (M = .00, SD = .00) was not significantly different from posttest 1 (M = .02, SD = .10), t(133) = 1.75, $p = .083$, and there was no difference between posttest 1 and the pretest (M = .00, SD = .00), t(133) = 1.75, $p = .083$. Combining results across both program schools and both posttests, the average incidence of vegetable intake at morning snack increased by .16 from the pretest, compared to only .01 for control students.

Table 5. *Analysis of Variance for Vegetable Intake at Morning Snack*

Source	df	F	SS	n^2
Time	1	443.05*	2.58	.64
Time x School	2	143.03*	1.66	.53
Error	255			

Note. *$p < .001$

Table 6. *Vegetable Intake Across Testing Periods*

Group	Testing Period			
	Pretest		Posttest 1	
	M	SD	M	SD
Program School 1***	.00	.00	.18	.17
	Posttest 1		Posttest 2	
Program School 1**	.18	.17	.25	.15
	Pretest		Posttest 1	
	M	SD	M	SD
Program School 2	.01	.08	.01	.04
	Posttest 1		Posttest 2	
Program School 2***	.01	.04	.22	.17
	Pretest		Posttest 1	
	M	SD	M	SD
Control School	.00	.00	.02	.10
	Posttest 1		Posttest 2	
Control School	.02	.10	.00	.00

Note. $*p < .05$, $**p < .01$, $***p < .001$

As was the case with fruit intake, it is important to consider the snacks served during each of the three-day testing periods. Program School 1 served a vegetable on one of three posttest 1 survey days. This snack, cauliflower, was eaten by 52.9% of students. This school again served a vegetable on one of three post-test 2 survey days. This snack, cucumber, was eaten at a higher rate, with 74.5% of students reporting they ate it. In Program School 2, no vegetables were served on any survey days during posttest 1, thus intake resembled the pretest. In contrast, a vegetable was served at this school on one of three post-test 2 survey days. The snack was carrots, which were eaten by 64.4% of the students.

The program effect for vegetables may also be seen by looking at the percent of students that reported not eating any vegetables for morning snack during the two posttest surveys. In Program School 1, 47.1% of students reported not eating any vegetables during posttest 1, while 25.5% reported not eating any vegetables during posttest 2. In Program School 2, the numbers were 98.6% and 35.6% for posttests 1 and 2 respectively. The fact that vegetable intake for morning snack remains much lower than fruit is the direct result of fewer vegetables being served to students through the FFVP, especially in Program School 2. In comparison, 97.8% and 100% of control students reported not eating any vegetables during posttests 1 and 2 respectively.

Non-FFVP Snack Days

No free snack was served in Program School 2 on one of the three survey days for each posttest. This allowed us to investigate whether students from Program School 2 brought fruit or vegetables from home to eat on non-FFVP days. Using paired samples t-tests, we compared average intake of fruit and vegetables for morning snack on day 1 of posttest 1 and posttest 2 with days 1, 2, and 3 of the pretest, respectively. There were no significant differences, with the exception of one comparison. Fruit intake on day 1 of posttest 2 ($M = .08$, $SD = .28$) was higher than day 3 of the pretest ($M = .03$, $SD = .16$), $t(72) = 2.04$, $p = .045$. This difference only represents an increase from two to six students who brought a fruit from home.

Teacher Reports

Results from monthly teacher reports confirm students were eating the free snacks served through the FFVP. Overall, teachers reported that 50-90% of students typically ate the snacks, depending on what item was served. Although teachers reported they usually ate the snacks themselves, entire classrooms rarely shared the snack as a group. Moreover, teachers incorporated almost no nutrition education throughout the program. The most common activity reported by teachers was encouraging students to eat the free snacks. Parents were notified of their children's involvement in the FFVP via an official program announcement, the parental consent form for this study, and school newsletters. Beyond this, teachers did not report any parental involvement in the program. For example, no homework assignments or activities related to fruit and vegetables or healthy eating were sent home for parents and students to work on together. Lastly, teachers did not report reminding or encouraging students to bring a fruit or vegetable from home to eat on non-FFVP days.

Discussion

Most children and adolescents in the United States consume far less than the USDA recommended 6-13 daily servings of fruit and vegetables (Adams, Pelletier, Zive, & Sallis, 2005). We investigate the impact of the FFVP on fourth- and fifth- grade students' consumption of fruit and vegetables at two months and six months of program implementation. This study has several strengths, including using pretest-posttest comparisons over time. The estimated impact of the effect of the FFVP is further enhanced by comparing changes across two program and two control schools. Lastly, this study is particularly relevant given the sizeable resources allocated to the FFVP and the lack of empirical research quantifying its impact, especially among elementary school students in the United States.

The hypothesis that program students will experience increased fruit and vegetable intake for morning snack compared to control students is supported by current findings. Positive effects of the FFVP are present early on, with no gains resulting from additional months of participation. Differences in fruit and vegetable intake between two and six months are the result of snack distribution patterns. For example, fruit intake at Program School 1 is higher at posttest 2 than

posttest 1 because students had greater access to fruit on posttest 2. Conversely, students from Program School 2 had essentially the same access to fruit on posttests 1 and 2, thus there is no difference in intake between these periods. Students in this study report eating fruit such as watermelon, apples, and oranges more than any vegetables. Students also report eating certain vegetables at higher rates, such as cucumber and carrots compared to cauliflower.

Although students consistently eat the fruit and vegetables served for free at morning snack, they do not bring these items from home to eat on days when no free snack is provided. Even after six months of experiencing the FFVP, no evidence of this behavior was found in this study. Possible explanations for this are the lack of substantial educational activities to enhance the FFVP experience for students and no meaningful parental involvement in the program. Even in the presence of nutrition education and parental involvement at school, factors in the home might limit the reach of the FFVP. Specifically, availability and affordability of fruit and vegetables, presence of competing food items, low parental intake of fruit and vegetables, and infrequent family meals represent possible barriers (Fisher, Mitchell, Smiciklas-Wright, & Birch, 2002; Gillman et al., 2000; Neumark-Sztainer, Wall, Perry, & Story, 2003). Nevertheless, incorporating creative nutrition education activities and garnering parental involvement could be useful in expanding the influence of the FFVP beyond the immediate impact of providing access to free fruit and vegetable snacks. Previous research suggests that such efforts will likely be challenging (Bai et al., 2011; Potter et al., 2011).

Limitations and Recommendations for Future Research

There are limitations to the present study that could be addressed in future research and practice. First, participating schools and students were not selected randomly and our sample is relatively small, thus results may not be generalizable. Additional research involving larger randomized samples from across the country is needed to fully understand the effects of the FFVP. Second, there can be difficulties collecting data from children via self-report measures. That said, this technique is considered a valid method to assess dietary intake for children as young as 8 years of age for the purposes of group comparisons (Lytle et al., 1993). Furthermore, we utilized procedures known to enhance young children's recall, including administering surveys in the morning (Domel, 1997), taking the entire class through the questions together, giving appropriate reminders and prompts, and allowing students to talk with one another during testing (Edmunds & Ziebland, 2002). Instead of using self-report to measure intake, future studies may want to employ observational methods, perhaps weighing each student's snack before and after consumption (Horne et al., 2004). Third, we measured the incidence of fruit and vegetable intake during morning snack in this study. In future studies, researchers could train children to provide portion size estimates and/or collect more detailed data to assess the nutrient content of foods consumed. It would also be desirable to measure average daily fruit and vegetable intake rather than just during morning snack to see whether the FFVP influenced consumption at other times, especially outside of school. A final limitation is the use of only two posttests with three survey days each. Future studies may want to employ more frequent testing. Monthly, weekly or even daily data collection could be used to investigate the impact of repeated exposure to new fruit and vegetables or those that children report initially disliking (Wardle, Herrera, Cooke, & Gibson, 2003).

CONCLUSIONS AND APPLICATION

When served free fruit and vegetables for snacks at school, participants in this study typically report eating them. This finding reinforces the importance and effectiveness of schools as a setting for providing children access to nutritious foods.

USDA program goals are to expand and increase the variety and amount of fruit and vegetables children consume. Given these goals and the limited funding of the FFVP, schools should serve mostly familiar, popular foods (apples, oranges, carrots) to increase consumption, while also providing some exposure to unfamiliar, less popular foods (cauliflower, jicama, papaya) to expand childrens' tastes and preferences. Schools should also take care to ensure that snacks are stored properly and served fresh to ensure the highest consumption and avoid waste.

Serving free snacks five days a week would certainly increase the program impact, but FFVP funding constraints may be a barrier. Thus, researchers and school personnel should identify and implement practical, low-cost methods for engaging children and parents in ways that result in students bringing fruit and vegetables from home on non-FFVP days.

Continued evaluation is also necessary to determine if positive changes related to the FFVP persist; specifically, if children will adopt healthy food choices that reduce the risk of obesity and chronic disease. Researchers may also want to explore the mechanisms that change fruit and vegetable intake. Finally, future research should attempt to quantify the health benefits from the FFVP, thus justifying the substantial program expenditures.

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