

USDA Fresh Fruit and Vegetable Program Creates Positive Change in Children's Consumption and Other Behaviors Related to Eating Fruit and Vegetables

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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 purpose of this study was to investigate the impact of the 2009–2010 USDA Fresh Fruit and Vegetable Program (FFVP) on fruit intake and other behaviors related to fruit and vegetable consumption among Wisconsin fourth- and fifth-grade students.

Methods

Participants were fourth- and fifth-grade from one FFVP school (n = 51) and one control school (n = 78). The FFVP school served students free fruits and vegetables for school snack. A pretest measuring 1) fruit and vegetable intake during school snack and 2) other behaviors related to eating fruit and vegetables was administered before the FFVP began, followed by a posttest at six months of program implementation. Pretest and posttest data were compared between FFVP and control schools using repeated measures analysis of variance. Researchers collected all data in classrooms with assistance from school staff and trained research assistants.

Results

Fruit intake increased for program students. Program students also exhibited positive change in other behaviors related to both fruit and vegetable consumption, such as asking parents to buy fruits and vegetables. Control students showed no meaningful change in intake or other behaviors for control students.

Applications to Child Nutrition Professionals

The FFVP increases availability and accessibility to a variety of fruit and vegetables, in addition to providing repeated exposures. In this study, the result was positive changes in intake as well as other positive behaviors related to fruit and vegetable consumption. Both future research and FFVP implementation may be enhanced by further developing collaborative partnerships between researchers and schools to improve program effectiveness and participation.

INTRODUCTION

Fruit and vegetable consumption has been recommended as an important component of a healthy diet, helping to manage weight and reduce the risk of chronic disease (Centers for Disease Control and Prevention [CDC], 2007; Institute of Medicine [IOM], 2005; U. S. Department of Health and Human Services, 2010). This is supported by data showing correlation between fruit and vegetable consumption and obesity rates. Seven of the states with the lowest rates of fruit and vegetable consumption are also in the top 10 for obesity, while many states with the highest rates of fruit and vegetable consumption are among the states with the lowest obesity rates (CDC, 2010). In

particular, children of all ages do not eat enough fruits and vegetables. Data from the 2009 Youth Risk Behavior Survey indicated that only 18.4% of U. S. high school students eat the recommended daily amount of fruits and vegetables (CDC, 2010). Similarly, data from the 1999-2002 National Health and Nutrition Examination Survey revealed fruit and vegetable intake below recommended guidelines for children, ages 2–18 years (Lorson, Megar-Quinonez, & Taylor, 2009). Thus, interventions designed to increase fruit and vegetable consumption among American children are needed.

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 healthy eating (Davison & Birch, 2001; IOM, 2005; Wechsler, Devereaux, Davis, & Collins, 2000; Wechsler, McKenna, & Dietz, 2004). The U. S. Department of Agriculture (USDA) initiated its Fresh Fruit and Vegetable Program (FFVP) in 2002 as part of a broad effort to address poor nutrition and rising obesity rates among children.

FFVP Background

The FFVP began as a pilot and was expanded in 2004 and 2006, eventually becoming nationwide in 2008 (U. S. Department of Agriculture [USDA], 2012). This program allocates funding for selected schools to provide students with free fresh fruit and vegetable snacks outside of school lunch. The school selection process and the administration of the funding are handled by designated agencies within each state. The program aims to identify and develop best practices for increasing consumption of fruits and vegetables in schools to improve nutrition and combat childhood obesity. Participating schools choose how many days per week, when, and where to serve the free snacks, as well as how much, if any, nutrition education to include. The program is restricted to elementary schools with at least 50% of students qualifying for free or reduced- price school meals. The history and implementation of the FFVP is described in more detail elsewhere (Bai, Feldman, Wunderlich, & Aletras, 2011; Buzby, Guthrie, & Kantor, 2003; Potter et al., 2011; USDA, 2011).

Fruit and Vegetable Program Research

Research has shown that distributing free fruits and vegetables to children through school snack programs outside of lunch raises fruit and vegetable intake. Two studies outside of the United States demonstrated significant increases in both fruit and vegetable consumption for intervention students compared to control students (Bere, Veierod, Bjelland, & Klepp, 2006; He et al., 2007). Similarly, four studies have shown the USDA FFVP to be successful in increasing fruit and vegetable intake among children and adolescents. One study found that Mississippi eighth- and tenth-grade students participating in the FFVP increased fruit intake, but not vegetable intake (Coyle et al., 2009). Another FFVP study found an increased likelihood of combined fruit and vegetable intake for participating Wisconsin fourth-, seventh-, and ninth-grade students who reported low initial consumption (Jamelske, Bica, McCarty, & Meinen, 2008). Additional research in Wisconsin found higher fruit and vegetable intake during school snack periods for fourth and fifth grade students participating in the FFVP compared to control students (Jamelske & Bica, 2012). A fourth study, involving Texas 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).

Two of these FFVP studies also investigated students' willingness to eat fruits and vegetables. The Mississippi study found increased willingness to try new fruits, but not vegetables, for eighth-grade students (Coyle et al., 2009). No change was found in the tenth grade, and fifth-grade students reported decreased willingness to try both new fruits and vegetables. Research in Wisconsin showed positive change in fourth-, seventh-, and ninth- grade students' willingness to try both new fruits and vegetables served at school (Jamelske et al., 2008). No effect was found for willingness to try new fruits or vegetables at home, or to choose fruits or vegetables as a snack instead of less healthy alternatives.

Together, these findings suggest it is possible to increase children's fruit and vegetable intake and create positive change in children's willingness to try new items through school-based snack programs. However, the research literature specific to the FFVP is small and still developing. Given the sizeable resources committed to funding the FFVP, more information is needed to understand

the successes, limitations, and potential in meeting its stated goals. Social cognitive theory provides a useful framework for understanding the impact of the FFVP. In the social cognitive view, human functioning is explained in terms of a model of triadic reciprocity in which behavior, cognitive and other personal factors, and environmental events all operate as interacting determinants of each other (Bandura, 1986). Both researchers and school nutrition personnel have long recognized availability of fruits and vegetables as an important environmental factor supporting increased consumption by children (Blanchette & Brug, 2005; Reinharts, de Nooijer, Candel, & de Vries, 2007). Accessibility, or whether foods are presented in a form, at a time, and in a location that facilitate consumption (e.g., pre-prepared, single servings), is also important (Blanchette & Brug, 2005; Reinarts et al., 2007). The FFVP creates an environment of fruit and vegetable availability and accessibility, supporting cognitive and behavioral change.

Cognitive/personal factors associated with fruit and vegetable consumption include preferences and self-efficacy. Research findings point to taste preference as the most important personal determinant of fruit and vegetable consumption in children (Blanchette & Brug, 2005). Humans' innate preferences for sweet tastes favor fruit intake; innate aversions to bitter and sour tastes, and tendencies of young children to reject unfamiliar foods, work against vegetable consumption (Birch, 1999). These predispositions may be altered through the increased availability, accessibility, and repeated exposure made possible by the FFVP. Although not as central to increasing children's fruit and vegetable consumption as preferences, self-efficacy is also a useful factor to consider when examining behavior change associated with the FFVP. That is, the availability/accessibility of fruits and vegetables in the classroom creates opportunities for school staff to develop students' beliefs about their ability to consume these foods.

Using a social cognitive framework, this study investigated behavior change related to fruit and vegetable consumption among fourth- and fifth-grade students participating in the 2009–10 Wisconsin FFVP. We hypothesized that program students would report increased fruit and vegetable intake compared to control students. We also hypothesized that program students would report other positive behavior changes related to fruit and vegetable consumption compared to control students. These combined effects would result from increased availability and accessibility of fruits and vegetables, and repeated exposure, made possible by the FFVP.

METHODOLOGY

Participants

One hundred and twenty-nine Wisconsin fourth- and fifth-grade students from one FFVP school (n = 51) and one matched control school (n = 78) participated in this study. Both schools were in the same geographic area, but were not from the same district. The schools were selected for participation based on proximity to and willingness to work with the researchers. Program and control samples were similar with respect to gender, age, and ethnicity distributions (see Table 1). The program school had a higher percent of students qualifying for free and reduced-price school meals. We were not permitted access to these data for study participants, but school administrators reported a free/reduced price rate of 58% across all students attending the program school and an overall rate of 46% for the control school.

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

	Group	
	Program School FFVP 3 days/week	Control School no FFVP
Variable	(n = 51)	(n = 78)
Mean age in years (SD)	9.6 (.72)	9.7 (.62)

	Group	
Gender (% boys)	47.1	57.7
Race/ethnicity (%)		
White	96.1	93.6
Asian American	0	3.8
African American	3.9	1.3
Latino(a)	0	1.3
American Indian	0	0

Materials

Students answered an open-ended question about what they ate during the school-snack period. This question measured the incidence of fruit and vegetable intake. Students did not provide portion size estimates, and the nutrient content of foods consumed was not assessed in this study. An eight-item survey designed to measure other behaviors related to fruit and vegetable consumption was used. This survey included four questions about fruit: trying new fruit offered at home; trying new fruit offered at school; choosing fruit as a snack instead of chips, cookies or candy; and asking parents to buy fruit when food shopping. There were four parallel questions for vegetables. Response options for all eight questions were 1 = *never*, 2 = *sometimes*, 3 = *often*, and 4 = *always*. Scores for this survey were calculated by taking the average across all eight items. Higher scores represent more positive or favorable behavior.

Fruit and Vegetable Distribution and School Snack Periods

This was the first year of FFVP funding for the program school. Distribution of free snacks began in October, 2009. Fruits and vegetables were purchased through the school's distribution channels and served for free, three days per week. A total of 95 snacks were served during the school year. Fruit was served 66 times and vegetables were served 29 times. Fruits and vegetables were usually obtained whole, then cut, and served in single servings. For example, oranges were cut into wedges, kiwis were cut in half, celery was cut into pieces, and cucumbers were sliced. Some exceptions were pre-packaged-mini carrots, and apples and pears served whole. The snacks were prepared in the school kitchen and distributed to classrooms for an organized afternoon snack period shared by teachers and students. Students were allowed to bring snacks from home to eat in the afternoon on non-FFVP snack days, as was the case before the FFVP began. No formal nutrition education activities were undertaken as part of the program. In the control school, no free snacks were provided. Students brought snacks from home and had their organized snack period in the classroom each morning rather than the afternoon.

Data collection

Pretest data were collected in the morning over three consecutive days at both schools before the start of the FFVP. On the first day, students reported what they ate for snack the day before, and completed the survey, which measured other behaviors related to fruit and vegetable consumption. Pretest surveys were administered in classrooms with assistance from the school staff and trained student research assistants. Instructions were read aloud to the entire class while others circulated through the room helping students understand the questions and remember what they ate for snack the previous day. Students were allowed to talk to one another during the survey. On the second and third days, students reported what they ate for the previous day's snack.

A posttest survey was administered at six months of program implementation, following the same procedures. During posttest data collection, an unexpected early release occurred at the FFVP school. Therefore, for days 1 and 2 of the posttest, program students reported snacks eaten in

school, whereas they reported snacks eaten outside of school (e.g., home, daycare, etc.) for posttest day 3. Demographic information, including age, gender, and race/ethnicity, was provided by school officials.

Statistical analyses

Univariate analysis of variance (ANOVA) was used to compare program and control school students at the pretest. Repeated measures ANOVA was used to examine the effect of the FFVP between schools and across time (pretest through posttest). Post hoc analyses were conducted using paired-samples t-tests. All analyses were completed using SPSS 18.0.

RESULTS AND DISCUSSION

Fruit and Vegetable Intake for School Snack

Pre- and post-test fruit and vegetable intake during school snack periods was determined for program and control schools by calculating the mean for each individual student across three consecutive days, and calculating the mean again across all students within a school. A univariate analysis of variance (ANOVA) was conducted to investigate average fruit intake for school snack at the pretest. Results revealed no significant difference between the program school ($M = .01, SD = .05$) and the control school ($M = .01, SD = .05$) for fruit consumption, $F(1, 127) = .045, p = .832, \eta^2 = .00$. No statistical analysis for vegetable intake during the pretest was completed because no students reported eating vegetables.

To examine the effect of the FFVP on average fruit intake during the school snack, a 2 (school: program, control) x 2 (time: pretest, posttest) repeated measures ANOVA was conducted, with school as a between-subjects factor and time as a repeated factor (see Table 2). Post hoc analyses indicated that program students' average fruit intake during school snack at the posttest ($M = .59, SD = .21$) was higher than the pretest ($M = .01, SD = .05$), $t(50) = 19.86, p < .001$. For control students, there was no significant difference in fruit intake during school snack between posttest ($M = .00, SD = .00$) and pretest ($M = .01, SD = 0.05$), $t(77) = 1.42, p < .159$.

Table 2. Analysis of Variance for Fruit Intake at Snack

Source	df	F	SS	η^2
Time	1	536.31*	5.07	.81
Time x School	1	568.44*	5.37	.82
Error	127			

Note. * $p < .001$

No posttest statistical test was run for vegetable intake because no vegetables were served through the FFVP during the posttest period and no students reported eating vegetables. The program effect for fruit may result from the FFVP fruit served on two of three posttest survey days. Out of 51 students, 47 ate the apple served on day 1 and 43 ate the kiwi served on day 2. No snacks were served through the FFVP on day 3 because of the early release.

Behaviors Related to Fruit and Vegetable Consumption

Other behaviors related to fruit and vegetable consumption were measured using an eight-item survey. Scores for this survey were calculated by taking the average across all eight questions, with higher scores representing more positive or favorable behavior toward fruit and vegetable consumption. Chronbach alphas calculated at the pretest ($\alpha = .84$) and at the posttest ($\alpha = .87$) indicate this survey maintains good internal consistency.

A univariate analysis of variance (ANOVA) was first conducted to investigate survey results at the pretest. Results demonstrated no significant differences in between the program school ($M = 2.51, SD = .74$) and control school ($M = 2.42, SD = .68$), $F(1, 127) = .491, p = .485, \eta^2 = .004$. A 2 (school: program, control) x 2 (time: pretest, posttest) repeated measures ANOVA was then conducted, with school as a between-subjects factor and time as a repeated factor, to examine the effect of the FFVP on student fruit- and vegetable-related behaviors, based on survey results. Results

revealed a significant main effect for time and a significant interaction between school and time (see Table 3).

Table 3. *Analysis of Variance for Behaviors Related to Fruit and Vegetable Consumption*

Source	<i>df</i>	<i>F</i>	SS	η^2
Time	1	18.92*	2.72	.13
Time x School	1	21.92*	3.15	.15
Error	127			

Note. * $p < .001$

Post hoc analyses indicated that average scores among program students at the posttest ($M = 2.94, SD = .68$) were higher or more favorable than at the pretest ($M = 2.51, SD = .74$), $t(50) = 5.52, p < .001$. For the control students, average scores at the posttest ($M = 2.40, SD = .74$) were not significantly different than the pretest ($M = 2.42, SD = .68$), $t(77) = .274, p = .785$.

Program students noticeably moved from reporting *never* and *sometimes* towards *often* and *always* for 7 of the 8 items measuring other behaviors related to fruit and vegetable consumption. The only exception was choosing fruit as a snack over chips, cookies, and candy. The percent of students reporting they would *often* or *always* try new fruits and vegetables in school nearly doubled, from 49.0% to 84.3%, for fruit and more than doubled, from 35.3% to 72.6%, for vegetables. The percent of students reporting they *often* or *always* ask their parents to buy fruits and vegetables increased by more than one-third, from 45.1% to 60.8%, for fruit and almost doubled from, 19.6% to 37.3%, for vegetables. There were no meaningful changes between pretest and posttest for control students on any of the 8 questions.

The hypothesis that program students would increase fruit intake for school snack compared to control students was supported by current findings. This study supports the belief that when students are given fruit, they eat it. Results are consistent with previous research showing students eat fruits and vegetables provided as free snacks through the FFVP (Jamelske & Bica, 2012). The hypothesis related to vegetable intake could not be tested because no students reported eating vegetables. Since no vegetables were served through the FFVP on any of the three posttest survey days, the finding that program students did not increase vegetables eaten for school snack is understandable.

The hypothesis that program students would exhibit positive change in other behaviors related to fruit and vegetable consumption compared to control students was also supported by current findings. Pretest responses showed program and control students were initially more likely to try new fruits than vegetables, and were more likely to try new fruits and vegetables at home than at school. Posttest responses indicate an increased likelihood of trying new fruit and vegetables both at home and at school for program students, but not for control students. It is noteworthy that the posttest revealed that the likelihood of trying new fruits and vegetables at school surpassed the likelihood of trying them at home. The posttest also showed an increase, as compared to the pretest, in program students reporting how often they ask their parents to buy both fruits and vegetables when they shop, with no change for control students. Posttest results also show a small positive change in the likelihood that program students would choose vegetables as a snack over chips, cookies, or candy. Neither group showed a change in likelihood of choosing fruit as a snack over less healthy alternatives. With all of the positive behavior changes related to fruit and vegetable consumption reported from pretest to posttest, fruits remain preferred to vegetables with one exception. On the posttest, 47.1% of the students (up from 35.3%) reported that they often or always choose a vegetable as a snack over chips, cookies, or candy. This frequency is identical to that of choosing fruit, which was unchanged from the pretest.

Most children and adolescents in the United States consume less than recommended amounts of fruits and vegetables (CDC, 2010; Lorson et al., 2009). Enough is known from theory, practice, and

research to suggest school-based environmental strategies promoting healthy eating among young people merit implementation and ongoing refinement (Davison & Birch, 2001; IOM, 2005; Wechsler et al., 2000; Wechsler et al., 2004). The nationwide expansion of the FFVP requires significant resources, with \$65 million allocated for the 2009–2010 school year. Given this sizeable financial commitment, more information is needed to assess the effectiveness of the program. This study addresses this need, and findings suggest a positive impact of the 2009–2010 FFVP on intake and other behaviors related to fruit and vegetable consumption among Wisconsin fourth- and fifth-grade students.

CONCLUSIONS AND APPLICATION

Reviews of school-based fruit and vegetable interventions recommend that programs include multiple components based on an appropriate theoretical framework and directed at behavior change (Bere et al., 2006; Knai, Pomerleau, Lock, & McKee, 2005). Social cognitive theory provides a useful framework for understanding how environmental factors made possible by the FFVP are associated with cognitive and behavioral change related to fruit and vegetable consumption.

Cognitive/personal factors associated with fruit and vegetable consumption include taste preferences and self-efficacy, with preferences emerging as the more important factor of the two. Preferences can be altered through increased availability, accessibility, and repeated exposure to fruits and vegetables made possible by the FFVP. Evidence suggests that up to 10 exposures to a new fruit or vegetable are needed to affect children's preferences (Birch, 1999). Schools could further increase the availability, accessibility, and exposure to fruits and vegetables made possible through the FFVP by providing free snacks more than three days a week, as well as in the morning and afternoon on some days. Schools could also balance the serving of popular/familiar fruits and vegetables with new/unfamiliar items in order to increase access, availability, and exposure to a variety of fruits and vegetables.

Two operational definitions of self-efficacy are relevant to this study and to school staff working to create change in students' dietary behaviors: choosing fruits and vegetables instead of less healthy foods and asking parents to buy fruits and vegetables. Practicing related cognitive or behavioral skills may increase self-efficacy related to fruit and vegetable intake in children. For example, school staff could help students learn to remember which days snacks are/are not served free through the FFVP. Staff could also help students practice the behavior of asking parents to buy fruits or vegetables that could be eaten at home or brought to school for eating on non-FFVP days. Students could also practice skills related to selecting healthy snacks instead of less healthy alternatives. Practicing related skills has been shown to be most effective when conducted, at least in part, by trained professionals (Blanchette & Brug, 2005). Thus, schools should consider collaboration with nutrition experts.

These practices likely require resources beyond the amount allocated through the FFVP, resulting in the need for schools to procure funding from other sources. Although this may seem a burdensome task, additional funding of \$25 per student represents a 50% increase to initial FFVP funding. In Wisconsin, for example, both funding and expertise are available to schools with at least 50% of students qualifying for free and reduced-price school meals through the University of Wisconsin-Extension. However, very few schools have utilized these services to enhance FFVP implementation. Such partnerships would enable schools to extend the reach of the FFVP to better achieve the goal of identifying and developing best practices to increase children's fruit and vegetable consumption.

Limitations to the present study could be addressed by future research. First, analyses of the impact of the FFVP would benefit from using larger, randomized samples. Second, the study focus was on incidence of fruit and vegetable intake during the school snack period. Use of more detailed measures of fruit and vegetable consumption, such as portion size estimates and measurement of intake over the entire day, is desirable. Third, fruit and vegetable intake was collected over three consecutive days at two points in time (pretest-posttest). Future studies could employ more frequent collection of student fruit and vegetable consumption data, such as monthly, weekly, or even daily. Fourth, vegetable consumption was not investigated because no students reported

eating vegetables. Coordination with the school nutrition manager regarding what items will be served during the survey period is essential to ensure that both fruits and vegetables are offered as snacks through the FFVP. Finally, although steps were taken to ensure accurate data collection, self-report methods present difficulties (Jamelske & Bica, 2012). Although positive change in behaviors related to fruit and vegetable consumption for program students was found, student reports may or may not reflect actual behavior. For example, since the FFVP exposed students to a variety of fruits and vegetables, including many new or unfamiliar items, and given evidence that students typically eat snacks served through the FFVP, it is reasonable to assume the reported rise in trying new fruits and vegetables at school accurately reflects students' behavior. Reported increases in trying new fruits and vegetables at home, and asking parents to purchase fruits and vegetables, suggests the influence of the FFVP has reached into the home. However, there is no corroborating evidence for these reported behavior changes. A small, favorable change in student preferences for vegetables over less healthy alternatives was found. Again, there is no corroborating evidence that this change is actually occurring. Nevertheless, the overall consistent pattern of positive behavior change related to fruit and vegetable consumption found in this study, both at school and in the home, is encouraging.

Further advances in the study of the FFVP will require collaborative partnerships between researchers and school staff to design more thorough evaluations. This could include providing students with choices between fruits, vegetables, and other alternatives and observing student behaviors. Student behaviors resulting from active encouragement to bring fruits and vegetables for school snacks on non-FFVP days could also be measured. Data collection in the home via parent survey or even direct home observations would provide additional insight into behavior changes as a result of the FFVP. As mentioned above, including nutrition professionals in FFVP-related implementation and research could also prove helpful. Designing and conducting these research protocols will be challenging given the time and resources required. However, the benefit of an increased understanding of how to successfully create positive behavior change through school-based interventions to increase children's fruit and vegetable intake could be significant.

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