

# Preliminary Findings from an Evaluation of the USDA Fresh Fruit and Vegetable Program in Wisconsin Schools

Eric Jamelske, PhD; Lori A. Bica, PhD; Daniel J. McCarty, PhD; Amy Meinen, MPH, RD

## ABSTRACT

**Introduction:** In 2002, the US Department of Agriculture (USDA) created the Fresh Fruit and Vegetable Program (FFVP) to improve nutrition and help reduce the prevalence of childhood overweight and obesity. The FFVP provides funding for students from selected schools in each participating state to receive a free fresh fruit or vegetable snack daily for an academic year. In November 2005, Wisconsin was added to this program. In this study, we evaluate whether the Wisconsin FFVP resulted in positive changes in children's attitudes and behavior related to eating fruits and vegetables.

**Methods:** In 2006, 25 Wisconsin schools were selected by the Wisconsin Department of Public Instruction for FFVP participation. Study measures included a pre-test and post-test survey given to 4th, 7th, and 9th graders in the intervention and controls schools. Post-test data from all 25 intervention schools were not yet available for analysis. Our sample, therefore, consisted of 1127 participants: 784 students in 10 intervention schools and 343 students in 10 control schools. Independent samples *t* tests and multivariate probit regression analyses were used to examine attitudinal and behavioral program effects.

**Results:** Compared to controls, intervention students reported an increased willingness to try new fruits (24.8% versus 12.8%,  $P < 0.01$ ) and vegetables (25.1% versus 18.4%,  $P = 0.01$ ) at school.

**Conclusions:** Findings indicate positive changes in attitudes and behavior among children participating in the Wisconsin FFVP.

## INTRODUCTION

Overweight and obesity is now the most common medical condition of childhood in the United States, with the prevalence more than doubling over the past 20 years.<sup>1</sup> Nationally, 15.3% of 6-11 year olds and 15.5% of 12-19 year olds are at or above the 95th percentile for Body Mass Index-for-Age.<sup>2</sup> In Wisconsin, nearly 24% of high school students are either obese or overweight.<sup>3</sup> The dramatic increase in the prevalence of childhood overweight and obesity and its resultant comorbidities are associated with significant health and financial burdens, thus warranting strong and comprehensive prevention efforts.<sup>2</sup>

Long considered one of the central causes of overweight and obesity, poor nutrition is prevalent among today's youth. Children and adolescents' food intake tends to be low in fruits, vegetables, and calcium-rich foods, and high in fat.<sup>4</sup> Current United States Department of Agriculture (USDA) guidelines recommend eating 6-13 servings of fruits and vegetables each day, however US children eat an average of only 3.5 servings daily.<sup>5</sup> Moreover, for the typical American adolescent, half of all vegetables consumed are french fries or other potatoes.<sup>4</sup> In Wisconsin, less than a third of high school students report eating  $\geq 3$  servings of fruit a day, while only 18% report eating  $\geq 3$  servings of vegetables.<sup>3</sup> Unhealthy dietary patterns developed during childhood and adolescence may create an increased risk for chronic diseases later in life.<sup>6</sup> Therefore, clearly focused efforts to improve the nutritional health of America's young people are needed, and schools, with their access to an estimated 95% of children and adolescents nationwide, are regarded as optimum settings for such efforts.<sup>7</sup>

There is a growing body of literature on the effectiveness of nutrition-related programs designed to

**Author Affiliations:** Departments of Economics and Psychology, University of Wisconsin-Eau Claire, Eau Claire, Wis (Jamelske, Bica); Department of Health Sciences, University of Wisconsin-Stevens Point, Stevens Point, Wis (McCarty); Marshfield Clinic Research Foundation, Marshfield, Wis (McCarty); Nutrition and Physical Activity Program, Wisconsin Department of Health and Family Services, Madison, Wis (Meinen).

**Corresponding Author:** Eric Jamelske, Department of Economics, University of Wisconsin-Eau Claire, 105 Garfield Ave, Eau Claire, WI 54702-4004; phone 715.836.3254; fax 715.836.5071; e-mail jamelsem@uwec.edu.

combat the rise in childhood overweight and obesity. A number of school-based interventions demonstrate that increasing children's fruit and vegetable intake is possible, even though effects are small and the long-term persistence of such changes is largely unknown.<sup>9</sup> Story et al found offering more and greater varieties of fruits and vegetables at lunch, combined with taste testing and skill building activities in the classroom, led to increased fruit and vegetable consumption at lunch.<sup>10</sup> Bere et al noted providing pupils with a piece of fruit or a vegetable at school at no cost to their parents is an effective strategy to increase school children's intake of fruit and vegetables.<sup>11</sup> Therefore, environmental interventions combined with educational approaches may be needed to effectively promote children's fruit and vegetable consumption at school.<sup>5</sup>

The USDA created the Fresh Fruit and Vegetable Program (FFVP) in 2002 to increase fruit and vegetable consumption in an effort to combat childhood overweight and obesity. In November 2005, Wisconsin was added to this program as an expansion state. Beginning in March 2006, approximately 13,500 students at 25 funded schools received daily fresh fruit and vegetable snacks for the remainder of the 2005-2006 school year and into the 2006-2007 school year. Additionally, the schools in the program incorporated into their curriculum nutrition education components designed to promote consumption of fresh fruits and vegetables.

In this study, we evaluated whether the Wisconsin FFVP is an effective method of introducing school-age children to fresh fruits and vegetables as a healthy food choice. Specifically, we sought to determine whether the program resulted in positive changes in attitude and behavior related to fruit and vegetable consumption.

## METHODS

### *Participants*

Students in the 4th, 7th, and 9th grade across 25 intervention schools and 10 matched control schools in Wisconsin participated in this study. A sample of 25 schools were selected as program sites by the Wisconsin Department of Public Instruction based on interest in the FFVP, geographic location, and number of students qualifying for free or reduced lunches. Ten control sites were selected based on characteristics similar to those of the intervention schools, including school size, geographic location, ethnic composition, and numbers of students qualifying for free or reduced lunches. Although these selection processes were not random, both the intervention and control schools were geographically diverse and, in general, reflected the characteristics of students in the state.

Our pre-test sample consisted of 2863 participants: 2287 students from the 25 intervention schools and 576 from the 10 control schools. Post-test data from all 25 intervention schools were not yet available for analysis, but we wished to report on a subset of 10 of the schools because, after interim analyses were performed, significant results emerged. Within this subset, analyses were further limited to only those students who provided both pre-test and post-test responses to the survey sections that are the focus of this study. Therefore, our final sample consisted of 1127 participants: 784 students in 10 intervention schools and 343 students in 10 control schools. Approximately equal numbers of girls (n=577) and boys (n=550) were represented in the sample, and just over 70% of the students were identified as white. Fourth grade students comprised 43.5% of the sample, while 33.8% were in 7th grade and 22.7% were in 9th grade.

### *Measures*

The survey instruments used in this study were based on previously validated measures.<sup>12-15</sup> In addition to demographic items, the survey contained questions on lifestyle, including fast food consumption, physical exercise, parental limits on video game/TV time, and eating family dinners. The next section contained a series of questions measuring participants' willingness to try new fruits and vegetables at home and school, the frequency with which they ate the fruit or vegetable that came with school breakfast or lunch, and their willingness to choose fruits and vegetables as snacks over less healthy alternatives. Specifically, there were 2 items that asked if participants would try a new fruit offered at school and at home, respectively. There were 2 parallel items for vegetables. Two additional items asked whether participants would choose fruit or a vegetable, respectively, as a snack instead of chips or candy. Response options for all 6 items were 1=would not, 2=might, and 3=would.

The next section of the survey presented a series of pictures of 23 target fruits and vegetables and asked students to demonstrate their knowledge by correctly identifying specific items. Participants were also asked to indicate which items they had tried or would be willing to try. We selected the 23 fruits and vegetables for this section because they were most likely to be served to students in all 25 intervention schools. In the next section, students were given an expanded list of 68 fruits and vegetables and asked to identify the items they had tried and what items they liked. The final section of the survey contained a list of various food items, including 39 fruits and vegetables. Students indicated how many times (from 1 to 5) they had eaten each item in the last

24 hours. This dietary recall portion of the survey was administered to students over 3 consecutive days to calculate average daily fruit and vegetable consumption for each student over the 3-day period. The focus of this paper is on 2 sections of the survey: the dietary recall section (behavior) and the section measuring students' willingness to try new fruits and vegetables at home and school and willingness to choose fruits and vegetables as a snack over less healthy alternatives (attitude).

### *Procedure*

Personnel in both intervention and control schools administered the pre-test to students during a regularly scheduled class period in March 2006 before the program began. All survey materials were approved by the University of Wisconsin-Madison Education Institutional Review Board. In addition, all persons administering the surveys completed the University of Wisconsin on-line tutorial on the use of human subjects in research and were given explicit instructions on how to administer the surveys. The post-test was given 3 months later at the end of the 2005-2006 school year following the same procedure. We surveyed the same students a third time as 5th, 8th, and 10th graders in March 2007 and also conducted teacher and parent surveys for 5th grade students in May 2007. Results from the first 2 sets of surveys, spanning approximately 3 months of program implementation, were analyzed for this study.

To compare changes in attitudes toward fruits and vegetables between the intervention and control schools, we generated an indicator variable =1 for those students with a positive change between the pre-test and post-test and 0 otherwise. A positive change was defined as a student response that changed from "would not" to either "might" or "would," or from "might" to "would" for a given item. The mean for each new variable measured the percent of students who increased their willingness to eat fruits and vegetables between the pre-test and post-test.

We used the dietary recall section of the survey to examine students' fruit and vegetable consumption. Students reported their eating patterns using a list of food items, including 39 fruits and vegetables, for 3 consecutive days. We then calculated each student's average daily fruit and vegetable intake for the 3-day period. To focus on students with very low fruit and vegetable intake, we restricted our analysis to a subset of students who reported eating fruits and vegetables an average of  $\leq 1$  times per day on the pre-test. To compare changes in behavior of fruit and vegetable intake between inter-

**Table 1.** Pre-test Data—Willingness to Try New Fruits/Vegetables and to Choose Fruits/Vegetables as Snacks

Variable	N	Willing (%)
Try new fruit at school	1120	33.8
Try new vegetable at school	1118	20.8
Try new fruit at home	1121	55.6
Try new vegetable at home	1121	32.9
Choose fruit as snack instead of chips/candy	1122	40.0
Choose vegetable as snack instead of chips/candy	1120	21.0

Note: The sample size varies due to non-response for some questions.

vention and control groups, we generated an indicator variable =1 for those students with a positive change between the pre-test and post-test and 0 otherwise. A positive change was defined as an increase in student's average daily fruit and vegetable intake of at least 0.2 times from pre-test to post-test. The mean of this new variable measured the percent of students that increased their average daily fruit and vegetable consumption between the pre-test and post-test.

To investigate attitudinal and behavioral program effects, we first used SPSS 15.0 to calculate independent samples *t* tests to examine differences in mean responses between intervention and control participants. To explore the robustness of these results to the inclusion of control variables, we used Stata 6.0 to conduct multivariate probit regression analyses.

## **RESULTS**

Pre-test data for the 6 items measuring students' willingness to eat fruits and vegetables are presented in Table 1. In terms of choosing fruits and vegetables as a snack instead of chips/candy, 40% indicated they would choose a fruit, but only 21% would choose a vegetable. Similarly, 33.8% of students said they would try a new fruit served in school, but only 20.8% would try a new vegetable. At home 55.6% of students indicated they would try a new fruit and 32.9% said they would try a new vegetable. Overall, students were more willing to eat fruits than vegetables and also more willing to try both fruits and vegetables at home versus at school. Of particular importance is that there was significant opportunity for students to move in a positive direction from either "would not" or "might" in terms of willingness eat fruits and vegetables.

Table 2 presents the change in student willingness to eat fruits and vegetables between the pre-test and post-test. In terms of trying a new fruit served at school, 24.8% of intervention school students reported an

**Table 2.** Pre-test/Post-test Comparison—Willingness to Try New Fruits/Vegetables and to Choose Fruits/Vegetables as Snacks

Variable	Intervention		Control		P
	N	Positive Change (%)	N	Positive Change (%)	
Try new fruit at school	741	24.8	337	12.8	<0.01
Try new vegetable at school	736	25.1	337	18.4	0.01
Try new fruit at home	741	15.4	336	13.1	0.31
Try new vegetable at home	740	18.2	339	17.4	0.74
Choose fruit as snack instead of chips/candy	742	18.1	339	15.0	0.21
Choose vegetable as snack instead of chips/candy	737	20.1	336	16.4	0.14

Note: The sample size varies due to missing data for some items.

**Table 3.** 4th Grade Student Pre-test/Post-test Comparison—Willingness to Try New Fruits/Vegetables and to Choose Fruits/Vegetables as Snacks

Variable	Intervention		Control		P
	N	Positive Change (%)	N	Positive Change (%)	
Try new fruit at school	347	25.1	117	11.1	<0.01
Try new vegetable at school	345	26.7	115	12.2	<0.01
Try new fruit at home	348	19.0	115	13.9	0.19
Try new vegetable at home	349	22.9	117	17.1	0.16
Choose fruit as snack instead of chips/candy	349	19.8	117	18.8	0.82
Choose vegetable as snack instead of chips/candy	346	24.3	115	14.8	0.02

Note: The sample size varies due to missing data for some items.

increased willingness compared to only 12.8% of control school students ( $P<0.01$ ). Similarly, intervention school students were also more willing to try a new vegetable served at school, with 25.1% reporting an increase compared to 18.4% of control school students ( $P=0.01$ ). Although no significant differences were found for the other comparisons, results are in the expected direction with intervention students demonstrating greater positive change than control students.

A multivariate probit regression model was used to explore if these simple differences in means were robust to the inclusion of control variables for gender, race/ethnicity, grade level, amount of physical activity, parental TV/video game limits, frequency of family dinners, and fast-food consumption. The model predicted that intervention students were 12.1 percentage points more likely to have experienced an increase in willingness to try a new fruit at school relative to control students ( $P<0.01$ ), while the difference for a new vegetable was 6.7 percentage points ( $P=0.02$ ).

We next looked at only 4th grade students' responses because we believe that school-based programs of this nature have the greatest potential to influence the behavior of younger children. Table 3 shows that the positive program effects were larger when we limited the analysis to just 4th grade students. Specifically, 25.1% of intervention students reported an increase in willing-

ness to try a new fruit served at school compared to only 11.1% of control students ( $P<0.01$ ). Intervention school 4th graders were also more willing to try a new vegetable at school, with 26.7% reporting an increase compared to 12.2% in control schools ( $P<0.01$ ). Again, there were no statistically significant differences in willingness to try new fruits and vegetables at home, but the trends are in the expected direction. Unlike results from the full sample comparison, we do see a statistically significant difference in increased willingness to choose a vegetable as a snack instead of chips/candy for intervention students (24.3%) versus control students (14.8%) at  $P=0.02$ .

To determine if the FFVP had positively influenced those students most in need, we analyzed fruit and vegetable consumption patterns for students who reported eating these foods an average of  $\leq 1$  times per day on the pre-test. As shown in Table 4, over 32% of intervention school students with low initial consumption reported an increased willingness to eat both fruits and vegetables compared to only 15% of control school students ( $P=0.03$  and  $0.04$ , respectively). Table 4 also shows that 62.8% of intervention school students with low initial consumption reported increased fruit and vegetable intake compared to only 47.1% of control school students ( $P=0.13$ ). A probit regression identical to that used above predicted that intervention school

**Table 4.** Low Consumption Student Pre-test/Post-test Comparison—Willingness to Try New Fruits/Vegetables and Intake

Variable	Intervention		Control		P
	N	Positive Change (%)	N	Positive Change (%)	
Try new fruit at school	83	32.5	33	15.2	0.04
Try new vegetable at school	82	32.9	33	15.2	0.03
Average daily fruit and vegetable intake	86	62.8	34	47.1	0.13

Note: The sample size varies due to missing data for some items.

students who reported low consumption initially were 19.5 percentage points more likely than control school students to have increased their average daily intake of fruits and vegetables ( $P=0.07$ ). Again, the positive program effect was larger when the analysis was limited to just 4th grade students. Low consuming 4th grade students in intervention schools ( $n=40$ ) were 29.7 percentage points more likely than control students ( $n=17$ ) to have increased their average daily fruit and vegetable intake ( $P=0.05$ ).

## DISCUSSION

Preventing childhood overweight and obesity is a national public health priority. Childhood appears to be a critical time to target nutritional messages designed to influence food preferences.<sup>15</sup> Children's preferences for specific foods tend to increase with frequency of exposure to the food.<sup>8</sup> Frequency and exposure is influenced by the availability and accessibility of foods.<sup>8</sup> Moreover, studies show that consumption of fruits and vegetables, as a habit in childhood, is an important predictor of higher fruit and vegetable consumption as adults.<sup>16</sup> Also, lifetime food experiences, such as developing food preparation skills, developing specific preferences for healthy foods, and gardening, have been found to contribute to food choice.<sup>17</sup>

It is essential that the effects of school, district, or state policy changes regarding the school food environment are evaluated.<sup>18</sup> In this study, we determined whether the FFVP is an effective method of introducing school-age children to fresh fruits and vegetables as a healthy food choice. In particular, we examined whether the program resulted in positive changes in attitude and behavior related to fruit and vegetable consumption following 3 months of program implementation. We found that students in the FFVP intervention sites compared to students in the control schools were more willing to try new fruits and vegetables at school, but not at home. It is possible that differences in attitudes toward trying these foods at home will emerge following longer exposure to the program. Certainly, for the program to

be considered a success, the effects must reach beyond school and into the home.

We recognize that there are certain limitations to the study. Participants were not selected at random and, although we feel they reflect the average characteristics of students in the state fairly well, it may be that our results are not generalizable to other samples of school-age children. We also recognize the limitations inherent in collecting data of this nature via self-report measures. We believe that the strengths of the study, including a large sample size, pre-test/post-test design, use of control schools, and comprehensive nature of the survey instruments provide informative and useful results.

In conclusion, this study indicates that the Wisconsin FFVP is having some beneficial short-term effects. Continued monitoring of this program will determine if healthier diets are being adopted by the students in the intervention schools and whether this in turn will eventually reduce the prevalence of childhood overweight and obesity.

**Acknowledgments/Funding/Support:** The authors would like to thank the University of Wisconsin-Eau Claire for funding support. They would also like to thank all students and staff at all participating schools; undergraduate student research assistants Anjali Anand, Emily Brown, Jason Haluska, Beth Lutz, John Rodgers, and others who assisted with data entry; Kirsten Austad and Jessica Zigman, Area Health Education Centers Interns, Wisconsin Department of Health and Family Services, for their contribution to the literature review; and the National Fruit and Vegetable Program, Centers for Disease Control and Prevention, for their suggestions for validated survey questions and review of the final student survey.

**Financial Disclosures:** Eric Jamelske is an employee of the University of Wisconsin-Eau Claire Economics Department. Amy Meinen is an employee of the Wisconsin Department of Health and Family Services.

## REFERENCES

1. American Academy of Pediatrics. Committee on school health policy statement. Soft drinks in schools. *Pediatrics*. 2004;113:152-154.
2. American Academy of Pediatrics. Policy statement: prevention of pediatric overweight and obesity. *Pediatrics*. 2003;112:424-430.
3. Centers for Disease Control and Prevention. 2005 Youth Risk Behavior Surveillance System. Available at: <http://www.cdc.gov>. Accessed July 3, 2008.

4. Story M, Neumark-Sztainer D, French S. Individual and environmental influences on adolescent eating behaviors. *J Am Diet Assoc.* 2002;102:S40-S51.
5. Adams MA, Pelletier RL, Zive ME, Sallis JF. Salad bars and fruit and vegetable consumption in elementary schools: a plate waste study. *J Am Diet Assoc.* 2005;105:1789-1792.
6. Shannon C, Story M, Fulkerson JA, French S. Factors in the school cafeteria influencing food choices by high school students. *J Sch Health.* 2002;72:229-234.
7. Kubik MY, Lytle LA, Hannan PJ, Perry CL, Story M. The association of the school food environment with dietary behaviors of young adolescents. *Am J Pub Health.* 2003;93:1168-1173.
8. Burchett H. Increasing fruit and vegetable consumption among British primary schoolchildren: a review. *Health Educ.* 2003;103:99-109.
9. Bere E, Veierod MB, Bjelland M, Klepp K. Outcome and process evaluation of a Norwegian school-randomized fruit and vegetable intervention: fruits and vegetables make the marks (FVMM). *Health Educ Res.* 2005;21:258-267.
10. Story M, Mays RW, Bishop DB, et al. 5-a-day power plus: process evaluation of a multi-component elementary school program to increase fruit and vegetable consumption. *Health Educ Behav.* 2000;27:187-222.
11. Bere E, Veierod MB, Bjelland M, Klepp K. Free school fruit-sustained effect 1 year later. *Health Educ Res.* 2005;21:268-275.
12. California Healthy Kids Survey. Elementary School Questionnaire. 2003.
13. California Health Kids Survey. Middle School Questionnaire. 2003.
14. Mississippi Fruit and Vegetable Pilot Student Survey. Fifth Grade. 2004.
15. Mississippi Fruit and Vegetable Pilot Student Survey. Eight and Tenth Grade. 2004.
16. Heimendinger J, Van Duyn M. Dietary behavior change: the challenge of recasting the role of fruits and vegetables in the American diet. *Am J Clin Nutr.* 1995;61:1397S-1401S.
17. Devine CM, Wolfe WS, Frongillo EA Jr, Bisogni CA. Life-course events and experiences: association with fruit and vegetable consumption in 3 ethnic groups. *J Am Diet Assoc.* 1999;99:309-314.
18. Story M, Kaphingst KM, French S. The Role of Schools in Obesity Prevention. *Future of Children.* Available at: <http://www.futureofchildren.org>. Accessed July 3, 2008.

# Wisconsin Medical Journal

The mission of the *Wisconsin Medical Journal* is to provide a vehicle for professional communication and continuing education of Wisconsin physicians.

The *Wisconsin Medical Journal* (ISSN 1098-1861) is the official publication of the Wisconsin Medical Society and is devoted to the interests of the medical profession and health care in Wisconsin. The managing editor is responsible for overseeing the production, business operation and contents of *Wisconsin Medical Journal*. The editorial board, chaired by the medical editor, solicits and peer reviews all scientific articles; it does not screen public health, socioeconomic or organizational articles. Although letters to the editor are reviewed by the medical editor, all signed expressions of opinion belong to the author(s) for which neither the *Wisconsin Medical Journal* nor the Society take responsibility. The *Wisconsin Medical Journal* is indexed in Index Medicus, Hospital Literature Index and Cambridge Scientific Abstracts.

For reprints of this article, contact the *Wisconsin Medical Journal* at 866.442.3800 or e-mail [wmj@wismed.org](mailto:wmj@wismed.org).

© 2008 Wisconsin Medical Society