

Practice-Based Evidence for Cornell's *Choose Health: Food, Fun, and Fitness (CHFFF) Youth Curriculum*

*Wendy Wolfe, Jamie Dollahite, Michelle Scott-Pierce
Division of Nutritional Sciences, Cornell University
June 2016*

Summary

Practice-based evidence was used to evaluate outcomes of Cornell's youth nutrition and fitness curriculum *Choose Health: Food, Fun, and Fitness (CHFFF)* in low-income Expanded Food and Nutrition Education Program (EFNEP)-eligible children. Four pre-post evaluation studies or sub-studies were conducted in youth participating in CHFFF in New York State during federal fiscal years (FY) 2014 and 2015. Two were based on the federal EFNEP surveys (one in 3rd-5th graders and one in 6th-8th graders), and two were based on sets of CHFFF-specific questions added to the 3rd-5th grade EFNEP survey, in summer 2014 and in part of 2015. Data were collected by trained educators as they taught CHFFF in schools, after-school programs, and other settings. Paired t-tests showed significant positive changes ($p < .001$) for youth from before to after participating in CHFFF for consumption of vegetables, fruit, soda and other sweetened drinks, nutrition label reading, tasting new foods, and other food and activity behaviors. Results provide practice-based evidence that the CHFFF curriculum is associated with positive nutrition outcomes in youth.

Introduction

The prevalence of childhood overweight in the United States has tripled over the past 30 years; 32% are now either overweight or obese, with higher rates in ethnic minority and low-income communities (1,2). Overweight children are at increased risk for adult overweight and chronic disease (3,4). Child diet and activity habits are also of concern, as they not only contribute to obesity, but are themselves associated with chronic disease risk. For example, vegetable and fruit consumption is well below recommended levels (5). Improving such habits during childhood is critical as they frequently persist into adulthood.

Although the role of the food and activity environment in these issues is increasingly recognized, youth nutrition education is also essential, especially since today's children frequently make many independent food decisions such as at school lunch, fast food outlets, etc. The US Department of Agriculture's Expanded Food and Nutrition Education Program (EFNEP) and the Supplemental Nutrition Assistance Program Education (SNAP-Ed) are two means by which to reach low-income youth with nutrition education to help reduce obesity and chronic disease risk. The importance of evidence-based curricula in such efforts is increasingly recognized, but few such curricula are

available for elementary age youth. This is due in large part to the methodological challenges of accurately measuring impact in children, especially in regular programmatic settings where executing lengthy validated methods can be very difficult. With the lack of well-validated instruments that meet the needs of programmatic settings – brief, low respondent burden, can be administered in group settings, and can measure specific behaviors of interest (6), current curricula rely on practice-based evidence. The purpose of this study was to conduct an outcome evaluation of one such curriculum.

Choose Health: Food, Fun and Fitness (CHFFF) is an award-winning, theory- and research-based nutrition and fitness curriculum for 8-12-year-olds that uses experiential learning to teach healthy eating and active play. CHFFF targets behaviors research shows to be most important for preventing childhood obesity and chronic disease, such as replacing sweetened drinks with low-fat milk and water, eating more vegetables, fruits, and whole grains, eating fewer high-fat and high-sugar foods, and playing actively, and supports USDA's Dietary Guidelines for Americans and MyPlate. Developed by Cornell University's Division of Nutritional Sciences in collaboration with Cornell Cooperative Extension's 4-H Youth Development Program, each of the six lessons includes interactive nutrition activities, food preparation or tasting, active games, goal setting, and a family newsletter. Based on Social Cognitive Theory (7), CHFFF uses a learner-centered dialogue approach for more effective retention and application of information and skills (8).

This report summarizes results from four evaluation studies or sub-studies of CHFFF in low-income EFNEP-eligible children in New York State: three in 3rd-5th graders, based on the national EFNEP instrument alone and two sets of additional CHFFF-specific questions, and one in 6th-8th graders, using the national EFNEP instrument for that age-group. Together, the results provide practice-based evidence that the CHFFF curriculum is associated with positive nutrition outcomes in youth. The sample, methods, and results for each study are presented below.

Methods

Data were collected by local Cornell Cooperative Extension (CCE) educators as they taught the 6-lesson CHFFF curriculum to low-income youth via EFNEP and SNAP-Ed. All educators were trained to teach the CHFFF curriculum. Paper surveys were completed by youth just before their first lesson and at the end of their final lesson. The research was approved by Cornell's Institutional Review Board.

Studies 1 and 4 were based on the national EFNEP 3rd-5th and 6th-8th grade pre-post survey instruments, required for all EFNEP youth programming since Oct. 2014. These surveys were developed by the national EFNEP Youth Evaluation Committee, of which Wolfe is a member and co-developed the 6th-8th grade instrument. Initial questions were selected by the committee and national EFNEP leadership from a review of the literature and existing tools, and revised based on expert review and cognitive testing to enhance face and content validity. Each of these samples include all youth with completed pre and post surveys who received CHFFF through NY EFNEP

(FY 2014-2015) and SNAP-Ed (FY 2014). Data were entered locally into the national EFNEP data collection system (WebNEERS) by trained staff.

Study 2 was based on 6 CHFFF-specific questions added to the national EFNEP 3rd-5th pre-post survey during the summer of 2014. Additional questions were limited to six to keep the respondent burden low, and allow the enhanced survey to be administered in regular program settings as usual. The questions were developed to enhance content validity by assessing some of the CHFFF behavioral objectives not addressed in the national EFNEP survey, such as sweetened drinks, and were based on a review of the literature and existing surveys, followed by expert review to enhance face and content validity. For sweetened drinks, few age-appropriate questions could be found, so input on question and response wording was gained from 24 CCE front-line educators teaching this topic to 3rd-5th graders. NY EFNEP and SNAP-Ed educators who were teaching CHFFF to 3rd-5th graders during summer 2014 were asked to voluntarily use this version of the standard pre-post EFNEP 3rd-5th youth survey, with the 6 additional questions. Paper surveys were mailed to Cornell for data entry of the added questions.

Study 3 was based on a modified set of CHFFF-specific questions added to the national EFNEP 3rd-5th pre-post survey in New York State beginning in Feb. 2015. The questions were modified based on Study 2 results, an updated literature review, educator input, and cognitive testing in nine 3rd-5th grade youth. All EFNEP educators in New York State who were teaching CHFFF were asked to use this modified version. Data were entered locally by trained staff into the state-specific additional questions section of the WebNEERS EFNEP data entry system, which is limited to five questions and which NY was testing.

All statistical analysis was done at Cornell using SAS 9.2 and SPSS 23. Paired t-tests were run on all pre-post questions. Questions and response options are shown in Tables 2-4, along with the results.

Results

Sample characteristics for all 4 studies are shown in Table 1. Youth characteristics are for all youth receiving CHFFF during each time period, not just those with both a pre and a post survey, since WebNEERS does not link individual response data to their demographics. As shown, all studies included a range of grades and ethnicities. While in general the demographic characteristics were similar between studies, the slight differences between Study 1 and Study 3 (a subsample of Study 1), such as more urban and Hispanic, and fewer school sites, is likely due to the latter being EFNEP only due to state SNAP-Ed administrative changes beginning in FY15.

Results of Study 1 showed that after receiving CHFFF, youth significantly increased their self-reported frequency of vegetable and fruit consumption, choosing healthy snacks, doing physical activity, and their willingness to ask their family to buy non-fat or 1% milk and have fruit and cut-

up vegetables available (Table 2). These results held for both school and non-school settings (data not shown).

Study 2 results showed that after receiving CHFFF, youth significantly decreased their self-reported frequency of drinking sweetened drinks, and increased their frequency of drinking water, reading Nutrition Facts Labels, talking to their family about healthy eating, trying a new food, and their willingness to ask their family to buy a new vegetable or fruit (Table 3). In addition, 59% reported that they or their family had made some of the CHFFF recipes at home.

Study 3 results showed that after receiving CHFFF, youth significantly decreased their self-reported frequency of drinking soda, fruit drinks and sweetened iced teas, and increased their frequency of eating vegetables and fruits at lunch (Table 4). For Nutrition Facts Labels, youth significantly increased how often they read them, for those indicating some frequency at both pre and post, and additionally, 54% went from *I don't know* at the pre-test to 1-2 days a week or more at the post-test, suggesting they learned to use a Nutrition Facts Label. Results again were somewhat stronger in non-school settings.

Results of Study 4 showed that after receiving CHFFF, these 6th-8th graders significantly increased their self-reported frequency of vegetable, fruit, whole grain, and low-fat milk consumption, their frequency of making healthy choices when eating out, and their physical activity level, and decreased their frequency of sweetened drinks consumption and screen time. They also significantly increased their confidence in following a recipe and in using measuring cups and spoons, and in how often they wash vegetables and fruits before eating them (Table 5). Results held for both school and non-school settings, but were somewhat greater in non-school settings.

Discussion

Evidence of the effectiveness of CHFFF is shown by significant positive changes from pre to post in vegetable and fruit consumption, sweetened drinks, reading nutrition labels, and other food and activity-related behaviors across all four studies.

Eating more vegetables and fruits is a behavior focused on and reinforced throughout CHFFF, and vegetable and fruit consumption showed consistent improvement across all the studies. More than a third of the 3rd-5th graders, and almost half of the 6th-8th graders, improved one point or more. For the 6th-8th graders, who were asked how many times they ate vegetables and fruits the previous day, the results translate to a mean increase in eating vegetables from 1½ to 2 times and in eating fruit from 1¾ to 2¼ times the previous day. This compares favorably with a recent systematic review that found an average increase of 0.39 servings per day for behavioral interventions to increase fruit and vegetable intake (9). These improvements are supported by the 3rd-5th graders' increased willingness to ask their family to buy a new vegetable or fruit and to make vegetables and fruits more available at home.

Drinking fewer sweetened drinks and more low-fat milk and water are also emphasized in CHFFF, and results suggest these changes are being made. For 3rd-5th graders, 37-45% decreased their consumption of sweetened drinks by at least one point, as did 41% of 6th-8th graders, who also reported increasing their low-fat milk consumption the equivalent of almost an additional half a "time." 3rd-5th graders also reported increased consumption of water and increased willingness to ask their family to buy non-fat or 1% milk instead of regular whole milk.

Reading Nutrition Facts Labels on food and drink containers is a learning objective of CHFFF that is introduced for sweetened drinks in the first lesson and reinforced for other food items in most of the other lessons. The significant increase in how often the 3rd-5th graders read NFLs (Studies 2 and 3) suggests that this new skill is being applied by many youth.

Preparing or at least tasting healthy snacks is a part of every CHFFF lesson. Every recipe includes at least one vegetable or fruit, and many include whole grains. Many of the recipes include food items that are new to participants, and all are encouraged to try at least a taste, with the goal of giving them a positive experience in trying a new food. The 19% increase in trying a new food in the last week (Study 2) supports the success of this aspect of CHFFF. The recipes are sent home in a colorful newsletter that is personalized via a check-off box to show parents and caregivers the behavior goal their youth chose to try that week. Youth are encouraged to share what they learned with their families, and the 29% increase in how often youth talked to their family about healthy eating suggests that many of them do so. This may help create home environments more supportive of the behavior changes CHFFF is trying to achieve.

Throughout CHFFF, participants play fun active games and are encouraged to play these at home or find other ways to be more active. Following CHFFF, both 3rd-5th graders and 6th-8th graders reported a significant increase in physical activity, with an increase for 6th-8th graders from 4 to 4½ days a week and a decrease in screen time of about a half hour.

Finally, making healthy choices when eating out and eating more whole grains are the topics of two different CHFFF lessons. Although relevant questions were only included on the 6th-8th grade survey, both behaviors showed improvement, with 40% improving at least one point for both healthy choices when eating out and eating whole grains.

The greater improvement seen in non-school compared to in-school settings may be due to factors related to the teaching environment. While in-school settings tend to be more structured, which could enhance learning, group sizes are often larger since a whole classroom is usually included, there is often less time allowed to the educator so some parts of the curriculum get omitted or shortened, and time and space constraints often result in fewer active games and offering food tastes rather than involving the youth in actual food preparation (sometimes even food tastings are not allowed). Non-school settings are usually less structured, but often allow for more time and space, and group sizes that are closer to the 12-15 recommended for CHFFF.

The generally greater size of the improvement in 6-8th graders across the various behaviors suggests that either this age group is more able to change the behaviors emphasized in CHFFF, the curriculum is more effective in this age group, or, since the results are based on different survey questions, the survey questions for this age group are more sensitive to change. Further research is needed to better understand this.

These evaluation studies have several limitations. First, while the survey questions were modified from existing questions and most were tested for face, content, and cognitive validity, reliability and construct validity studies were not conducted, and existing measures that were both well-validated and feasible for program settings could not be found. Second, the samples used were part of regular educational programming - there was no randomization of the intervention or comparison to a control group not receiving the intervention.

In conclusion, these evaluation studies provide practice-based evidence that youth who participate in Cornell's *Choose Health* curriculum report improvements in a number of healthy behaviors that research shows are related to obesity and chronic disease prevention.

Implications for Research and Practice

There is little disagreement about the need for nutrition education for youth, and funders and program administrators alike are increasingly demanding curricula that are not only experiential and theory-based, but also evidence-based, with an emphasis on documenting behavior change and not just precursors such as attitudes, preferences and self-efficacy. Yet brief, well-validated measures that can be used in programmatic settings are lacking. As stated recently in an article describing the need for a youth EFNEP cost-effectiveness model, there was "...collective agreement that measuring program effects would be the most difficult challenge in this endeavor" (10). While such research is greatly needed, in the meantime, practice-based evidence such as this study can provide support for quality programming.

Table 1. Sample characteristics for Studies 1-4, based on all youth participating in the relevant CHFFF groups during each study period.

	3rd-5th Grade Studies			6th-8th Grade
	Study 1, NYS, FY14 & 15	Study 2, 6 Q's, Summer 2014	Study 3, 5 Q's, 2/15-9/15	Study 4, NYS, FY14 & 15
Number of youth receiving CHFFF	10,590	949	1211	2762
Sample size with both pre and post surveys	5636	686	954	1747
Number of counties	42	5	12	28
Number of educational groups	449 ^a	54	76	149 ^a
Group Characteristics	Percentage	Percentage	Percentage	Percentage
Group Settings:				
• School	48	42	24	42
• After school program	32	1	25	31
• Summer camp	7	3	1	16
• 4-H club or special interest program	13	24	49	11
County density:				
• Urban	35	75	46	39
• Medium density	48	25	47	46
• Rural	18	0	7	15
Youth Characteristics	Percentage	Percentage	Percentage	Percentage
Grade				
• 3 rd	43	39	40	
• 4 th	24	32	25	
• 5 th	33	28	36	
• 6 th				42
• 7 th				36
• 8 th				22
Gender - % female	51	48	54	52
Hispanic Ethnicity (all races)	30	30	44	33
Race:				
• White	38	38	23	27
• Black	22	29	24	28
• Other (includes "Hispanic" as race)	40	33	53	44

^a Note: Some of these groups included both 3rd-5th and 6th-8th grades

Table 2. Results of Study 1: Paired t-tests for 3rd-5th graders participating in CHFFF, based on the national EFNEP survey in New York State, Fiscal Year 2014 and 2015 (Oct. 2013 – Sept 2015) (n=5636).

Question	Response Options	n	Entry	Change** Mean \pm SEM	% Who Improved \geq1 Point
1. I eat vegetables...	<i>1=Never or almost never</i> <i>2=Some days</i> <i>3=Most days</i> <i>4=Every day</i>	5636	2.56	0.40 \pm .014	40%
2. I eat fruit...		5625	3.07	0.31 \pm .013	35%
3. I choose healthy snacks...		5562	2.56	0.39 \pm .014	42%
5. I do physical activity...		5577	3.13	0.30 \pm .014	34%
12. Will you ask your family to buy non-fat or 1% milk instead of regular whole milk?	<i>1=No</i> <i>2=Maybe</i> <i>3=Yes</i>	5504	2.03	0.32 \pm .012	38%
13. Will you ask your family to have fruits in a place like the refrigerator or a bowl on the table where you can reach them?		3770	2.40	0.22 \pm .014	29%
14. Will you ask your family to have cut-up vegetables in the refrigerator where you can reach them?		3761	2.14	0.27 \pm .015	35%

**p < 0.0001 for paired t-test of difference between pre and post

Table 3. Results of Study 2: Paired t-tests of pre-post responses for 3rd-5th graders participating in CHFFF – 6 questions added to the National EFNEP youth survey in 5 counties in New York, Summer 2014 (n=686).

Question	Response Options	n	Entry	Change** Mean \pm SEM	% Who Improved \geq1 Point
I drink sweet drinks like soda, fruit-flavored drinks and sports drinks...	<i>1=Almost never 2=Some days 3=Most days</i>	667	3.02	-0.50 \pm 0.062	37%
I drink water...	<i>4=About once a day 5=2 or more times a day</i>	621	3.73	0.73 \pm 0.054	18%
I read Nutrition Facts Labels on food packages...	<i>1=Never or almost never 2=Some days 3=Most days 4=Every day</i>	673	2.02	0.67 \pm 0.047	38%
In the last week, I talked to my family about healthy eating.	<i>1=No 2=Yes, a little 3=Yes, a lot</i>	677	1.67	0.42 \pm 0.033	48%
In the last week, I tried a new food.	<i>1=No, 2=Yes</i>	683	1.44	0.22 \pm 0.023	40%
Will you ask your family to buy a new vegetable or fruit?	<i>1=No, 2=Maybe, 3=Yes</i>	667	2.23	0.38 \pm 0.033	31%

**p < 0.0001 for paired t-test of difference between pre and post

Table 4. Results of Study 3: Paired t-tests for 3rd-5th graders participating in CHFFF – 5 added pre-post questions in New York State, Feb – Sept 2015 (n=954).

Question	Response Options	n	Entry	Change** Mean \pm SEM	% Who Improved \geq 1 Point
I drink fruit-flavored drinks and sweetened iced teas...	1 = <i>Almost never</i> 2 = <i>1-3 times a week</i> 3 = <i>4-5 times a week</i>	954	3.17	-0.60 \pm 0.055**	45%
I drink soda or pop...	4 = <i>About once a day</i> 5 = <i>2 or more times a day</i>	953	2.51	-0.51 \pm 0.049**	37%
I eat fruit at lunch...	1 = <i>Almost never</i> 2 = <i>1-2 days a week</i> 3 = <i>3-4 days a week</i>	949	3.30	+0.47 \pm 0.054*	38%
I eat vegetables at lunch...	4 = <i>5-6 days a week</i> 5 = <i>Every day</i>	940	2.62	+0.54 \pm 0.054**	41%
I read Nutrition Facts Labels on food packages...	1 = <i>Almost never</i> 2 = <i>1-2 days a week</i> 3 = <i>3-5 days a week</i> 4 = <i>Every day</i>	643 ^a	2.96	+0.36 \pm 0.066**	37%

* p < 0.01, **p < 0.0001 for paired t-test of difference between pre and post

^a Excludes those who answered “don’t know” on either entry or exit survey.

Table 5. Results of Study 4: Paired t-tests for 6th-8th graders participating in CHFFF, based on national EFNEP survey in New York State, Fiscal Years 2014 and 2015 (Oct. 2013 – Sept 2015) (n=1747).

Question	Response Options	n	Entry	Change** Mean \pm SEM	% Who Improved \geq 1 Point
Yesterday, how many times did you eat vegetables, not counting French fries?		1747	1.41	0.57 \pm .032	51%
Yesterday, how many times did you eat fruit, not counting juice?	0 = <i>None</i> 1 = <i>1 time</i>	1747	1.72	0.42 \pm .034	46%
Yesterday, how many times did you drink nonfat or 1% low-fat milk?	2 = <i>2 times</i> 3 = <i>3 times</i>	1740	1.21	0.47 \pm .033	46%
Yesterday, how many times did you drink sweetened drinks like soda, fruit-flavored drinks, sports drinks, energy drinks, and vitamin water?	4 = <i>4+ times</i>	1736	1.71	-0.36 \pm .031	41%

When you eat grain products, how often do you eat whole grains, like brown rice instead of white rice, whole grain bread instead of white bread, and whole grain cereals?	1 = <i>Never</i> 2 = <i>Once in a while</i> 3 = <i>Sometimes</i>	1600	2.49	0.34 ± .027	40%
When you eat out at a restaurant or fast food place, how often do you make healthy choices when deciding what to eat?	4 = <i>Most of the time</i> 5 = <i>Always</i>	1431	2.17	0.36 ± .030	40%
During the past 7 days, how many days were you physically active for at least 1 hour?	0 = <i>None</i> 1 = <i>1 time</i> 2 = <i>2 times</i> 3 = <i>3 times</i> 4 = <i>4+ times</i>	1745	4.24	0.56 ± .052	43%
During the past 7 days, how often were you so active that your heart beat fast and you breathed hard most of the time?	1 = <i>Never</i> 2 = <i>Once in a while</i> 3 = <i>Sometimes</i>	1696	3.32	0.41 ± .033	41%
9. How many hours a day do you spend watching TV or movies, playing electronic games, or using a computer for something that is not school work?	4 = <i>Most of the time</i> 5 = <i>Always</i>	1665	3.36	-0.32 ± .035	37%
11. How often do you wash vegetables and fruits before eating them?	1 = <i>Never</i> 2 = <i>Once in a while</i> 3 = <i>Sometimes</i> 4 = <i>Most of the time</i> 5 = <i>Always</i>	1666	4.10	0.30 ± .028	28%
13. How confident are you in using measuring cups and measuring spoons?	1 = <i>Never</i> 2 = <i>Once in a while</i> 3 = <i>Sometimes</i>	1647	2.40	0.41 ± .028	44%
14. How confident are you in following directions in a recipe?	4 = <i>Most of the time</i> 5 = <i>Always</i>	1600	2.77	0.34 ± .028	39%

**p < 0.0001 for paired t-test of difference between pre and post

References

1. Ogden CL, Carroll MD, Kit BK, et al. Prevalence of childhood and adult obesity in the United States, 2011-2012. *JAMA*. 2014;311(8):806-814.
2. Kumanyika SK, Grier S. Targeting interventions for ethnic minority and low-income populations. *The Future of Children*. 2006; 16(1): 187-207.
3. Ebbeling CB, Pawlak, DB, Ludwig DS. (2002). Childhood obesity: Public health crisis, common sense cure. *Lancet*, 360(9331), 473-482.
4. Freedman, D. S., Dietz, W. H., Srinivasan, S. R., & Berenson, G. S. (1999). The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa Heart Study. *Pediatrics*, 103(6 Pt 1), 1175-1182.
5. Lorson BA, Melgar-Quinonez HR, Taylor CA. Correlates of fruit and vegetable intakes in US children. *J Am Diet Assoc*. 2009; 109:474-478.
6. Branscum, P., Sharma, M., Kaye, G., & Succop, P. (2010). An evaluation of the validity and reliability of a food behavior checklist modified for children. *Journal of nutrition education and behavior*, 42(5), 349-352.
7. Bandura A. *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, NJ: Prentice-Hall; 1986.
8. Norris JA. *From Telling to Teaching: A Dialogue Approach to Adult Learning*. North Myrtle Beach, NC: Learning by Dialogue; 2003.
9. Thomson, Cynthia A., and J. Ravia. A Systematic Review of Behavioral Interventions to Promote Intake of Fruit and Vegetables. *Journal of the Academy of Nutrition and Dietetics*, 2011, 111(10):1523 - 1535.
10. Serrano E, McFerren M, Lambur M, Ellerbock M, Hosig K, Franz N, Townsend M, Baker S, Muennig P, Davis G. Cost-effectiveness model for Youth EFNEP programs: What do we measure and how to we do it? *JNEB* 2011; 43:295-302.