Research Article

Impact of a School-Based Cooking Curriculum for Fourth-Grade Students on Attitudes and Behaviors Is Influenced by Gender and Prior Cooking Experience

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ABSTRACT

Objective: To compare effects of the *Cooking With Kids* (*CWK*) cooking and tasting curriculum (*CWK-CT*) with a less-intense, tasting-only curriculum (*CWK-T*) and to conduct a non-treatment comparison on fourth graders' cooking self-efficacy (SE), cooking attitudes (AT), and fruit and vegetable preferences (FVP).

Design: Pre–post, quasi-experimental, 2 cohorts.

Setting: Eleven low-income public schools in a Southwestern city.

Participants: Fourth-grade students, 50% female and 84% Hispanic.

Interventions: School-based experiential nutrition education program of 5 2-hour cooking and/or 5 1-hour fruit and vegetable tasting lessons throughout the school year.

Main Outcome Measures: Cooking self-efficacy, AT, and FVP were assessed with 3 tested, validated scales administered in a 37-item survey pre- and post-classroom intervention.

Analysis: General linear modeling with gender and prior cooking experience were fixed factors.

Results: Among 961 students, *CWK* positively affected FVP, especially in *CWK-CT* students and males ($P = .045$ and .033, respectively); vegetable preference drove this outcome. Independent of treatment, students without cooking experience (61% male) had more than twice the gains in cooking self-efficacy ($P = .004$) and an improved AT response ($P = .003$).

Conclusions and Implications: *Cooking With Kids* increased FVP, especially with vegetables. Greatest gains in preferences and self-efficacy were seen in boys without prior cooking experience. For fourth graders, experiential nutrition education improved cognitive behaviors that may mediate healthful food choices.

Key Words: fruits, vegetables, nutrition survey, nutrition education, child, cooking, food preferences, self-efficacy, attitude (*J Nutr Educ Behav*. 2014;46:110-120.)

INTRODUCTION

For children to eat healthfully, encouraging repeated exposure to a wide variety of foods and engagement of all of their senses is requisite.[1-4] Involving them in direct cooking experiences continues to appear in recommendations to address obesity[5,6] and is congruent with addressing the self-efficacy (SE) and attitude constructs that undergird behavior change theory. Yet, only a few studies have investigated cooking's positive impact on children's dietary consumption and other health outcomes. One of these used a cross-sectional survey of Canadian fifth graders, and revealed that those who reported more frequently helping prepare and cook foods at home had stronger preferences for fruits and vegetables (FVP) and higher SE for selecting and eating healthy foods.[7] Another example is the Cookshop program, which was examined using a 2 × 2 factorial design to compare the effectiveness of 10 vegetable and whole-grain cooking lessons with and without additional (non-cooking) food and environment lessons, against a non-intervention comparison group. Results included (1) significant improvements in targeted food preferences for students in both groups receiving the experiential food lessons compared with those receiving just the food and environment lessons or comparison, (2) increases in cooking SE among older children receiving the cooking lessons, and (3) greater behavioral intentions among younger children receiving the cooking lessons.[8] Finally, a quasi-experimental, 12-week gardening and cooking curriculum for fourth- and fifth-grade Latino students, LA Sprouts, demonstrated

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increased fiber consumption and decreased blood pressure, and among overweight students, reduced body mass index and slowed weight gain compared with a control group.[9]

Cooking With Kids (*CWT*) is a school-based food and nutrition education curriculum that has been positively reviewed[10] and successfully adopted by elementary schools, but does not have a research evidence-base. *Cooking With Kids* engages elementary school children in hands-on learning with fresh affordable foods based on diverse cultural traditions. Students are encouraged to explore varieties of healthful foods using all of their senses, acquire practical food preparation skills, have fun working in a cooperative environment, and exercise choice. The bilingual curriculum was developed for a predominantly low-income, Hispanic community in the Southwestern United States, and refined over 12 years. Currently, nearly 5,000 prekindergarten through sixth-grade students in 13 district schools participate in this program. *Cooking With Kids* models interdisciplinary learning in math, science, language arts, social studies, music, and art.[11]

Implementation of the full curriculum includes 16 hours of cooking and tasting lessons (1 introductory class, 5 1-hour fruit and vegetable tastings led by classroom teachers, and 5 2-hour cooking classes led by *CWK* food educators) throughout the school year. *Cooking With Kids* supports family involvement by inviting parents to volunteer during cooking classes, and sends recipes home with encouragement to students to prepare these dishes with their family. Because of limited resources, some schools just receive the fruit and vegetable tasting lessons. In addition, the program links classroom learning with school meals, because foods prepared in the classroom are served at school lunches several times each month.

The purpose of this study was to examine the effects of the *CWK* cooking and tasting (*CWK-CT*) curriculum, against a less resource- and time-intense, tasting-only (*CWK-T*) curriculum and a non-treatment comparison condition (comparison), on fourth-grade students' FVP, cooking attitudes (AT), and cooking SE.

METHODS

Study Design, Participants, and Interventions

The pre–post, quasi-experimental study included 2 cohorts of Santa Fe, NM Public School students in fourth-grade classrooms from 2 consecutive school years. Two inclusion criteria were applied to school recruitment and assignment to condition: (1) All schools had to be eligible for participation in the United States Department of Agriculture–funded Supplemental Nutrition Assistance Program Education (ie, ≥ 50% of students qualify for free or reduce-priced school meals); and (2) prior *CWK* participation (or lack of participation) was congruent with assigned treatment. That is, schools receiving *CWK-CT* had prior exposure to both cooking and tasting lessons, those receiving *CWK-T* had prior exposure only to tasting lessons, and those with no prior program exposure were assigned to the comparison. All eligible schools who were invited to participate agreed to do so.

Data Collection

Survey development and description. Three scales combined into a 37-item survey were administered in each participating classroom before and after intervention to assess the impact of the 2 *CWK* intervention conditions on students' perceived cooking SE (8 items), cooking AT (6 items), and FVP (18 items). Five response options were provided for each scale. Possible scores for the SE scale ranged from 8 to 40, score ranges for the AT scale were 6 to 30, and score ranges for the FVP scale were 18 to 90. Higher scores indicated a more positive response for each scale. Demographic information and pre-study cooking experience (5 items) were also assessed.

Survey items were written in both English and Spanish. Accuracy of Spanish translation was ensured with a valid back translation. A 3.7-grade reading level was determined using the SMOG method. Items were assessed for translational validity (ie, face and content validity) by experts and by members of the target audience using one-on-one cognitive interviews as described previously.[12] Testing also included assessment of psychometric parameters, and a Cronbach alpha of ≥ .74 was achieved for all scale administrations.[12] In addition, test-retest reliability was established and with individual test-retest scores significantly ($P < .001$) correlated (n = 344; 72.9% Hispanic); r = 0.80 (SE), 0.82 (AT), and 0.88 (FVP).[12]

Survey administration. Surveys were administered as a group to each class to all assenting students present on the day of administration. Survey administration followed a protocol that was developed with teacher input and formatively tested. Thus, after the protocol: (1) teachers were present in their classroom but not directly involved in survey administration; (2) verbal encouragement to students was given to complete the survey in their preferred language (Spanish or English); (3) instructions and the top item on each survey page were read aloud by researchers with guidance to students to complete the rest of the page independently; (4) trained researchers completed an observation form to record start and stop time of survey administration, any questions students had completing the survey, and any unusual happenings during survey administration that might influence student responses (eg, fire alarm); and (5) for cohort 2, administrators returned to collect surveys from students absent on the day of post-survey administration. The survey is available as online supplemental data.

Analysis

For each scale, item responses were summed to create a scale score. For all scales, desired outcomes were noted by higher scores. Internal consistency was assessed with Cronbach alpha; scale structure was analyzed using principle components extraction with varimax rotation. For the AT scale, (which had only 6 people missing just 1 scale item), missing data were handled by list-wise deletion and AT scale score was not calculated if any item was missing. Self-efficacy and FV scale scores were not calculated if more than 1 item was missing. If only 1 item was missing, the maximum likelihood estimation method

was used to calculate the item mean. This process increased the sample size by 86 for FVP scale scores and by 33 for SE scale scores. Sample size calculations were based on prior survey performance.[12] To detect a difference of 3 points for FV preference and 1 point for AT among 3 groups with 90% power, the required sample size was 500 for FV preference and 700 for AT; to detect 1-point SE change with 80% power, the recommended sample size was 800. Differences between attriters and completers, cohorts 1 and 2, and dichotomous variables were assessed with *t* tests. Based on group differences at baseline, post-intervention change (along with pre- and posttest outcomes) were examined using univariate general linear models that included gender, treatment group, and pre-study cooking experience. Classroom differences were examined using *t* tests and 1-way ANOVA to compare class means. Data were analyzed with SPSS, version 19 for Mac (SPSS, Inc, Chicago, IL, 2010). Level of significance was set at $P < .05$.

The study, including instruments, protocols, and consent procedures, received exempt approval by the University of New Mexico and Colorado State University Institutional Review Boards and the Santa Fe Public School District. Written parent consent was not required because the student survey portion of this project was classified as exempt, but students signed a written assent before completing the survey.

RESULTS

Eleven schools participated in the study: 4 *CWK-CT* (12 classrooms in year 1 and 14 in year 2), 4 *CWK-T* (10 classrooms in year 1 and 8 in year 2), and 3 comparison (10 classrooms in both years). In year 2, the number of classrooms varied from year 1 because of fluctuations in student enrollment. A total of 1,442 students completed ≥ 1 surveys. For a number of reasons (eg, incomplete survey, absent or not attending school on pre- or posttest survey administration days), 212 students' data were excluded from final analyses. A total of 1,230 students completed at least 1 of the 3 scales (SE, ATs, or FVP) at pre- and posttest, with 961 students completing all scales at both pre- and posttest. Figures 1–3 present the flow diagram of student participation for each scale.

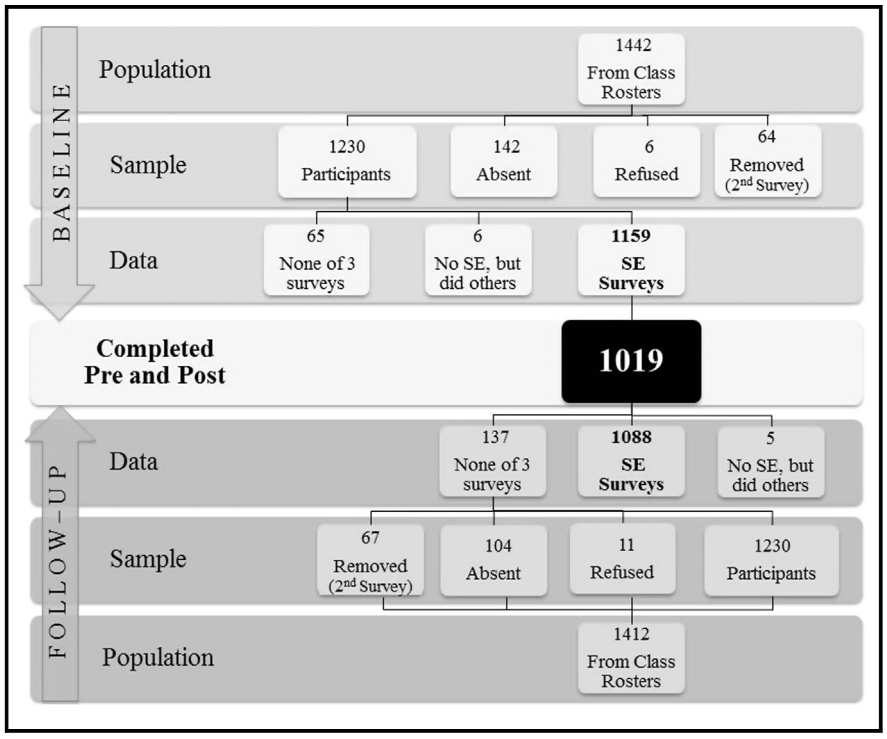

Figure 1. Recruitment and retention of fourth graders completing self-efficacy (SE) scale. Pre indicates before the intervention; Post, after the intervention.

Table 1 lists student characteristics. Approximately half of student participants were female; most (92%) were in the fourth grade. Students in other grades attended mixed-grade

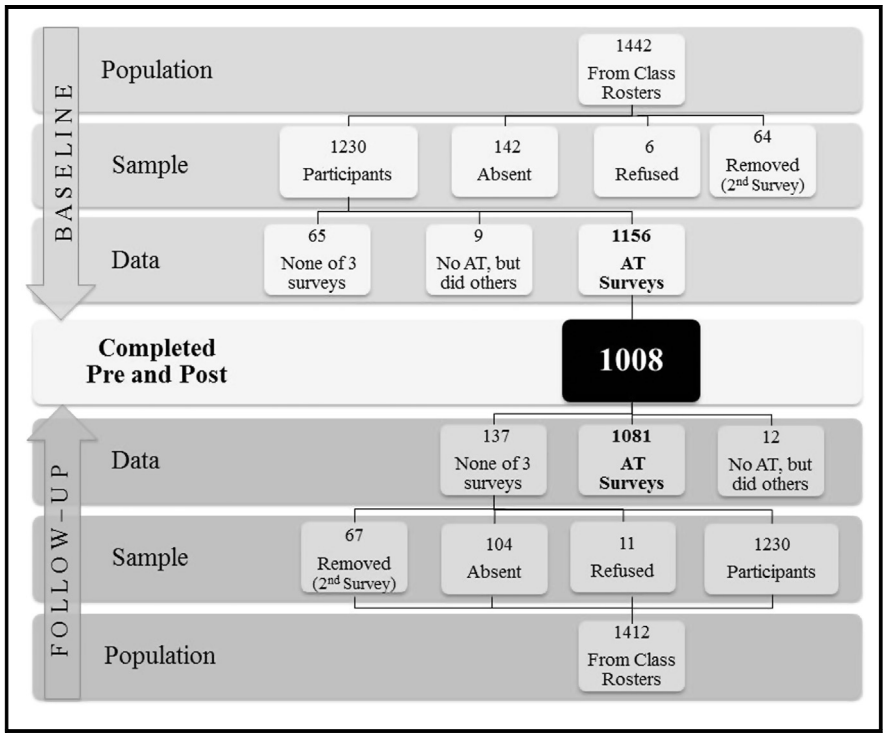

Figure 2. Recruitment and retention of fourth graders completing attitude (AT) scale. Pre indicates before the intervention; Post, after the intervention.

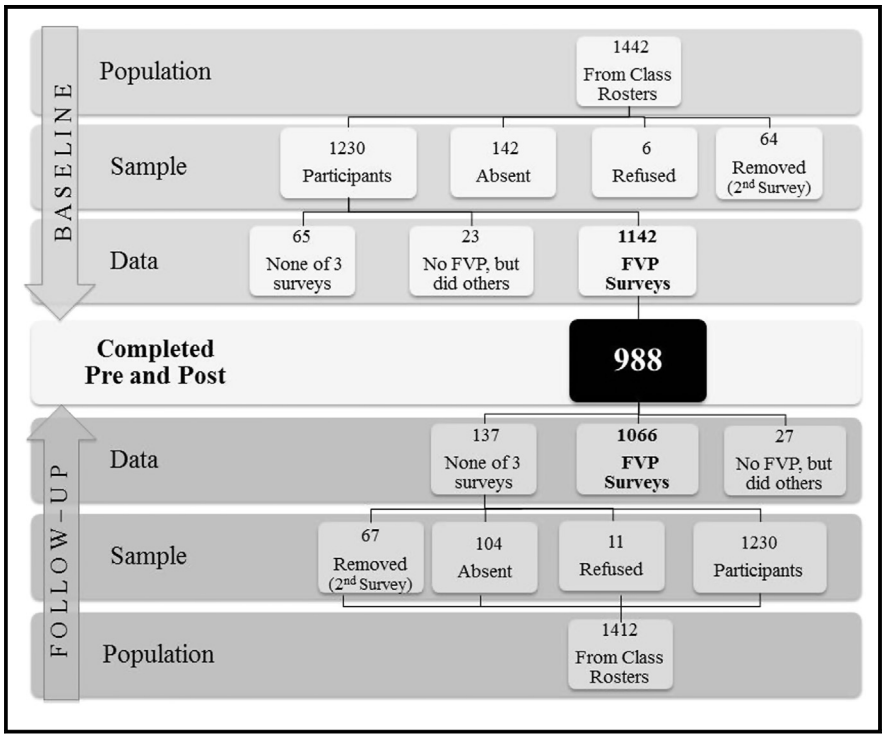

Figure 3. Recruitment and retention of fourth graders completing the fruit and vegetable preferences (FVP) scale. Pre indicates before the intervention; Post, after the intervention.

classrooms (ie, third/fourth or fourth/fifth); thus, ages ranged from 8 to 12 years of age. The majority of students were Hispanic (84%), which reflected the demographics of the school district, and 75% completed the survey in English. On the pretest survey, over 80% of students in all conditions reported cooking (affirmative response to the "Do you cook?" item). The percentage of affirmative responses for making food with friends was highest among *CWK-CT* students (68%). Nearly 90% of students reported making food with their family. At pretest, *CWK-CT* SE was higher than comparison SE ($F = 3.41$; $P = .03$) (Table 2), and *CWK-T* AT was higher than comparison AT ($F = 3.12$; $P = .05$) (Table 3). Differences at the classroom level were not significant.

Internal consistency of each scale was determined from pretest responses. Cooking SE Cronbach $\alpha = .71$ (n = 1,159); cooking AT Cronbach $\alpha = 0.65$ (n = 1,156); and FVP Cronbach $\alpha = .79$ (n = 1,142). Results are displayed separately for each scale

Table 1. Student Demographic Characteristics and Prior Cooking Experience at Baseline

Factor	Total Sample (n = 1,230)	*CWK-CT* (n = 539)	*CWK-T* (n = 294)	Comparison (n = 397)
Gender				
Male	608 (49.6)	265 (49.3)	143 (49.0)	200 (50.6)
Female	617 (50.4)	273 (50.7)	149 (51.0)	195 (49.4)
Grade				
3	52 (4.2)	–	45 (15.4)	7 (1.8)
4	1,123 (91.7)	517 (96.1)	218 (74.7)	388 (98.2)
5	50 (4.1)	21 (3.9)	29 (9.9)	–
Survey language				
English	875 (74.8)	364 (70.8)	236 (82.5)	275 (74.3)
Spanish	206 (17.6)	112 (21.8)	34 (11.9)	60 (16.2)
Both	89 (7.6)	38 (7.4)	16 (5.6)	35 (9.5)
Ethnicity				
Hispanic	1,035 (84.1)	454 (84.2)	240 (81.6)	341 (85.9)
White	124 (10.1)	60 (11.1)	27 (9.2)	37 (9.3)
American Indian	34 (2.8)	11 (2.0)	14 (4.8)	9 (2.3)
Black	14 (1.1)	5 (0.9)	6 (2.0)	3 (0.8)
Asian	7 (0.6)	1 (0.2)	1 (0.3)	5 (1.3)
Not available	16 (1.3)	8 (1.5)	6 (2.0)	2 (0.5)
Cooks	983 (83.2)	435 (84.0)	235 (85.4)	313 (81.3)
Makes food with friends[a]	743 (61.6)	360 (67.9)	167 (58.6)	216 (55.1)
Makes food with family	1,091 (89.9)	483 (90.8)	256 (88.6)	352 (89.6)

CWK-CT indicates the *Cooking With Kids* cooking and tasting curriculum; *CWK-T*, *Cooking With Kids* tasting-only curriculum. Data are shown as n (%).

[a]Mean pretest responses were significantly different between treatment groups ($\chi^2 = 17.04$; $P < .001$).

Table 2. Cooking Self-Efficacy Change[a] From Pretest to Posttest, by Treatment, Gender, and Cooking Status

	***CWK-CT* (n = 442)**				***CWK-T* (n = 226)**				**Comparison (n = 312)**			
Self-efficacy change	**Mean**		**SEM**		**Mean**		**SEM**		**Mean**		**SEM**	
Treatment	1.6		0.29		1.4		0.43		1.2		0.35	
Gender	Male (n = 215)		Female (n = 227)		Male (n = 108)		Female (n = 118)		Male (n = 156)		Female (n = 156)	
	Mean	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*
	1.9	0.39	1.3	0.44	2.4	0.55	0.5	0.67	0.8	0.44	1.7	0.54
Cooking status[b]												
Yes	1.4	0.35	0.5	0.33	0.8	0.49	0.6	0.44	0.4	0.41	1.0	0.39
	(n = 172)		(n = 196)		(n = 87)		(n = 105)		(n = 121)		(n = 136)	
No	2.3	0.69	2.0	0.82	4.0	0.99	0.3	1.26	1.2	0.77	2.4	1.02
	(n = 43)		(n = 31)		(n = 21)		(n = 13)		(n = 35)		(n = 20)	
Self-efficacy pretest	**Mean**		**SEM**		**Mean**		**SEM**		**Mean**		**SEM**	
Treatment	33.8[1]		0.29		33.2[1,2]		0.42		32.6[2]		0.34	
Gender[c]	Male		Female		Male		Female		Male		Female	
	Mean	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*
	33.1	0.38	34.4	0.43	31.5	0.54	35.0	0.65	32.1	0.43	33.1	0.53
Cooking status [d]												
Yes	34.3	0.34	36.5	0.32	34.2	0.47	36.7	0.43	34.3	0.40	35.0	0.38
No	31.9	0.68	32.3	0.80	28.7	0.97	33.3	1.23	29.9	0.75	31.2	0.99
Self-efficacy posttest	**Mean**		**SEM**		**Mean**		**SEM**		**Mean**		**SEM**	
Treatment	35.3[1]		0.27		34.7[1,2]		0.39		33.8[2]		0.32	
Gender[e]	Male		Female		Male		Female		Male		Female	
	Mean	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*
	35.0	0.35	35.7	0.40	33.9	0.50	35.5	0.61	33.0	0.40	34.7	0.49
Cooking status[f]												
Yes	35.7	0.32	37.1	0.30	35.0	0.44	37.3	0.40	34.7	0.38	36.0	0.35
No	34.2	0.63	34.3	0.74	32.7	0.90	33.7	1.15	31.2	0.70	33.5	0.92

CWK-CT indicates the *Cooking With Kids* cooking and tasting curriculum; *CWK-T*, *Cooking With Kids* tasting-only curriculum.
Mean values within a row with unlike superscript numbers were significantly different ($P < .001$).
[a]Five response options were provided for this scale. Possible scores ranged from 8 to 40. Higher scores indicated a greater self-efficacy. n for pretest and posttest cells are the same as shown for the change cells; [b]Mean difference between those who cook (mean, 0.8; SEM, 0.17; n = 817) and do not cook (mean, 2.0; SEM, 0.39; n = 163), $F = 8.30$, $P = .004$; [c]Mean difference between males (32.2; SEM, 0.26; n = 479) and females (34.2; SEM, 0.31; n = 501), $F = 23.23$, $P < .001$; [d]Mean difference between those who cook (35.2; SEM, 0.16; n = 817) and do not cook (31.2; SEM, 0.38; n = 163), $F = 92.96$, $P < .001$. Interaction between treatment and gender was significant, $F = 3.16$, $P = .043$; [e]Mean difference between males (33.9; SEM, 0.24; n = 479) and females (35.3; SEM, 0.29; n = 501), $F = 12.78$, $P < .001$; [f]Mean difference between those who cook (36.0; SEM, 0.15; n = 817) and do not cook (33.3; SEM, 0.35; n = 163), $F = 51.20$, $P < .001$.

Table 3. Cooking Attitude Change[a] From Pretest to Posttest, by Treatment, Gender, and Cooking Status

	***CWK-CT* (n = 440)**		***CWK-T* (n = 223)**		**Comparison (n = 309)**	
Attitude change	**Mean**	**SEM**	**Mean**	**SEM**	**Mean**	**SEM**
Treatment	0.6	0.21	0.0	0.31	0.4	0.25
Gender[c]	Male (n = 214)	Female (n = 226)	Male (n = 106)	Female (n = 117)	Male (n = 153)	Female (n = 156)
	Mean *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*
	0.8 0.28	0.3 0.32	–0.1 0.40	0.0 0.48	–0.1 0.32	0.8 0.39
Cooking status[b]						
Yes	–0.3 0.25 (n = 169)	0.2 0.23 (n = 196)	–0.5 0.36 (n = 85)	0.0 0.32 (n = 104)	–0.5 0.30 (n = 119)	0.1 0.28 (n = 136)
No	1.9 0.49 (n = 45)	0.5 0.60 (n = 30)	0.3 0.72 (n = 21)	0.1 0.91 (n = 13)	0.2 0.56 (n = 34)	1.6 0.73 (n = 20)
Attitude pretest	**Mean**	**SEM**	**Mean**	**SEM**	**Mean**	**SEM**
Treatment	26.4[1,2]	0.18	26.8[1]	0.26	26.0[2]	0.21
Gender[c]	Male	Female	Male	Female	Male	Female
	Mean *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*
	25.5 0.23	27.3 0.27	26.0 0.33	27.6 0.40	25.3 0.27	26.7 0.33
Cooking status[d]						
Yes	27.1 0.21	28.3 0.20	27.5 0.30	28.3 0.27	27.2 0.25	27.9 0.23
No	23.9 0.41	26.2 0.50	24.4 0.60	26.9 0.76	23.3 0.47	25.4 0.61
Attitude posttest	**Mean**	**SEM**	**Mean**	**SEM**	**Mean**	**SEM**
Treatment	27.0	0.20	26.8	0.29	26.3	0.24
Gender[e]	Male	Female	Male	Female	Male	Female
	Mean *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*
	26.3 0.26	27.6 0.30	25.9 0.37	27.6 0.45	25.1 0.30	27.5 0.37
Cooking status[f]						
Yes	26.8 0.24	28.4 0.22	27.0 0.33	28.3 0.30	26.7 0.28	28.0 0.26
No	25.9 0.46	26.7 0.56	24.8 0.67	27.0 0.85	23.5 0.53	27.0 0.69

CWK-CT indicates the *Cooking With Kids* cooking and tasting curriculum; *CWK-T*, *Cooking With Kids* tasting-only curriculum.
Mean values within a row with unlike superscript numbers were significantly different ($P < .05$).
[a]Five response options were provided for this scale. Possible scores ranged from 6 to 30. Higher scores indicated a more positive attitude. n for pretest and posttest cells is the same as shown for the change cells; [b]Mean difference between those who cook (–0.2; SEM, 0.12; n = 809) and do not cook (0.8; SEM, 0.28; n = 163), $F = 9.08$, $P = .003$; [c]Mean difference between males (25.6; SEM, 0.16; n = 473) and females (27.2; SEM, 0.19; n = 499), $F = 39.93$, $P < .001$; [d]Mean difference between those who cook (27.7; SEM, 0.10; n = 809) and do not cook (25.0; SEM, 0.23; n = 163), $F = 110.44$, $P < .001$. Interaction between gender and cooking status was significant, $F = 7.49$, $P = .006$; [e]Difference between males (25.8; SEM, 0.18; n = 473) and females (27.6; SEM, 0.22; n = 499), $F = 39.73$, $P < .001$; [f]Mean difference between those who cook (27.6; SEM, 0.11; n = 809) and do not cook (25.8; SEM, 0.26; n = 163), $F = 37.66$, $P < .001$.

because the correlations between them were small (data not shown), which indicated that they measured distinct factors.

Cooking Self-Efficacy

Table 2 presents changes in reported cooking SE from pretest to posttest. Although all groups increased SE over the course of the study, those who reported at pretest that they did not cook showed significantly greater improvement in SE for food preparation (eg, measuring ingredients, following recipe directions, making a snack with vegetables) with more than 2.5 times greater improvement in those who did not cook. The *CWK-CT* treatment students had the largest SE gain, even after controlling for their greater pretest SE ($F = 4.65$; $P = .01$). The *CWK-T* males who reported that they did not cook demonstrated the highest increases in SE (although not significantly different from females). Interestingly, unlike the cooking status effect, the significant gender effect apparent at both pretest and posttest disappeared when considering treatment impact. In addition, a significant interaction between gender and treatment ($F = 4.37$; $P = .08$) revealed that males in the intervention groups showed significantly lower pretest SE than females; this was not noted in the comparison group.

Cooking Attitudes

Table 3 presents AT results. At pretest, *CWK* group differences were significant ($F = 3.12$; $P = .05$); *CWK-T* AT was the most positive. Students who reported previous cooking experience had significantly ($F = 155.38$; $P < .001$) more positive pretest AT (27.7; SEM, 0.10; n = 809) than those who did not cook (24.7; SEM, 0.22; n = 163). The significantly more positive AT reported at pretest and posttest by females and at pretest by females with cooking experience disappeared when assessing intervention impact. At pretest, males without cooking experience had a significantly less positive AT toward cooking than males who cooked; differences were not as striking in females. For both males and females, attitudinal improvement was greatest in students without prior cooking experience, with the largest difference in AT change noted between males without prior cooking experience (1.0; SEM, 0.33; n = 100) and males with cooking experience (−0.4; SEM, 0.17; n = 373).

Fruit and Vegetable Preferences

Changes in FVP, presented in Table 4, were significantly different by treatment, with greatest improvement noted for *CWK-CT*. Improvements were also significantly ($F = 4.58$; $P = 0.03$) greater for males (−1.7; SEM, 0.51; n = 465) than females (0.0; SEM, 0.62; n = 487). The *CWK-CT* and *CWK-T* males reported increases in FVP that were nearly 2.5 times greater than that for comparison males. The significant cooking status effect, apparent at both pretest and posttest, disappeared when considering impact. Changes in fruit preferences were examined separately from vegetables. Vegetable preference improved for *CWK-CT* and *CWK-T* and was significantly different ($P < .05$) from the comparison group (*CWK-CT*, 1.1; SEM, 0.47; *CWK-T*, 0.9; SEM, 0.69; comparison, −0.9; SEM, 0.57). Groups did not differ in changes in fruit preference (data not shown); all groups reported a slight improvement in fruit preference.

DISCUSSION

In this quasi-experimental study, 11 schools were assigned to 1 of 3 groups: those receiving *CWK-CT*, those receiving *CWK-T*, or a non-treatment comparison condition. Results indicated that this study of 1,230 fourth graders in schools in low-income neighborhoods supported participation in *CWK*, especially for males with limited cooking experience. Significant gains in cooking SE for all non-cooker students were noted as well as improvements in AT toward cooking among these non-cookers. Fruit and vegetable preferences increased, especially for students in the *CWK-CT* condition and for males. Unlike SE and AT, the influence of cooker/non-cooker status on FVP disappeared, owing to the strength of intervention impact, with increases in vegetable preferences driving this result.

Cooking Self-Efficacy

Students in the *CWK-CT* condition reported significantly greater pretest cooking SE than students in the comparison condition, which suggests evidence of prior exposure to *CWK* in earlier grades. They also made significantly greater gains in cooking SE at posttest, which indicates that the curriculum dosage was sufficient. These results are similar to those reported by other experiential nutrition curricula.[8,13,14] Males and non-cookers reported lower pretest cooking SE scores and made the greatest gains over the testing period in both intervention and control conditions. Hispanic boys are much less likely to cook at home, compared with girls,[15-18] which suggests the influence of gender and ethnicity. The different results by gender are also congruent with findings from Bisset et al.[13] In their experiential 8-session cooking program, Little Cooks/Parental Networks, those authors noted significant differences in food preparation SE for fifth-grade girls compared with boys. Interestingly, gains in SE by *CWK-CT* students were not significantly greater than by *CWK-T* students, likely because of the high prevalence of cooking both at home and at school reported by students in all 3 conditions.

Cooking Attitudes

As might be expected, pretest attitudes toward cooking and eating foods that students, helped make were more positive for cookers than for non-cookers and for females more than for males. These differences remained at posttest, with no significant differences across conditions. This lack of treatment effect likely resulted from the high prevalence of cooking both at home and at school reported by students in all 3 conditions. However, male non-cookers made the biggest improvements in AT, especially those in the *CWK-CT* condition, although the sample size was small and the interaction of cooking status with gender was not statistically significant. Yeung[19] also found gender differences in attitudes toward cooking among 11- to

Table 4. Fruit and Vegetable Preference Change[a] From Pretest to Posttest, by Treatment, Gender, and Cooking Status

	***CWK-CT* (n = 431)**		***CWK-T* (n = 215)**		**Comparison (n = 306)**	
Preference change	**Mean**	**SEM**	**Mean**	**SEM**	**Mean**	**SEM**
Treatment	1.6[1]	0.56	1.5[1,2]	0.83	–0.5[2]	0.68
Gender[b]	Male (n = 210)	Female (n = 221)	Male (n = 101)	Female (n = 114)	Male (n = 154)	Female (n = 152)
	Mean *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*
	2.0 0.73	1.1 0.85	2.3 1.08	0.8 1.25	0.9 0.82	–1.9 1.10
Cooking status						
Yes	1.4 0.66 (n = 167)	0.8 0.61 (n = 192)	1.3 0.94 (n = 82)	0.0 0.85 (n = 101)	0.1 0.78 (n = 119)	1.2 0.73 (n = 135)
No	2.7 1.30 (n = 43)	1.4 1.58 (n = 29)	3.2 1.95 (n = 19)	1.5 2.36 (n = 13)	1.6 1.44 (n = 35)	–4.9 2.06 (n = 17)
Preference pretest	**Mean**	**SEM**	**Mean**	**SEM**	**Mean**	**SEM**
Treatment	68.8	0.71	67.8	1.05	68.1	0.87
Gender[c]	Male	Female	Male	Female	Male	Female
	Mean *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*
	68.2 0.92	69.5 1.07	65.2 1.37	70.5 1.59	67.4 1.04	68.8 1.39
Cooking status[d]						
Yes	69.1 0.83	71.5 0.78	67.7 1.19	71.8 1.07	68.8 0.99	68.8 0.93
No	67.3 1.64	67.5 2.00	62.7 2.47	69.2 2.99	66.0 1.82	68.9 2.61
Preference posttest	**Mean**	**SEM**	**Mean**	**SEM**	**Mean**	**SEM**
Treatment	70.4[1]	0.68	69.4[1,2]	1.01	67.6[2]	0.83
Gender	Male	Female	Male	Female	Male	Female
	Mean *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*	*Mean* *SEM*
	70.2 0.88	70.6 1.03	67.5 1.32	71.2 1.52	68.3 0.99	67.0 1.33
Cooking status[e]						
Yes	70.5 0.80	72.3 0.75	69.0 1.14	71.8 1.03	69.0 0.95	70.0 0.89
No	69.9 1.58	68.9 1.92	65.9 2.37	70.7 2.87	67.6 1.75	63.9 2.51

CWK-CT indicates the *Cooking With Kids* cooking and tasting curriculum; *CWK-T*, *Cooking With Kids* tasting-only curriculum.
Mean values within a row with unlike superscript numbers were significantly different ($P = .02$).
[a]Five response options were provided for this scale. Possible scores ranged from 18 to 90. Higher scores indicated greater preference. n for pretest and posttest cells are the same as shown for the change cells; [b]Mean difference between males (1.7; SEM, 0.51; n = 465) and females (0.0; SEM, 0.62; n = 487), $F = 4.58$, $P = .033$; [c]Mean difference between males (66.9; SEM, 0.65; n = 465) and females (69.6; SEM, 0.79; n = 487), $F = 6.85$, $P = .009$; [d]Mean difference between those who cook (69.6; SEM, 0.40; n = 796) and do not cook (66.9; SEM, 0.94; n =156), $F = 6.97$, $P = .008$; [e]Mean difference between those who cook (70.4; SEM, 0.38; n = 796) and do not cook (67.8; SEM, 0.90; n = 156), $F = 6.90$, $P = .009$.

18-year-old Hong Kong students surveyed (n = 836). She reported that more boys believed that only girls should cook and that more girls reported that their parents taught them how to cook. Bissett and colleagues[13] also reported gender differences in the belief that cooking skills are important for eating healthfully, with girls and program participants agreeing with this concept significantly more than boys.

Fruit and Vegetable Preferences

The significant treatment effect for improvements in FVP seen with *CWK-CT* students was similar to that reported by other experiential cooking programs that emphasize these food groups.[13,14,20] Greater preferences for fruits and vegetables have been strongly associated with higher intake.[20-23] As with cooking SE and AT, gender differences were noted with FVP in this study. The literature is replete with evidence of girls' greater preference for FV.[23-25] At pretest, boys in both treatment conditions reported poorer preferences for FV compared with girls.

As reported above, improvements in vegetable preferences mirrored the overall FVP gains for both intervention groups; fruit preferences did not follow this trend. This suggests that the gains in vegetable preferences were driving the change in FVP scores. Differences in preferences for fruits compared with vegetables have been noted in many studies of school-aged children throughout the world.[26-28]

A recent review of school-based programs' impact on fruit and vegetable intake among children noted moderate improvements in fruit intake but minimal impact on vegetable intake.[29] Of the 21 interventions reviewed, however, only 3 included food preparation or tasting activities for the students. The others focused on non-experiential activities such as fruit and vegetable provision or distribution programs as intervention strategies. Those authors noted that barriers to vegetable intake among children must be identified and addressed to effectively increase their intake. In a recent meta-analysis of gardening programs, Langelotto and Gupta[30] noted the strength of impact these programs had on vegetable consumption compared with more traditional nutrition education, and hypothesized that gardening increased children's access to vegetables and reduced their reluctance to try new foods. The results of this study also indicate that direct experience with vegetables can have a positive effect on preferences for these foods. Similar improvements in vegetable preferences were noted with a vegetable-focused fourth-grade nutrition education program that included 4 tasting lessons, compared with students in a control condition.[31]

Study Limitations and Strengths

Limitations of this study include nonrandomized assignment to condition and the potential for students to have had prior *CWK* exposure because of the long history of the program in this school district. Impact evaluations of existing community health programs usually contend with this issue. In this study, treatment assignments were carefully made so that schools were assigned to conditions congruent with their prior exposure/non-exposure to *CWK*. An additional limitation was that expected changes in cognitive developmental growth were not monitored and therefore not included in the outcome analyses. Participants were predominantly low-income and Hispanic, which limited the generalization of findings to other populations. Another limitation was that the researchers measured FVP rather than dietary intake. However, FVP is strongly correlated with intake and has served as a proxy for intake[32]; given resource limitations, this was a viable alternative. Finally, although parents were encouraged to volunteer, this was only informally monitored. Future studies should encourage and more formally monitor parent involvement.

> Assessing children's prior cooking experience is important when measuring their dietary intake and food preferences.

Study strengths included participation of 2 student cohorts, thereby increasing sample size and enhancing internal reliability and generalizability, especially to Hispanic audiences. In addition, students were from 1 school district and instruments were valid and reliable and tested using cognitive interviews with the target audience. Also, unlike most similar studies, prior cooking experience was measured so that it could be studied as a moderator of cooking SE, AT, and food preferences. Finally, preferences for vegetables were analyzed separately from fruits so that important distinctions in their intervention-derived changes and influences on other factors were able to be determined and described, facilitating future curricular design.

> Involving children in cooking experiences can improve their cooking attitudes, self-efficacy, and preferences for vegetables.

IMPLICATIONS FOR RESEARCH AND PRACTICE

This study affirms that children's involvement in cooking and meal preparation and tasting will affect attitudes toward cooking, cooking SE, and preferences for vegetables. This is important because this involvement has been associated with improved nutrition goal setting and achievement, as well as important health and academic outcomes.[9,26,33] To better elucidate the effect of cooking interventions and tasting experiences, the authors recommend including assessment of dietary intake and a definition of prior cooking experience extending beyond the "yes or no" items used here. For example, frequency terms such as "a lot," "a little bit," and "hardly ever" could be tested. Including parent perspectives in the characterization of their child's cooking experience is also recommended. These findings also suggest that boys, especially those with little prior cooking experience,

benefit the most from this type of school-based program. In addition, this study supports testing the impact of gender- and culture-driven tailoring of nutrition curricula for fourth-grade students and a focus on enhancing positive experiences with vegetables.

> Boys especially benefit from cooking activities; consider this when planning interventions for boys.

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SUPPLEMENTARY DATA

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.jneb.2013.09.007.

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