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Omolola A. Adedokun
University of Kentucky, lola.adedokun@uky.edu

Jean M. Najor
University of Kentucky, jean.najor@uky.edu

Paula Plonski
University of Kentucky, paula.plonski@uky.edu

S. Brooke Jenkins-Howard
University of Kentucky, bjenkins@uky.edu

Anna Caroline Durr
University of Kentucky, caroline.durr@uky.edu

See next page for additional authors

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Authors

Omolola A. Adedokun, Jean M. Najor, Paula Plonski, S. Brooke Jenkins-Howard, Anna Caroline Durr, and Jackie Walters

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Omolola A. Adedokun
Jean Najor
Paula M. Plonski
Brooke Jenkins
Caroline A. Durr
Jackie Walters
University of Kentucky

Emerging research indicates that chronic illnesses exacerbated by obesity begin in childhood. While research continues to show that consumption of fruits and vegetables can lower rates of obesity, children in the United States often fall short of consuming the recommended daily intake of fruits and vegetables. Youth nutrition education and cooking education programs have emerged as proven strategies for promoting youth consumption of fruit and vegetables, and other factors (e.g., nutrition knowledge, food-related behaviors, food preferences, attitude toward cooking, and cooking self-efficacy) that mediate youth consumption of fruits and vegetables. The purpose of this study was to evaluate the impact of the Recipes for Life program, a field-trip-based nutrition education program, on fifth-grade students. Results showed that the program elicited pre-post improvements in students' content knowledge, cooking self-efficacy, and cooking attitudes.

Keywords: youth nutrition education, cooking self-efficacy, cooking attitudes, recipes for life program

Introduction

Childhood obesity is one of the most pressing public health concerns of the 21st century, as obesity rates have increased steadily over the last four decades in developed countries, including America. Centers for Disease Control and Prevention data from 2017–2018 indicate obesity rates in the United States among children ages six to eleven have increased to 20.3% from 4.0% in the early 1970s (Fryar et al., 2020). Emerging research indicates that chronic illnesses exacerbated by obesity (e.g., type 2 diabetes and coronary heart disease) begin in childhood (Sahoo et al., 2015). Research findings show that higher levels of fruit and vegetable consumption are associated with lower levels of obesity (Yu et al., 2018); however, both adults and children in the United States often fall short of consuming the recommended daily intake of fruits and vegetables.

Youth nutrition education and cooking education programs are proven strategies for enhancing youth consumption of fruit and vegetables and their willingness to try new foods (Bai et al., 2018; Cunningham-Sabo et al., 2013, 2014). Moreover, several studies have also documented the positive effects of nutrition education on the factors (e.g., nutrition knowledge, food-related behaviors, food preferences, attitude toward cooking, and cooking self-efficacy) that mediate youth consumption of fruits and vegetables (Hersch et al., 2014; Nelson et al., 2013; Wall et al., 2012). In their evaluation of a community-based nutrition and cooking education program for low-income elementary and middle school students, Jarpe-Ratner and colleagues (2016) reported pre-post improvements in students' nutrition knowledge and cooking self-efficacy. Likewise, Wolfe and Dollahite (2021) reported that a school-based cooking curriculum for third through sixth-grade students elicited an increase in fruit and vegetable intake and an increased likelihood of trying new foods. Oakley et al. (2017) reported that a peer-led culinary skills intervention for adolescents improved sixth- and seventh-grade students' cooking attitudes; however, the gains did not persist at three and six months post-program follow-ups. Cunningham-Sabo and Lohse (2014) found that pre-post improvements in cooking attitudes were higher among male students, with or without previous cooking experience. Studies evaluating classroom-based nutrition education programs that incorporate fruit and vegetable tasting components have also reported increased fruit and/or vegetable preferences, intention to consume more vegetables, and the likelihood of trying new foods (Bai et al., 2018; Cunningham-Sabo et al., 2014; Gold et al., 2017; Wolfe et al., 2021).

While these studies point to the benefits of nutrition education programs for youth in general, the advantages for limited-resource youth cannot be overemphasized. Nutrition education and cooking programs provide youth from socio-economically disadvantaged backgrounds with opportunities to learn cooking and food preparation skills that otherwise may be unavailable to them. Several Cooperative Extension programs targeting Supplemental Nutrition Assistance Program (SNAP)-eligible youth audiences have shown positive impacts on nutrition knowledge, cooking self-efficacy, cooking attitude, and increased fruit and vegetable consumption (Adedokun et al., 2020; Cunningham-Sabo et al., 2014; Gold et al., 2017; Wall et al., 2012).

The advantages notwithstanding, a notable gap in the literature is that much of youth nutrition programming tends to focus on interventions implemented in classroom and after-school settings. For example, the Cooking with Kids program (Cunningham-Sabo et al., 2013, 2014), the Chefs Adopt a School program (Caraher et al., 2013), and the Cookshop program (Liquori et al., 1998) all include in-class student food preparation elements. However, some participating schools lacked the resources to allow in-class food preparation and could only allow tasting of prepared food. Cunnigham-Sabo and Lohse's 2014 article used this variation to compare the outcomes of the Cooking with Kids curriculum implementation involving both cooking and tasting to the same curriculum with tasting only. Their results indicated a greater improvement in fruit and vegetable preference for participants in the hands-on food preparation (cooking) group.

Only a few programs found in the literature mention the inclusion of experiential learning beyond the classroom. Some of these experiences include working in school gardens either during or after school (Gibbs et al., 2013; Jaenke et al., 2012; Parmer et al., 2009). Others, like the Common Threads program (Jarpe-Ratner et al., 2016), are held after school at school locations, and programs like CHEF Bites (Schmidt et al., 2022) are held at Boys and Girls Clubs after the school day. Fewer programs combine classroom nutrition and cooking instruction with opportunities for field trips such as field trips to farmers markets (e.g., Davis et al., 2011), community farms (e.g., Thomas et al., 2011), and other local food systems (e.g., Harley et al., 2018).

The purpose of this study was to evaluate the impact of the University of Kentucky's Recipes for Life (RFL) program on student outcomes. Specifically, the study reports on the extent to which the program enhanced students' content knowledge, cooking self-efficacy, cooking attitudes, intentions to eat more fruits and vegetables, try new foods, and help prepare food at home.

Program Description

The Recipes for Life (RFL) program is a hands-on cooking and nutrition education program for fifth-grade students. The two core components of the program are the implementation of RFL curriculum lessons in the classroom and a field trip where students are transported from their schools to the county Extension office to gain firsthand experience in recipe preparation. The University of Kentucky's Nutrition Education Program (NEP) developed RFL to teach limited-resource fifth-grade students about nutrition education, food and kitchen safety, and food preparation skills. The goal of the program is to enhance students' content knowledge, cooking self-efficacy, cooking attitudes, and intentions to try new foods, eat more fruits and vegetables, and help prepare food at home. Family and Consumer Sciences (FCS) and 4-H Youth Development Extension educators implemented RFL during school hours, with support from NEP program assistants and adult volunteers.

Prior to program implementation, FCS and 4-H Extension educators participated in a half-day in-person training conducted by University of Kentucky Extension specialists. Training topics included a description of the RFL program model and learning objectives; school recruitment strategies; demonstration of the curriculum resources, content, and recipes; strategies for partnering with school administrators/teachers; program planning and evaluation procedures; and program implementation requirements (e.g., equipment and facilities needed and a timeline for implementation). Extension educators, in turn, delivered training to program assistants and adult volunteers who provided support during program implementation. Topics covered during volunteer and program assistant training included a description of lessons and content of the RFL curriculum, strategies for interacting with students, and hands-on recipe preparation.

The RFL program implementation plan stipulated adherence to the core program components (i.e., curriculum lessons in the classroom along with the field trip to the Extension office for

recipe preparation) to enhance implementation fidelity across counties. But Extension educators were also afforded some flexibility in program delivery to accommodate differences in their local contexts. Program delivery decisions were predicated upon contextual factors, including willingness of the school to allow in-class lesson delivery, length of the field trip approved by the school (i.e., half versus whole day), and the number of adult volunteers available to assist with implementation. Initial planning with schools included discussion regarding field trip scheduling, program description, and program alignment with school curriculum. Extension educators coordinated with school personnel in person or virtually. Educators had the choice of delivering the lessons during the field trip (i.e., at the Extension office) or before the field trip (i.e., in the classroom). Table 1 provides an overview of the curriculum lessons. Each lesson required 15–30 minutes to implement. Educators who chose to deliver lessons before the field trip typically visited the school and taught the lessons during class instruction time (e.g., as part of the school's health class).

Table 1. Curriculum Lesson Overview

Lesson Title	Concepts Covered
MyPlate and Nutrition Concepts	What it means to be healthy, how eating a variety of foods provides the body with different nutrients, and how to use MyPlate to choose healthy meals that include foods from all the food groups.
Handwashing	Why handwashing is important in food preparation, when to wash hands, and demonstration of the steps to clean hands properly.
Food Safety	Food safety issues that can arise in the kitchen, including personal hygiene, demonstration of proper dish and kitchen cleaning, demonstration of ways to prevent cross-contamination, how to wash produce, demonstration of using a meat thermometer correctly, and how to store foods safely.
Kitchen Safety	Burn avoidance, fire safety, and using appliances safely.
Knife Safety and Skills	How to properly hold and use a knife, how to use a cutting board, how to safely hold and guide food while cutting, and basic food-cutting techniques.
Measuring Skills	Properly identify measuring tools and demonstration of how to measure ingredients accurately.
Meal Planning	Concepts of meal planning and time management problem-solving skills using activity sheets.
Recipe Identification and Modification	Basic parts of a recipe and problem-solve practical issues like doubling or halving a recipe.

The RFL program model incorporates experiential learning in a field trip format. Kolb (1984) defined experiential learning as a process whereby knowledge is created through a transformative learning experience. Kolb described learning as a continuous process that is interactive, reflective, and applied. In line with Kolb's theory, RFL included interactive applied learning during the field trip to Extension offices, where students had access to large standard kitchen spaces. Extension educators could choose to have students remain at one assigned workstation or rotate to different stations. Extension educators also chose the number of recipes prepared by students, with some selecting to have students make one or multiple recipes at one

workstation, while other educators selected to have students rotate workstations to prepare multiple recipes. All options resulted in a total of three to eight prepared recipes. Depending on the size of the group, the selected recipes were prepared multiple times to allow a full serving for each student during the meal. The RFL curriculum includes a total of twenty-six recipes that fall into five different categories: starters and snacks, meats and main dishes, vegetable salads and sides, breads and bars, and fruit recipes. Typically, one recipe from each category was prepared.

Adult volunteers led each station to facilitate critical thinking about the process of food preparation, help students to reflect on and consider broader skills gained from the lessons, and consider ways to apply concepts learned in daily life. The recipes represented a variety of food groups, meals, and food preparation techniques. The recipes appealed to students while also meeting NEP standards for nutrition content. For example, the oven-baked chicken nugget recipe was an option. Chicken nuggets are a popular food for students. By adjusting the recipe to make them healthier, with less sodium and saturated fat than the typical fried version, students recognize that their favorite foods can be both healthy and delicious. Additionally, most recipes incorporated fruits and vegetables (e.g., sizzlin' chicken and rice, broccoli spoonbread, easy cheesy spinach, zucchini, and carrot muffins) with the intention to encourage consumption of these food groups beyond the program.

After recipe preparation, students reconvened in a large group and shared a meal consisting of what they had prepared. The shared meal afforded students additional opportunities for reflective processing of lessons learned, as volunteers asked open-ended questions about how students intended to use their new knowledge of nutrition and food preparation. At the end of the field trip, students were provided with cooking booklets that included food preparation information and recipes, along with reinforcement items (e.g., measuring cups, cutting board, measuring spoons, and aprons) to support nutrition and cooking behavior change.

Methods

Evaluation Design

Evaluation of the impact of RFL on student outcomes involved a single-sample pretest-posttest design. The University of Kentucky Institutional Review Board approved the study protocol. Evaluation data reported in this study came from students (N = 753) in the five rural counties that implemented RFL and provided useful outcome evaluation data between the spring of 2019 and before the onset of the COVID-19 pandemic in the spring semester of 2020. Table 2 provides a description of implementation characteristics in each of the five counties.

Table 2. County and Student Characteristics

County	# of Students	# Recipes Prepared by Students	FRL (%)	Male (%)	Female (%)
County A	157	2	57	70 (44.6)	87 (55.4)
County B	89	5	64	41 (46.1)	44 (53.9)
County C	120	1	60	58 (48.7)	61(51.3)
County D	322	3	41	154 (47.8)	168 (52.2)
County E	65	1	56	20 (30.8)	45 (69.2)
Total	753			343 (45.6)	409 (54.4)

Note. # = Number; FRL (%) = Free and Reduced Lunch percentage

Educators administered a multi-section pre-posttest before and after program participation to assess the program's impact on students. Specifically, the evaluation instrument assessed students' knowledge of lesson content (e.g., MyPlate, food safety, kitchen safety, food preparation skills), cooking self-efficacy, and cooking attitudes. The posttest also assessed students' intentions to make behavioral changes after participating in the program (i.e., eating more fruits and vegetables, helping prepare food at home, and trying new foods). Between 2016 and the spring of 2018, RFL program evaluators, Extension educators, and content specialists reviewed pilot versions of the pre-posttest instrument for content validity and alignment with curriculum learning outcomes. Content specialists used the findings of the face and content validity assessments to identify problematic questions and later removed them from the pre-posttest.

Measurement of Program Outcome Variables

Content knowledge was assessed with seventeen items targeting students' understanding of the concepts covered in the curriculum, particularly food safety (e.g., food storage to avoid contamination), kitchen safety (e.g., knife skills and positioning of the pot while cooking on the stove) and food preparation (e.g., order of meal preparation and measuring ingredients). Students' responses to these questions were coded as 1 (*correct*) or 0 (*incorrect*) and summed to create an overall knowledge score (with a maximum total score of 17) at pretest and posttest.

Cooking self-efficacy was measured using a modified version of the Cooking with Kids self-efficacy scale (Cunningham-Sabo et al., 2014; Woodruff et al., 2013). The scale included eight items regarding students' self-perceived ability to perform certain cooking activities (e.g., make a salad, cut food with a knife, follow a recipe, etc.). Response categories for the eight items ranged from 1 (*very hard*) to 4 (*very easy*). Students' responses to these eight items were combined to create a summated rating scale for a maximum total score of 32 on the scale. Cronbach's alpha for the scale was .68 at pretest and .79 at posttest. Exploratory factor analyses were conducted to justify combining the eight items into a single variable. Factor loadings for the items ranged from .50 to .63 at pretest and .53 to .73 at posttest (Costello & Osborne, 2005). All factor loadings were statistically significant at $p < .05$.

Cooking attitudes were measured as a total score on seven items regarding students' feelings about cooking, measuring ingredients, making food with their family/friends, etc. Response categories for the items ranged from 1 (*really don't like*) to 5 (*really like*). Students' responses to the items were combined to create a summated rating scale, with 35 being the maximum possible total score. Cronbach's alpha for the scale was .73 at pretest and .78 at posttest. Exploratory factor analyses were conducted to justify combining the items into a single variable. Factor loadings for the items ranged from .58 to .78 at pretest and .59 to .78 at posttest (Costello & Osborne, 2005), and all factor loadings were statistically significant at $p < .05$.

The posttest also included questions regarding students' intentions to eat more fruits and vegetables, help prepare foods at home, and try new foods after participating in the program. Response categories for the items ranged from 1 (*strongly disagree*) to 4 (*strongly agree*). Response categories were collapsed into two—agree and strongly agree versus disagree and strongly disagree—for ease of analysis.

Data Analyses

Paired sample *t*-tests were used to examine pre-post changes in content knowledge, cooking self-efficacy, and cooking attitudes. As indicated in the program description, all program sites were required to implement the core program components (i.e., curriculum lessons in the classroom along with the field trip to the Extension office for recipe preparation) but were allowed flexibility regarding the length of the field trip, time of curriculum delivery, number of recipes prepared, and the choice of the same stations versus rotations during recipe preparation. Of note, implementation in County A was different from the other four counties. County A implemented a half-day field trip (others implemented full-day field trips), did not implement all lessons in the curriculum (County A omitted two lessons while others implemented the entire curriculum), and implemented lessons only during the field trip (others implemented lessons both before and during school visits, and during the actual field trip to Extension offices). Hence, independent sample *t*-tests were conducted to examine if the differences in implementation between County A and the other counties influenced student outcomes. For all dependent and independent samples *t*-tests, Cohen's (1998) effect sizes (*d*) were calculated to examine the practical significance of group differences. Based on the benchmark suggested by Cohen, *d* values of 0.2 are described as small (negligible), 0.5 as medium, and values of ≥ 0.8 as large effect sizes.

Three separate linear regression models were estimated to examine the effects of the number of recipes prepared, a key implementation characteristic, on student outcomes (i.e., content knowledge, cooking self-esteem, and cooking attitudes). Each of the regression models included students' self-reported sex and their baseline scores as control variables. The coefficient of determination, R^2, was used to assess the percentage of variability in the dependable variable explained by each model. Finally, descriptive statistics (i.e., frequencies and percentages) were used to summarize students' responses to post-participation questions regarding their intentions

to eat more fruits and vegetables, help prepare food at home, and try new foods. All analyses were conducted in SPSS (version 27.0), with the statistical significance level set at $p < 0.05$.

Findings

Results of the paired sample *t*-tests comparing pre- and post-participation measures of program outcomes showed statistically significant improvements in students' content knowledge, cooking self-efficacy, and cooking attitudes (see Table 3). On average, content knowledge improved by 2.9 points from 10.3 in the pretest to 13.2 in the posttest, out of a maximum score of 17. Cooking self-efficacy improved by 2.4 points from 25.5 in the pretest to 27.9 in the posttest out of a maximum of 32. Likewise, cooking attitudes improved by 1.6 points from 29.6 in the pretest to 31.2 in the posttest, out of a maximum of 35. The effect sizes for these pre-post improvements signified moderate to large effects (i.e., an effect size of 1.2 for content knowledge, 0.6 for cooking self-efficacy, and 0.4 for cooking attitudes), indicating that the improvements were not only statistically significant but also practically meaningful.

Table 3. Pre-Post Changes in Content Knowledge, Cooking Self-efficacy, & Cooking Attitudes (N= 753)

Student Outcomes	Pretest Mean (SD)	Posttest Mean (SD)	*p*	Effect Size
Content Knowledge	10.3 (2.2)	13.2 (2.4)	< .001	1.2
Cooking Self-efficacy	25.5 (3.9)	27.9 (3.9)	< .001	0.6
Cooking Attitudes	29.6 (4.5)	31.2 (4.1)	< .001	0.4

Note. SD = Standard Deviation; *p* = Statistical Significance Level

Table 4 summarizes the findings of the independent samples *t*-tests comparing outcomes between students in County A and other counties. The results showed that students in County A had statistically similar outcomes as their counterparts in other RFL counties. The results showed nonsignificant group differences in entry, exit, and gain scores in content knowledge, cooking self-efficacy, and cooking attitudes.

Table 4. Independent Samples t-tests Comparing Student Outcomes Between County A and Other Counties (N= 753)

Student Outcomes		County A Mean (SD)	Other Counties Mean (SD)	*p*	Effect Size
Content Knowledge	Entry	10.4 (2.4)	10.2 (2.2)	.47	< 0.1
	Exit	13.0 (2.1)	13.3 (2.4)	.22	0.1
	Gain (Exit-Entry)	2.6 (2.2)	3.1 (2.6)	.06	0.2
Cooking Self-efficacy	Entry	25.4 (4.3)	25.4 (3.9)	.93	< 0.1
	Exit	28.1 (4.3)	27.8 (3.8)	.44	< 0.1
	Gain (Exit-Entry)	2.7 (4.2)	2.3 (3.7)	.34	< 0.1
Cooking Attitudes	Entry	29.5 (4.4)	29.5 (4.5)	.93	< 0.1
	Exit	31.6 (4.1)	31.0 (4.2)	.10	0.1
	Gain (Exit-Entry)	2.3 (1.4)	2.4 (1.9)	.78	< 0.1

Note. SD = Standard Deviation; *p* = Statistical Significance Level

Table 5 presents the results of the linear regression models that examined the effects of the number of recipes prepared on student outcomes. The results showed a statistically significant positive effect of the number of recipes prepared on content knowledge and cooking self-efficacy, but not cooking attitudes. Specifically, a unit increase in the number of recipes prepared increased pre-post gains in content knowledge by 0.17 points and pre-post gains in cooking self-efficacy by 0.26 points. The R^2 values for the models were .28 for Model 1, .25 for Model 2, and.10 for Model 3. The R^2 values indicate that Model 1 explained 28% of the variability in content knowledge, Model 2 explained 25% of the variability in cooking self-efficacy, and Model 3 explained 10% of the variability in cooking attitudes. These R^2 values suggest that there are still unexplained variabilities in each of the dependent variables.

Table 5. Regression Models Estimating the Effects of Number of Recipes Prepared on Content Knowledge, Cooking Self-efficacy, and Cooking Attitudes

Independent Variables	**Dependent Variables**		
	Model 1 Content Knowledge	**Model 2 Cooking Self-efficacy**	**Model 3 Cooking Attitudes**
Intercept	8.21 (0.46)*	13.88 (0.88)*	2.58 (0.48)*
Number of recipes prepared	0.17 (0.07)*	0.26 (0.10)*	0.08 (0.06)
Sex (Female vs Male)	0.22 (0.16)	-0.03 (0.25)	-0.02 (0.14)
Baseline Scores	-0.59 (0.04)*	-0.46 (0.03)*	-0.01 (0.02)

Note. *$p < .05$

Regarding student intentions, 91% of respondents plan to eat more fruits, 77% plan to eat more vegetables, 90% plan to try new foods, and 92% plan to help prepare foods at home.

Discussion and Implications

Overall, the findings suggest that RFL enhanced content knowledge, cooking self-efficacy, and cooking attitudes. These findings are similar to those of other youth nutrition and cooking education programs (Caraher et al., 2013; Cunningham-Sabo et al., 2014; Nelson et al., 2013; Wolfe et al., 2021). The findings also suggest that RFL promotes students' intentions to eat more fruits and vegetables, try new foods, and help prepare food at home after the program. In their evaluation of the *Choose Health: Food, Fun, and Fitness* curriculum for third- through sixth-grade students, Wolfe and Dollahite (2021) reported that the program elicited an increased likelihood of trying new foods.

Beyond the findings regarding the immediate effects of RFL on student outcomes, the results also offer insights into the potential effects of implementation characteristics on program outcomes and contribute to the identification and understanding of core versus optional program components. The results indicated statistically similar outcomes between participants in the counties that followed implementation requirements and the county that deviated from the requirements (i.e., County A). Unlike the other four counties, Extension educators in County A offered a half-day field trip, implemented lessons only during the field trip, and did not

implement all lessons in the curriculum. These findings suggest that the length of the field trip (half-day versus full-day), the omission of a few lessons from the curriculum, and the decision to implement lessons during and/or before the actual field trip may not be detrimental to student outcomes.

The results of linear regression models showed mixed results regarding the potential effects of the number of recipes prepared on student outcomes. On the one hand, the results showed statistically significant positive effects of the number of recipes prepared on pre-post gains in content knowledge and cooking self-efficacy. These findings are logical and not surprising. Recipe preparation is an opportunity for students to learn about nutrition concepts and to experience/practice cooking. On the other hand, the result showed nonsignificant effects of the number of recipes prepared on pre-post gains in cooking attitudes. These mixed findings warrant further studies to clarify program factors with the potential to promote or inhibit student outcomes. Such an implementation evaluation study would provide additional insights into the processes and conditions under which RFL successfully achieves its expected outcomes. For example, our data shows that the students in schools that implemented station rotation prepared at least three recipes (see Table 1). It is also logical to assume that full-day programs (versus half-day programs) may give students the opportunities to prepare additional recipes. Hence, further evaluation studies will help to clarify how the combination of station rotation and length of field trips influence the numbers of recipes prepared and student outcomes.

Limitations

This study is not without limitations. First, the study employed a single sample design with no comparison groups; hence, it is difficult to ascertain an empirical causal link between participation in RFL and the reported student outcomes. Second, the regression analyses explored the impact of only one program characteristic (number of recipes prepared) on student outcomes. Further evaluations of the program may explore the effects, if any, of other program characteristics such as station rotation, the experience of educators and volunteers, etc. Third, this study did not include sufficient demographic variables. For example, the pretest and posttest did not solicit information regarding students' race, ethnicity, or family income. Hence, the study is unable to offer any data-driven insights into how the program outcomes may differ by race. Likewise, the five participating counties were all rural counties. Hence, the study was unable to assess how program outcomes may differ between students in rural versus urban schools. The study did not include data on school characteristics and statistical comparisons across schools. Each Extension educator implemented in at least two schools within their county of assignment; however, four of the five educators did not collate student data by school. Hence, it was difficult to conduct school-level analyses. Future evaluations of RFL will collect data on school characteristics and examine how student outcomes differ by school.

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Omolola Adedokun is the Director of Evaluation for the University of Kentucky Cooperative Extension Service. Please direct correspondence about this article to Omolola Adedokun at lola.adedokun@uky.edu.

Jean Najor is a registered dietitian nutritionist and Program Coordinator II for the University of Kentucky Nutrition Education Program.

Paula M. Plonski was an Extension Evaluation Specialist for the University of Kentucky Nutrition Education Program.

Brooke Jenkins is an Extension Specialist for Curriculum Development for the University of Kentucky Nutrition Education Program.

Caroline Durr is an Extension Specialist for the University of Kentucky Nutrition Education Program.

Jackie Walters was a registered dietitian nutritionist and a Senior Extension Specialist for the University of Kentucky Nutrition Education Program.

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