*Research Article*

# A Randomized Controlled Trial of a Community-Based Nutrition Education Program for Low-Income Parents

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## ABSTRACT

**Objective:** Assess effectiveness of the Expanded Food and Nutrition Education Program on nutrition behaviors post-education and longitudinally.

**Design:** Switching replications randomized experimental design. Participants randomly assigned to immediate education (IE) or delayed education (DE). Participants in IE received intervention the first 8 weeks, and those in DE the second 8 weeks, with no intervention during alternate periods. Data were collected in 3 repeated measures.

**Participants:** Parents (n = 168 randomized; n = 134 completed) of children in 2 Head Start and 6 low-income schools.

**Intervention:** Eight weekly workshops, based on *Eating Right is Basic-Enhanced* adapted to incorporate dialogue approach with experiential learning.

**Main Outcome Measures:** Ten-item self-reported behavior checklist on nutrition, food resource management, food safety, and food security; responses on a 5-point scale reporting frequency of behavior.

**Analysis:** Chi-square, analysis of variance, and multiple regression.

**Results:** Groups were demographically similar. Both groups reported improved behaviors pre- to post-education ($P < .05$). There was no significant difference between groups at Time 1 (T1) or DE control period (T1 vs T2). Changed IE behavior was retained T2 to T3. A multiple regression model of overall change, controlling for T1 score and educator, showed significant improvement (n = 134, $\beta = 5.72$, $P < .001$).

**Conclusions and Implications:** Positive outcomes were supported by this experimental study in a usual program context, with reported behavior changes retained at least 2 months.


**Key Words:** low income, EFNEP, randomized controlled trial, longitudinal behavior change, Head Start, parents (*J Nutr Educ Behav*. 2014;46:102-109.)

## INTRODUCTION

Expanded Food and Nutrition Education Program (EFNEP), funded by the US Department of Agriculture and implemented by state land grant universities, targets low-income families with children. The goal is "to assist limited resource audiences in acquiring the knowledge, skills, attitudes, and changed behavior necessary for nutritionally sound diets, and to contribute to their personal development and the improvement of the total family diet and nutritional well-being."[1] Epidemiological evidence indicates that families with low socioeconomic status consume diets of poorer nutritional quality.[2,3] Although several contextual factors appear to contribute to this problem,[4-6] there is evidence that lack of nutrition knowledge can also be a contributing factor.[7,8] Nutrition education programs are designed to address this knowledge gap. Programs also teach management skills so that participants can make the most of limited financial and time resources when choosing food, thereby addressing lack of time and money.

EFNEP was begun in 1969. Education is delivered using an indigenous paraprofessional model with a goal of hiring educators from the communities in which they work; educators are trained and supervised by nutrition professionals.[1] This model brings necessary content expertise along with credibility offered by paraprofessional educators because of life experiences similar to those of program participants.

EFNEP has a well-established evaluation system[9] used in a pre-/post-education design that documents positive behavior change among EFNEP graduates.[10-15] Retention of this change has been reported.[10,13-16] However, rigorously designed studies are needed to test the hypothesis that nutrition education provided to low-income participants through

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community-based programs can improve nutrition behaviors. Few randomized controlled trials of EFNEP have been reported, and none included longitudinal retention of behavior change as part of a strong design.

The current study was designed to assess the effect of EFNEP education on reported nutrition behaviors and longitudinal retention of reported behavior change. The hypotheses were (1) participants completing at least 6 EFNEP sessions would report behaviors that significantly improve from pre- to post-education as compared to participants not enrolled in EFNEP; and (2) 8 weeks after graduation, participants would report behavior changes similar to those reported immediately post-education.

## METHODS

### Research Design

The study used a switching replications randomized experimental design,[17,18] with 2 8-week periods. Data were collected at 3 time points: at enrollment into the study (T1); 8 weeks later, between the 2 periods (T2); and 8 weeks later, when the study ended (T3). The intervention included an 8-week EFNEP nutrition workshop series implemented among 18 groups. Power analysis was conducted on historical EFNEP data collected pre- and post-intervention, with power set at 0.80 and $\alpha = .05$ to estimate sample size needed to demonstrate statistical significance in total scores. The results indicated that a total sample of 120 would be needed for the 4 groups. Based on group size and retention rates in the New York City program, participants were recruited to form 16 groups, as described below.

Participants were randomly assigned to 1 of 2 groups at each site, either immediate education (IE) or delayed education (DE). For the IE group, data were collected upon enrollment (T1), and the intervention period began the following week. No additional intervention occurred during the second period, allowing an assessment of retention of behavior change over these 8 weeks. For the DE group, no intervention occurred during the initial period, so any nutrition information received and behavioral changes made (T1 vs T2) represented secular trends. This method allowed the DE group to serve as a control during the first period, with the intervention occurring during the second period.

The switching replications randomized experimental design was appealing for several reasons. Education to control participants was delayed, but not denied. The design enabled study of retention effects for the group treated first. Demonstrating the utility of this design in a real-world setting was a secondary but important purpose of this study. The study was approved by the Cornell University Institutional Review Board. Participants provided written, informed consent.

### Study Sites and Educators

The study was carried out in New York City because of the large number of EFNEP participants available in this urban area. Study sites chosen to participate (2 Head Start and 6 schools) had a history of successfully recruiting EFNEP groups; a waiting list for EFNEP; and a site coordinator who was enthusiastic about the study, had a good working relationship with the educator, and was willing to help with recruitment of participants. Recruitment was by word of mouth and flyers posted in the participating sites. Each site hosted 2 groups (1 IE and 1 DE), except for 1 Head Start program, which hosted 4 groups (2 IE and 2 DE). Six experienced educators participated, each of whom worked with pairs of groups (IE and DE) at a given site.

### Participants

At each site, participants who were recruited were randomly assigned to either an IE or a DE group at that site. Eligible participants met EFNEP criteria of being parents or primary caregivers of children and having incomes at 185% or less of the federal poverty level.[19] Participants were 18 years of age or older, not previously enrolled in EFNEP, willing to accept random assignment, and available to participate over 6 months. The intervention included 8 educational sessions and an additional session that included a program graduation celebration and distribution of incentives. Participants who attended at least 6 sessions were considered graduated, and their data were included in the evaluation.

To assist with participant retention, incentives were provided to participants attending at least 6 of the 8 educational sessions and for whom data were gathered at each time period. Qualifying participants could choose either an electric skillet or $25 cash, and they were automatically entered into a raffle for a chance to win a canvas tote bag filled with kitchen tools.

### Intervention

The 8-session intervention was facilitated by 6 paraprofessional educators who routinely worked with the identified sites. They were trained in nutrition content and facilitation skills and had 2 or more years of experience delivering EFNEP. Educators were trained to meticulously follow the lesson plans to ensure fidelity to the protocol and consistency across groups.

The curriculum used was *Eating Right is Basic–Enhanced*,[20] a curriculum that is commonly used in EFNEP. The lessons were adapted to incorporate more visuals and a dialogue approach to learning that is based on adult learning theory incorporating principles described by Norris (eg, respect for and inclusion of each participant in the discussion, information that was relevant to and could be immediately applied in participants' lives, learning that engaged participants and allowed them to discover new knowledge themselves).[21] The educator was a facilitator of behavior change who motivated participants and supported the adoption or maintenance of behaviors conducive to long-term health. The program focused on improving knowledge, skills, and food choices with hands-on, dialogue-based activities that included preparation of healthy recipes and food tasting. Each session was designed on a "4A" rubric that included an *anchor*, in which the participants were invited to share their preexisting knowledge and experience, as well as challenges they were having applying new information; *add*, where new information was provided by the

educator; *apply*, during which participants engaged in hands-on activities designed to reinforce the *add* and discover knowledge; and *away*, where participants set goals related to the session that were revisited in the anchor the following week. The educational sessions were delivered weekly and included the topics and learning objectives outlined in Table 1.

## Instruments and Data Collection

The data collected were standard EFNEP evaluation data, but the study educators were trained to follow a strict data collection protocol to ensure consistency. Data were entered into the Evaluation Reporting System 4 (USDA, Washington, DC, 2007). All data were self-reported and included demographic characteristics (age, sex, race/ethnicity, family size, other adults in the household, and number of children) and the 10 EFNEP Behavior Checklist items used nationally by all EFNEP programs. The 10 items represent 4 behavioral constructs: diet quality (4 items: thinking about healthy food choices when planning for the family; preparing food without salt; using Nutrition Facts labels; feeding children breakfast); food safety (2 items: appropriate defrosting of food, maximum time for leaving food without refrigeration); food security (1 item: running out of food by the end of the month); and food resource management (3 items: planning meals ahead of time, comparing prices, shopping with a list). The 4 diet quality and 2 of the food resource management items, as well as the food security item, have been shown to have acceptable validity as compared to the Partial Healthy Eating Index (J. Anliker, W. Willis, R. Cox, oral presentation, Dallas, TX, September 13, 2001). Each construct exhibits internal reliability, and confirmatory factor analysis was used to verify the assignment of items to the behavioral constructs.[22] Participants responded on a 5-point scale

**Table 1.** Educational Topics and Learning Objectives of *Eating Right is Basic–Enhanced* Curriculum[20]

| Topics | Learning Objectives |
|---|---|
| Introduction and How Much Am I Eating? (Portion Sizes) | 1. Estimate and measure amounts of food from each MyPyramid[a] food group.<br>2. Contrast recommended amounts of food to typical intake.<br>3. Compare portion sizes of food items commonly consumed today vs 20 years ago. |
| MyPyramid and Grains Group | 1. Using MyPyramid key messages and recommended amounts, choose food items that represent 1 day's intake from the grains group.<br>2. Read food labels and ingredients list on grain products to identify whole grains, deciding which are healthiest. |
| Fruits and Vegetables Group | 1. Review key messages for fruits and vegetables.<br>2. Compare fresh, canned, and frozen fruits and vegetables.<br>3. Sort foods within each food group color band to decide which food items should be selected more often.<br>4. Read food labels and ingredients lists to identify better options.<br>5. Assess amounts of added sugars in popular beverages and identify more nutritious choices. |
| Meat and Beans Group | 1. Review key messages for meat and beans group.<br>2. Assess amount and types of fat in popular choices and decide on strategies to decrease the amount of total fat, saturated fat, trans fat, and cholesterol.<br>3. Compare Nutrition Facts labels for sodium content to identify lower sodium food items. |
| Low-fat Milk Group | 1. Review key messages for the milk group.<br>2. Compare food items from milk group, looking in particular at calcium and fat content.<br>3. Discuss nondairy sources and substitutions.<br>4. Sort various food items within each food group on the MyPyramid colored bands to reflect those with most to least added sugars and solid fats. |
| Food Safety | 1. Explore the 4 Fight Bac![23] food safety messages.<br>2. Determine strategies for practicing food safety in various situations. |
| Food Shopping and Menu Planning | 1. Practice planning meals using what is on hand.<br>2. Plan meals within a budget, and create a shopping list using grocery store flyers.<br>3. Come up with ideas for including children in meal planning.<br>4. Compare name brand vs store brand products for cost and quality.<br>5. Determine strategies for stretching food dollars while shopping. |
| Feeding Children | 1. Sort the responsibilities of children and parents regarding feeding practices.<br>2. Describe the benefits of family meals.<br>3. Design a "kid-friendly meal" considering color, texture, shape, and temperature.<br>4. Identify choking hazards for children under age 4.<br>5. Participate in a fun game that can be played with children.<br>6. Substitute popular children's food items with healthier options. |

[a]MyPyramid is the predecessor of MyPlate.

reporting relative frequency of practicing the behavior ("do not do" to "almost always"). The possible range for the total behavioral score was 0-50; scores for each construct contributed proportionately by number of items to the total score.

### Statistical Analysis

The analysis was limited to those study participants who provided responses to all demographic data and checklist items collected at each of the 3 time points. Statistical analyses were conducted using SAS (version 9.1.2, SAS Institute, Inc, Cary, NC, 2004). Statistical significance was determined to be $P < .05$. Data were examined for outliers and tested for normal distribution. T1 (IE) and T2 (DE) groups demonstrated random distribution of scores. T2 (IE) and T3 (DE) demonstrated negative skewness, which was expected with positive behavior change.

An overall behavior change score was calculated by summing responses to the 10 checklist items for each participant at each time point. Scores were similarly calculated for each construct. Chi-square analysis was used to identify differences between groups for demographic characteristics. Repeated measures analyses of variance were used to analyze differences among data collection points within a group. Multiple regression analysis was then performed to examine the relationship between the intervention and overall behavior change while controlling for participant enrollment (T1) score and demographic characteristics, as well as the influence of different educators.

An additional chi-square analysis compared the sociodemographics of study participants with those of regular EFNEP participants across New York City to determine whether the study population was representative of the larger EFNEP participant population.

## RESULTS

One hundred sixty-eight participants enrolled and were randomly assigned (85 IE, 83 DE; Table 2). Of these participants, 134 (74 IE, 60 DE; 79.8%) were retained throughout the study, had complete data, and were included in the analyses. There were no statistically significant differences in the sociodemographic characteristics between those participants who were retained throughout the study and those who discontinued prior to completion, with the exception of

**Table 2.** Sociodemographic Characteristics of Participants Enrolled in the Study[a,b]

| | Enrolled (n = 168) | | Complete Data (n = 134) | |
|---|---|---|---|---|
| | Immediate Education | Delayed Education | Immediate Education | Delayed Education |
| Participants, n | 85 | 83 | 74 | 60 |
| Age, y | | | | |
| < 29 | 22 | 30 | 19 | 18 |
| 30-39 | 26 | 31 | 21 | 22 |
| 40-49 | 25 | 12 | 22 | 10 |
| >50 | 12 | 10 | 12 | 10 |
| Sex | | | | |
| Female | 84 | 81 | 73 | 60 |
| Male | 1 | 2 | 1 | 0 |
| Race/ethnicity | | | | |
| Black | 8 | 3 | 7 | 2 |
| Hispanic | 74 | 73 | 66 | 54 |
| Other | 3 | 7 | 1 | 4 |
| Family size | | | | |
| 1–3 | 16 | 21 | 14 | 17 |
| 4 or 5 | 50 | 44 | 42 | 31 |
| ≥ 6 | 19 | 18 | 18 | 12 |
| Other adults in home | | | | |
| None | 13 | 22 | 9 | 16 |
| 1 | 34 | 35 | 32 | 28 |
| 2 | 24 | 17 | 19 | 10 |
| 3 | 14 | 9 | 14 | 6 |
| Number of children | | | | |
| 1 or 2 | 24 | 21 | 24 | 14 |
| 3 or 4 | 51 | 50 | 41 | 38 |
| ≥ 5 | 10 | 12 | 9 | 8 |

[a]Chi-square used for statistical analysis; [b]There were no statistically significant differences between the immediate education (IE) and delayed education (DE) groups at T1 (enrollment into the study), between the IE and DE groups who completed the study, or between those who enrolled and those who completed the study.

age. Participants who did not complete the study were more likely to be younger (32 ± 11.5 y vs 38 ± 6.7 y, $P < .05$).

No significant difference was observed between the 2 study groups for enrollment scores (T1), indicating that the groups' initial reported behavior was similar (Table 3). The 2 groups also began the intervention period with similar behavior (IE at T1 and DE at T2). There was no difference between the enrollment assessment (T1) and immediate pre-assessment for the DE group (T2)—the control period—indicating that secular changes did not significantly influence participant responses. This lack of change with no intervention also demonstrated the temporal stability of the instrument.

The educational intervention had an impact on total reported behavior (Table 2), as indicated by T2 scores where immediate post-education (IE) was compared to the control (DE). The education resulted in statistically similar increases in reported behaviors in both groups from pre- to post-intervention. The post-education scores remained stable in the IE group between T2 and T3, when they received no additional education, so they retained the behavior change exhibited immediately post-education for at least 8 weeks, and there was no difference between the groups at T3.

The Figure presents the data by behavioral construct for each of the 2 groups. The DE group reported no change in nutrition, food resource management, or food safety practices from T1 to T2, the control period. Both groups showed improvement in practices for each of these 3 behavioral constructs with education (T1 to T2 for the IE group, and T2 to T3 for the DE group). The IE group reported stable nutrition and food safety practices from T2 to T3, whereas practices in food resource management continued to improve, indicating stability or even continued improvement in spite of completion of the intervention. Food security results did not change in the same way as reported nutrition, food safety, and food resource management practices. Regardless of the differences in treatment, both groups reported similar slight but significant ($P < .05$) improvements in food security from T1 to T2, and insignificant improvements from T2 to T3. These results suggest secular effects for food security rather than an impact of education.

A multiple linear regression model of overall behavior change, controlling for confounders, was constructed to assess the impact of the intervention in the combined groups (n = 134). A stepwise analysis resulted in the elimination of age, sex, race/ethnicity, family size, other adults in the household, and number of children from the final model. Enrollment score and educator were the only variables found to have significant impacts on the behavior change scores. Differences were noted in educator effectiveness; Educator 3 appeared to be the most effective, followed by Educators 1 and 2. Controlling for these variables, the education accounted for 35.5 points on the overall behavior change score (Table 4).

To ensure that study participants were representative of the larger EFNEP population, the authors compared the study population to the usual EFNEP population in New York City. There were no differences in sociodemographic characteristics between the study sample and the larger New York City EFNEP population, with the exception that there was only 1 male participant in the study (< 1%) as compared to 6% among usual EFNEP participants. Checklist scores were not significantly different between usual EFNEP participants and study participants either at enrollment or immediately post-education, which provides a positive assessment of external validity.

**Table 3.** Reported Behavior for 3 Time Periods During Education Intervention (mean ± SEM)[a,b]

| Group | Time 1 | Time 2 | Time 3 |
|---|---|---|---|
| Immediate education (n = 74) | 34.9 ± 0.7[c] | 42.8 ± 0.5[d] | 43.9 ± 0.5[d] |
| Delayed education (n = 60) | 34.2 ± 0.8[c] | 35.4 ± 0.8[c] | 42.0 ± 0.5[d] |

[a]Self-reported behavior assessed using a 10-item instrument required of all EFNEP programs; maximum score possible = 50; [b]Repeated measures analysis of variance used for statistical analyses; [c,d]Different superscripts represent significant differences ($P < .05$).

## DISCUSSION

This project was designed to assess the effectiveness of EFNEP in a rigorous study, controlling for threats to validity, particularly selection bias, and controlling for secular trends by the use of a control group that did not initially receive the intervention. The hypotheses were supported by the data. As compared to participants who did not receive the intervention, those who completed at least 6 of the 8 sessions reported that behaviors significantly improved from pre- to post-education. Not surprisingly, educators varied in their effectiveness, but even when controlling for educator, participants reported significant behavior change, indicating that the education itself had the greatest influence on the outcomes. In addition, there was evidence of temporal stability in behavior change 8 weeks after graduation, when participants continued to report behavior changes similar to those reported immediately post-education.

Studies of retention of behavior change and randomized controlled trials have previously been conducted in EFNEP, but none has combined these designs. A 1988 randomized controlled trial of usual EFNEP reported significant impacts among participants' food practices as compared to controls.[24] More recently, a cost-benefit study estimated savings in food costs over 5 years as compared to the costs of providing EFNEP.[25] However, most randomized controlled trials of EFNEP have compared enhanced education, such as the addition of videos[16,26] or changes in educational delivery techniques,[27] to traditional programming. Because these studies did not have control groups with no intervention or an intervention without nutrition content, the designs have not controlled for secular trends. One pilot study did include a control group that received life skills rather

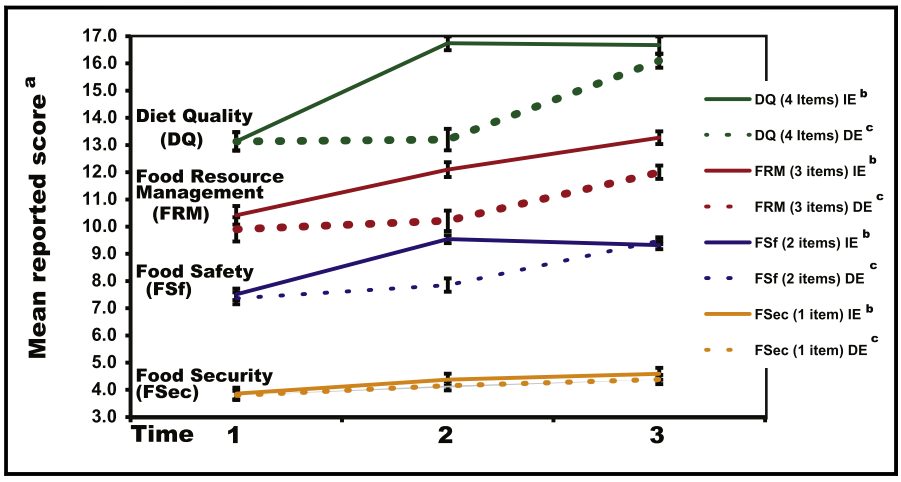


**Figure.** Reported behavior score[a] ± SEM by practice at 8-week intervals for immediate education (IE) group[b] and delayed education[c] (DE) group.

than food and nutrition education as 1 of 3 arms. The other groups included usual EFNEP and EFNEP education enhanced with a "contract for change."[28] Although there was an indication that outcomes were better with the enhanced education group, there was no difference between the traditional EFNEP group and the control group. However, dropout rates were large, and the final control sample had only 5 participants.

The retention of behavior change results is consistent among previous studies and the current study. Three studies, all completed at least 10 years ago, reported retention of behavior change over 1 year[10,13] and 20 months[14] post-education and found that changes were retained for most behaviors over the periods studied. The only recent study of retention of behavior change reported similar results for graduates of either EFNEP or Food Stamp Nutrition Education (now called Supplemental Nutrition Assistance Program–Education, or SNAP-Ed) 6 months post-graduation.[29] It is encouraging to see that even in the context of the current challenging food environment, EFNEP participants appear to be able to change their behavior and maintain that change.

A secondary purpose of this study was to determine the feasibility of using a switching replications randomized experimental design in a real-world nutrition setting. There is considerable evidence that randomized experiments are often challenging to conduct because they involve denying the program to a group of recipients. Consequently, program administrators, staff, and participants often resist implementing or taking part in such studies. The switching replications design has all of the advantages of the traditional randomized design without requiring that 1 group be denied treatment, and it also provides information about retention of effects for the group treated first. It is especially useful in real-world settings in which waiting lists exist, because a "lottery" (random assignment) is a fair way to decide who receives treatment first. In this study, the authors found that key stakeholders were motivated and enthusiastic about carrying out the design, in large part because of its unique advantages. This finding suggests that the switching replications design may have broader potential and should be further explored in the future.

This study has several limitations. First, there was no separate control group for the follow-up period of the IE group, introducing the possibility that other sources of nutrition information could influence the results. However, the apparent retention of behavior change is still noteworthy when education and program support was no longer being provided. Second, because EFNEP varies by location in delivery strategies and curricula chosen, these results may not be generalizable. Randomized controlled trials in other contexts are called for, at least intermittently, to ensure more rigorous program evaluation under normal program conditions. Third, the data were self-reported and collected by the nutrition educators delivering the program. However, the potential social desirability bias that was introduced should be mitigated by having a design in which data were collected similarly and simultaneously between the DE and IE groups. Overreporting of behavior change post-education is also possible. However, response shift bias[30] and the fact that people tend to overestimate their knowledge and skills more when they know less[31] would suggest an underestimation of behavior change. EFNEP educators support this idea in their observations that outcome data underestimate program benefit; they

**Table 4.** Factors Associated With Change in Participant Scores From Pre- to Post-Education (n = 134)[a]

| Factors | β Coefficient[b] | SEM | t | P > t |
|---|---|---|---|---|
| Enrollment (T1) score | −0.74 | 0.05 | −13.55 | < .001 |
| Educator | | | | |
| 1 | −2.89 | 1.05 | −2.75 | .007 |
| 2 | −2.42 | 1.19 | −2.03 | .044 |
| 3 | −5.18 | 1.15 | −4.52 | < .001 |
| 4 | −0.64 | 1.34 | −0.48 | .630 |
| 5 | −1.77 | 1.10 | −1.62 | .108 |
| 6 | 0.00 | | 0 | [reference] |
| Intercept | 35.51 | 2.10 | 16.9 | < .001 |
| F | 36.69 | | | < .001 |
| $R^2$ | 0.64 | | | |
| Adjusted $R^2$ | 0.62 | | | |

[a]Multivariate regression used for statistical analysis; [b]Represents point change on a scale ranging from 1 to 50.

report that participants are more accurate in their self-reports at program completion, when trust has been developed and participants understand what the behaviors actually entail (EFNEP educators, personal communications, 2013).

## IMPLICATIONS FOR RESEARCH AND PRACTICE

It is encouraging that positive outcomes of EFNEP regularly reported in program evaluation were supported by this randomized controlled trial done in the usual program context, and that the reported behavior changes were longitudinally retained. As would be expected, outcomes varied by educator, but with experienced educators, this influence did not override the effectiveness of the education program. Many SNAP-Ed programs use similar programmatic designs and strategies, for example, series of hands-on sessions delivered by paraprofessional educators, so these results should be applicable to this program as well. The results are therefore important to both nutrition educators working in EFNEP and similarly designed SNAP-Ed programs, as well as the federal leadership at USDA as they consider the future of support for these important nutrition education programs.

Although it is reassuring that current nutrition education methods appear to be effective in eliciting behavior change that is sustained for at least a few months among limited-resource populations, ongoing research into the most effective and efficient way to deliver nutrition education to limited-resource populations will continue to be needed. In addition, a well-designed study similar to that presented here, but extending over a longer period, is needed to assess how well behavior change is retained over a number of years.

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