

Nutrition Education Brings Behavior and Knowledge Change in Limited-Resource Older Adults

Abstract

A prospective, controlled, randomized, crossover design was used to examine a nutrition education curriculum's effects on knowledge and behavior of 463 limited-resource older adults in 13 counties. Counties were randomized to begin with the treatment or control curriculum and then the remaining curriculum. Participants completed a pre-test before beginning, a post-test at the completion of the first curriculum, and another post-test at the completion of the remaining curriculum. Significant results provide an evidence base for this intervention's effectiveness. The study reported here provides factors that can contribute to Extension outreach to limited-resource older adult audiences and to Extension scholarship.

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Introduction

Today's demographic, health, and nutrition-related trends show a growing need for evidence-based nutrition interventions to prevent and manage chronic health conditions in older Americans (Johnson et al., 2011). As well, the American Dietetic Association, the American Society for Nutrition, and the Society for Nutrition Education encourage nutrition education programs targeted to older adults (Kamp, Wellman, & Russell, 2010). This is especially important in the areas of fruit, vegetable, and fat consumption, areas related to chronic disease prevalence (Eyler, Haire-Joshu, & Nanney, 2004; Casagrande, Wang, Anderson, & Gary, 2007).

The typical approach by national groups to increasing fruit and vegetable consumption has not targeted or impacted the elderly (Allcock et al., 2012, , McBee, Cotugna, & Vickery, 2001). Few well-controlled theory-driven studies have focused on nutrition knowledge and behavior change among older adults (Hendrix et al., 2008). None could be found targeting community-dwelling, low-income older adults. The study reported here shows that a theory-driven, community nutrition intervention

can significantly increase knowledge and change behavior in regard to fruit, vegetable and fat intake in limited-resource older adults.

Program Overview

The program consisted of two curricula, "Eat Smart, Stay Well" (ESSW) and "Eating Well on a Budget" (EWOB), adapted from Partners in Wellness, an effective nutrition education program targeted to limited-resource older adults (McClelland, Bearon, Fraser, Mustian, & Velazquez, 2001). The ESSW curriculum topics included a healthy diet, effects of dietary fats, benefits of fruits and vegetables, and strategies for making healthy choices.

The EWOB curriculum focused on food dollar management to increase nutritious foods purchased within a limited budget. Both curricula were based on theoretical models, including the Health Belief Model, the Socio-ecological Model, and The Theory of Planned Behavior (Strecher & Rosenstock, 1997; Bronfenbrenner, 1979; Ajzen, 1991). Each curriculum provided sessions once a-week for 5 weeks. Session formats were similar and included weekly progress check-ups, discussions, food preparation demonstrations, interactive hands-on skill-building activities, taste tests, challenges, and peer-group exchange. Educational extenders and development of personal plans encouraged behavior change.

Purpose and Objectives

The study's purpose was to evaluate a multi-county community nutrition education program delivered to limited-resource older adults. Objectives included determining whether participants improved:

1. Their nutrition knowledge related to importance of reducing fat intake and eating recommended servings from fruit and vegetable groups.
2. Their dietary habits related to decreasing fat intake and eating more fruits and vegetables.

Methods

Research Design

All Cooperative Extension Family and Consumer Science (FCS) county agents were invited to participate in this program. Thirteen agents agreed to deliver it at one congregate nutrition site (CNS) per county that served limited-resource participants. All CNS selections by agents were finalized prior to program initiation.

The research design called for random assignment of the 13 counties to either the *Apples* Group (n=6) with the treatment curriculum (i.e., ESSW) delivered first or the *Beans* Group (n=7) with the control curriculum (i.e., EWOB) delivered first. Each group would then receive the remaining curriculum for Period 2 of programming, ensuring that the total program was presented in each county. Both curricula had a similar delivery and length, but non-overlapping content and were delivered within a specified time frame.

Training, Participants, and Recruitment

Agents were trained to deliver both curricula. Marketing events were held at each CNS, and attendees were invited to register for the program. Interested older adults registered and completed demographic and consent forms and the baseline survey. Agents read the survey aloud and let participants record their responses to each question before proceeding. This same process was used each time the survey was administered. All forms were collected in a privacy box for confidentiality.

Measures

Three experts in nutrition, consumer economics, and Extension evaluation developed, reviewed, and edited the survey instrument to ensure content validity and audience appropriateness based on their collective experiences of working with the audience since 1988. The survey was then pilot-tested for clarity (face validity) and readability (reliability) with limited-resource older adults at a CNS not participating in the program.

Nutrition knowledge-testing questions were true and false answer format. An additional answer choice, "don't know," was included to address the possible guessing error associated with true and false questions. The score ranged from 0 = lack of knowledge to 5 = highest knowledge related to the question.

The nutrition behavior was recorded from two five-point Likert scale questions ranging from 1 = not practicing the behavior to 5 = practicing it regularly. One question related to eating fruits and vegetables, while the other related to decreasing fat intake. The recorded scores for these questions were pooled for nutrition behavior and ranged from 2 = very low to 10 = very high.

The survey questions were limited to the fewest number necessary to: capture actual change; accommodate group administration; facilitate survey completion; and avoid over-challenging the older adults.

Limiting the number and type of questions is necessary because of challenges with older adults' abilities to complete questionnaires, including physical limitations, low reading levels, survey fatigue, and subject burden (Lengyel, Smith, Whiting, & Zello, 2004; Clarke Barkley, Higgins, Hart, McClelland, & Saddam, 2003; Higgins & Clarke Barkley, 2003; McClelland et al., 2001; Serrano, Taylor, Kendall, & Anderson, 2000; Taylor, Serrano, Anderson, & Kendall, 2000). Others have used short surveys to determine fruit and vegetable consumption of older adults, and Allicock et al. (2012) used a two-item measure to assess adult fruit and vegetable intake (McBee et al., 2001).

Evaluation Design

A uniform crossover design was implemented in that each set of participants (*uniform on participants*) participated in the same number of sessions (treatments) (*uniform on periods*). This is explained in "Application of Crossover Design for Conducting Rigorous Extension Evaluations" (Jayaratne, Bird, & McClelland, 2013)

The 10 sessions were delivered in two 5-week periods. In Period 1, the ESSW curriculum was

delivered (*Apples* or treatment 1), and in Period 2 the EWOB curriculum was delivered (*Beans* or treatment 2). The survey instrument contained 10 knowledge-testing and four behavior-testing questions, with half of each question type drawn from each curriculum for equal representation. The survey was administered pre-program initiation (Baseline), after 5 weeks (Period 1) when participants completed either treatment (2nd administration of survey) and after 10 weeks (Period 2) when participants had finished both treatments in different sequences (3rd administration of survey).

An indication of the absence of testing effect is that individual test scores did not show increase on treatment knowledge scores from survey 2 to survey 3. Because memory loss is a concern for older adults (Parker, Powell, Hermann, Phelps, & Brown, 2011; Johnson, 2007) educators use handouts to prompt memory. The survey, administered three times for approximately 20 minutes each time, represented a short segment of the overall contact time. If printed information read fairly quickly could be remembered for weeks, educators would not need multiple educational strategies.

For Period 1, the *Apples* participants received the ESSW curriculum, and the *Beans* participants received the EWOB curriculum. Then the survey was administered a second time to each group, documenting participants' knowledge and behavior change after exposure to their respective curriculum as compared to baseline.

For Period 2, the curricula were switched, and the *Apples* received the EWOB curriculum, and the *Beans* received the ESSW curriculum. At the end of Period 2, all participants had been exposed to both curricula in different sequences. The survey was administered a third time. This article presents the outcomes of the ESSW curriculum (treatment 1); EWOB (treatment 2) served as control for the ESSW treatment group.

For Period 1, the difference between the responses for the ESSW questions for the *Apples*' data from the second and baseline administrations of the survey provides outcome data of the ESSW curriculum (the treatment group). The difference between the second survey and the baseline results of the ESSW questions for the *Beans* provides comparison data (the control group) for the ESSW curriculum, because the *Beans* were not exposed to the ESSW curriculum in Period 1 before taking the second survey.

For Period 2, the *Apples* group received the EWOB curriculum, and the *Beans* group received the ESSW curriculum. At the end of Period 2, the survey was administered a third time to the two groups. The difference between the third survey and the second survey results of the ESSW questions for the *Beans* group provides outcome data of the ESSW curriculum. This serves as a replication of the ESSW curriculum because it was first taught to the *Apples* group (Period 1) and then taught to the *Beans* group (Period 2).

The difference between the third survey and the second survey results of the ESSW questions for the *Apples* group provides additional comparison data for the ESSW curriculum.

Data Analysis

Data were analyzed using SPSS 19 software. Independent samples t-test was used to compare the mean values of the treatment group (*Apples*) and control group (*Beans*) at baseline. Paired samples

t-tests were used to compare the outcomes of the ESSW treatment with those of control groups.

Results and Discussion

The program containing two curricula was presented to a total of 452 individuals. Nearly 64% of the participants were African American, and 36% were White. The majority (79%) of the participants were female. Participants' age ranged from 60 to 100 years, with the mean of 76.5 years. Nearly 49% of the participants had less than a high school education.

There were 353 usable surveys for the 2nd administration at the end of Period 1 and 336 usable surveys for the 3rd administration at the end of Period 2, indicating that there was some attrition of participants. However, comparison of mean age of the respondents at baseline, 2nd survey, and 3rd survey confirmed that the attrition was random (not systematic) and had no significant effect on the remaining sample. The age of the participants who responded to the survey at baseline, 2nd survey, and 3rd survey ranged from 60\–100 years, with the mean 76.5, 76.5, and 76.4 years respectively.

Comparison of Treatment and Control Groups Before ESSW Training

Data revealed that the participants' levels of knowledge and behavior related to the ESSW contents were comparable for *Apples* and *Beans* at baseline, with no significant difference between them in terms of their knowledge and behavior related to the ESSW curriculum content (Table 1).

Table 1.

Comparison of the Means of Nutrition Knowledge and Behavior for Eat Smart Stay Well (ESSW) for the Participants in *Apples* (Treatment) and *Beans* (Control) Groups at Baseline

Variables	Treatment Group		Control Group		t	p
	n	M	n	M		
Overall nutrition knowledge ^a	183	3.2	124	3.1	0.73	0.47
Overall nutrition behavior ^b	156	4.9	118	4.9	.05	0.96
Note: a - Scale ranges from 0 being lack of knowledge to 5 being very high knowledge related to the content						
Note: b - Scale ranges from 2 being lack of behavior to 10 being very positive behavior toward the planned dietary change						

Comparison of the Means of Participants' Nutrition Knowledge and Behavior at Baseline and 2nd Administration of the Survey

The mean of the treatment group participants' knowledge related to the ESSW content improved

significantly from 3.2 at baseline to 3.6 after completing the curriculum. Compared to this, the mean of the control group participants' knowledge related to the ESSW content did not change significantly from baseline to the second survey (Table 2).

Table 2.

Comparison of the Means of Participants' Nutrition Knowledge and Behavior For Eat Smart, Stay Well (ESSW) content at Baseline and the 2nd Survey (End of Period 1)

Variables	Treatment Group (<i>Apples</i>)					Control Group (<i>Beans</i>)				
	<i>n</i>	1st Survey Mean	2nd Survey Mean	<i>t</i>	<i>p</i>	<i>n</i>	1st Survey Mean	2nd Survey Mean	<i>t</i>	<i>p</i>
Overall nutrition knowledge related to the content of variety matters (Scale ranges from 0 being lack of knowledge to 5 being very high knowledge related to the content)	172	3.2	3.6	4.91	.000*	108	3.0	3.0	0.39	.70
Overall nutrition behavior related to the variety matters' program objectives (Scale ranges from 2 being lack of behavior to 10 being very positive behavior toward the planned dietary change)	144	4.9	5.3	2.64	.01*	91	4.8	5.0	1.11	.27
Note. * $p < .05$ (2-tailed)										

The mean of the treatment group participants' behavior related to the ESSW objectives improved from 4.9 at baseline to 5.3 after completing the curriculum. This is a significant change albeit a relatively small one. Changing dietary habits of older adults is rather challenging especially since they have lived this long with their former habits. Compared to the treatment group, the mean of the control group's behavior related to the ESSW objectives did not change significantly.

Comparison of the Means of Participants' Nutrition Knowledge and Behavior at the 2nd and 3rd Administration of the Survey

Table 3 compares means for the replication of the survey after the crossover where the ESSW treatment curriculum was delivered to the *Beans* and the EWOB control curriculum was delivered to the *Apples*. The mean of the *Beans* participants' knowledge related to the ESSW content improved significantly from 3.0 at the second administration of the survey to 3.5 after the end of Period 2

upon the third administration of the survey. Compared to this, the mean of the *Apples* participants' knowledge related to the ESSW content did not change significantly from the second to the third administration of the survey (Table 3).

Even though the means of the *Apples* for this replication were not significantly changed, those values were relatively high and comparable with the *Beans* participants' knowledge test mean at the third administration of the survey. This shows the retention of knowledge gained during the first five weeks when the *Apples* received the ESSW curriculum before crossover took place, which in crossover design is referred to as a carryover effect (Bate & Jones, 2006).

The means of treatment group participants' behavior related to the ESSW objectives improved significantly from 5.0 at baseline to 5.9 after completing the training. Compared to this, the mean of the control group participants' behavior related to the ESSW objectives change from 5.4 to 5.8. This change, significant at .05 level., may be associated with the fact that those in the *Apples* group were exposed to the ESSW content in Period 1 before the group crossover and it continued during Period 2 (the replication stage).

The *Apples* behavior change may have improved over time as they began to practice what they had learned during Period 1. We attribute their significant behavior change to the completion of written and signed personal action plans at the end of Period 1. The curriculum employed the Theory of Planned Behavior to show that strong intention, such as writing out a plan, increases the likelihood of performing the behavior (Ajzen, 1991).

Table 3.

Comparison of the Means of Participants' Nutrition Knowledge and Behavior at the 2nd Survey and the 3rd Survey (After Crossover)

Comparison of the Means of Participants' Nutrition Knowledge and Behavior at the 2nd Survey and the 3rd Survey (End of Period 2) Variables	Treatment Group (<i>Beans</i>)					Control Group (<i>Apples</i>)				
	<i>n</i>	1st Survey Mean	2nd Survey Mean	<i>t</i>	<i>p</i>	<i>n</i>	1st Survey Mean	2nd Survey Mean	<i>t</i>	<i>p</i>
Overall nutrition knowledge related to the content of ESSW curriculum (Scale ranges from 0 being lack of knowledge to 5 being very high knowledge related to the content)	101	3.0	3.5	3.73	.000*	152	3.6	3.7	1.50	.13
Overall nutrition behavior related to the ESSW curriculum objectives (Scale ranges from 2 being lack of	80	5.0	5.9	5.96	.000*	115	5.4	5.8	2.06	.04*

behavior to 10 being very positive behavior toward the planned dietary change)										
Note. *p<.05 (2-tailed)										

Comparison of the Means of Nutrition Knowledge and Behavior Changes of the Participants in Treatment and Control Groups

The knowledge change score was calculated by subtracting their knowledge test score before exposure to the ESSW from their knowledge test score after exposure. This knowledge change score ranges from -5 (very negative) to 5 (very positive).

Knowledge change scores for two replications of the control group and the treatment group were calculated separately. Then, the calculated knowledge change scores for the two replicated groups (*Apples* and *Beans*) were pooled separately for the control and the treatment. The mean of the knowledge change score for the treatment group (.53) was significantly higher than that of the control group (.08) as summarized in Table 4.

Table 4.
Comparison of the Means of Nutrition Knowledge and Behavior Changes of the Participants in Treatment and Control Groups (Pooled Data)

Variables	<i>n</i>	Treatment Group <i>M</i>	Control Group <i>M</i>	<i>T</i>	<i>p</i>
Overall nutrition knowledge change related to the content of ESSW curriculum (Scale ranges from -5 being negative changes in knowledge to 5 being very high knowledge improvement related to the content)	308	.53	.08	3.86	.000*
Overall nutrition behavior change related to the variety matters' program objectives(Scale ranges from -8 being negative behavior changes to 8 being very positive behavior changes toward the planned direction)	227	.64	.28	2.09	.04*
Note. *p<.05 (2-tailed)					

The behavior change score (BCS) was calculated by subtracting the BCS before exposure to the ESSW from the BCS after exposure. This score ranges from -8 (very negative change) to 8 (very

positive behavior change).

Behavior change scores for two replications of the control group and the treatment group were calculated separately. Then, the calculated behavior change scores for the two replicated groups (*Apples* and *Beans*) were pooled separately for the control and the treatment. The mean of the behavior change (pooled) score for the treatment group (.64) was significantly higher than that of the control group (.28), as summarized in Table 4.

Limitations and Strengths

A longer, more in-depth survey would have provided additional information; however, use of a longer survey was prohibitive due to the limitations of the audience, as mentioned earlier. Due to practical limitations we were not able to randomize participants. This may be a limitation of the study reported here.

Strengths of the program include the fact that it was theory-based, that we used trained educators to deliver it, and that it was experiential, using food demonstrations, taste tests, and hands-on activities that engaged participants in learning, self efficacy, and skill building. Handouts and educational extenders strengthened the key messages. All participants were encouraged to practice the skill learned during the sessions before the next session through weekly challenges. Also, the participants knew one another and continue to attend the sites, which according to social learning theory, should promote the continuation of the behavior changes.

Conclusions

A prospective, controlled, randomized, and crossover design was used to examine the effects of delivery of a specific curriculum on knowledge and behavior of low-income older adults. Results show that this theory-driven and community-based nutrition intervention successfully increased knowledge and change behavior in regard to fruit, vegetable, and dietary fat intake of a diverse group of limited-resource older adults attending congregate nutrition sites.

More specifically this evaluation study demonstrates that:

- The participants' knowledge and behavior related to the ESSW curriculum contents were the same for the control and treatment groups at baseline (before any exposure to the program).
- The participants exposed to ESSW curriculum significantly improved their nutrition knowledge compared to those in the control group, indicating that the ESSW curriculum is effective in educating older adults about the importance of eating less fat and eating more fruits and vegetables.
- The participants exposed to ESSW curriculum significantly improved their dietary habits toward cutting fat intake and eating more fruits and vegetables compared to those in the control group, indicating that the ESSW curriculum is effective in improving older adults' dietary habits.

Implications

The study shows the curriculum is effective in improving limited-resource older adults' nutrition knowledge and behavior. Success can be attributed to the fact that it is based on the aforementioned theories. This implies the significance of applying these theories in developing Extension curricula.

Recommendations

Based on this evaluation study, the following recommendations can be made.

- The ESSW training curriculum is appropriate for educating older adults to improve their nutrition knowledge about the importance of decreasing fat intake and eating more fruits and vegetables.
- The ESSW training curriculum is appropriate for improving older adults' dietary behavior toward reducing fat intake and eating more fruits and vegetables.
- Attention should be paid to continue to improve the ESSW training curriculum for achieving greater changes in knowledge and dietary behavior improvement of limited-income older adults.
- Delivering appropriate theory-based interventions can bring about significant change in limited-resource older adults in as little time as five sessions over 5 weeks and therefore educators should be encouraged to deliver these programs.

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