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Martha Archuleta

Utah State University, martha.archuleta@usu.edu

Dawn VanLeeuwen

New Mexico State University, vanleeuw@nmsu.edu

Karen Halderson

New Mexico State University, khalders@nmsu.edu

Linda Wells

Texas AgriLife Extension Service, linda.wells@ag.tamu.edu

Margaret Ann Bock

New Mexico State University, abock@nmsu.edu



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Diabetes Cooking Schools Improve Knowledge and Skills in Making Healthful Food Choices

Martha Archuleta

Associate Dean
Utah State University
Salt Lake City, Utah
martha.archuleta@usu.edu

Dawn VanLeeuwen

Professor
New Mexico State University
Las Cruces, New Mexico
vanleeuw@nmsu.edu

Karen Halderson

Diabetes Program Coordinator
New Mexico State University
Albuquerque, New Mexico
khalders@nmsu.edu

Linda Wells

County Extension Agent
Texas AgriLife Extension Service
Burnet, Texas
linda.wells@ag.tamu.edu

Margaret Ann Bock

Professor
New Mexico State University
Las Cruces, New Mexico
abock@nmsu.edu

Abstract: Rates of type 2 diabetes are increasing nationally and in New Mexico, particularly in ethnic minorities. A key self-care area with challenging barriers is healthy eating. The New Mexico Cooperative Extension Service conducts diabetes cooking schools statewide together with community health providers. The study reported here determined if this education was effective in people with type 2 diabetes and their family members. Self-report surveys showed that knowledge and behaviors significantly improved ($p < 0.05$) following participation in cooking schools in all ethnic groups, both genders, and a wide range of ages. Hands-on cooking schools are an effective method for diabetes education.

Introduction

The Cooperative Extension Service has a long history in improving health in communities (United States Department of Agriculture(a), 2011). In previous decades, the focus has been on disease prevention. An example of a successful program using skills-based learning is the Expanded Food and Nutrition Education Program (EFNEP), which incorporates hands-on food

preparation and tasting. EFNEP has been shown to improve dietary patterns among participants (Burney & Haughton; 2002, United States Department of Agriculture(b), 2011).

In the past decade, Extension has increased its engagement with communities and within universities to identify and ameliorate community health problems (Condo & Martin, 2002). In particular, Extension has increased activity in diabetes education targeted at people with type 2 diabetes, which reflects the rapidly increasing rates of this disease, particularly among minority audiences (Centers for Disease Control and Prevention, 2008). Diabetes education has been shown to be effective in improving outcomes and lowering medical costs (Duncan, Birkmeyer, Coughlin, Li, Sherr, & Boren, 2009; Pastors, Warshaw, Daly, Franz, & Kulkarni, 2002). Healthy eating is a key self-care behavior identified by the American Association of Diabetes Educators (2009). However, challenges exist in improving diets of people with diabetes. Patients typically know they need to improve their diets, but recommendations are confusing and can be difficult to implement (Gazmararian, Ziemer, & Barnes 2009; Anderson, 2003). Additional barriers include food preferences, cooking skills and habits, lack of family support, and limited budgets (Albarran, Ballesteros, Morales & Ortega, 2006; Nagelkerk, Reick, & Meengs, 2006; Wang, Abbott, Goodbody, Hui, & Rausch, 1999).

The American Diabetes Association recommends diabetes education that is skills-based and focuses on making informed choices (American Diabetes Association, 2009). Extension is a particularly good fit for delivering this type of education because of its history with programs like EFNEP that include learning by doing. Examples of Extension efforts in diabetes education include: use of Conversation Map® techniques to teach diabetes awareness and healthy eating (Grenci, 2010); the Diabetes Stepping Up to the Plate curriculum, which focuses on food portioning skills (Christensen, Williams & Pfister, 2004; Williams, LeBlanc, Christensen, 2004); The Healthy Diabetes Plate curriculum, which focuses on meal planning skills using a plate format (Raidl et al., 2007); and the Dining with Diabetes curriculum, which teaches meal planning and includes recipe demonstrations and tasting (West Virginia University Extension, 2011; Chapman-Novakofski & Karduck, 2005). These programs have all been used successfully in community settings.

The goal of the New Mexico Cooperative Extension Service was to develop a program that incorporated strategies used in EFNEP, particularly hands-on food preparation and research-based information, in the form of a cooking school for people with type 2 diabetes and their families.

Objective

The purpose of the research study reported here was to determine if a "cooking school" approach was effective in improving knowledge and food-related behaviors in people with type 2 diabetes and their family members and if the effects varied by gender, ethnicity, or age.

Background/Methods

A curriculum entitled Kitchen Creations: A Cooking School for People with Diabetes and Their Families (KC) was developed by certified diabetes educators, dietitians, and home economists in the New Mexico Cooperative Extension Service and the New Mexico Department of Health's Diabetes Prevention and Control Program. The curriculum focused on current type 2 diabetes nutrition recommendations and practical food selection and preparation skills. The curriculum drew upon EFNEP educational techniques, the social cognitive theory (Contento, 2007), and successful approaches in diabetes education used by Extension in other states, particularly the Dining with Diabetes curriculum because of the interest in a cooking school approach. Input was also garnered from Extension personnel across New Mexico working with a variety of ethnically and socio-economically diverse audiences.

The nutrition information in KC focused on using the Diabetes Food Guide Pyramid (Halderson & Archuleta, 2008), food labels, portion control, identifying sources of carbohydrate, and heart healthy cooking techniques. In addition, participants were taught the "50-50 Method" of selecting foods at meals that are high in nutrients and are balanced in low and higher carbohydrate foods. Using this method, participants were taught to select about half (50%) of their food servings from low carbohydrate foods such as non-starchy vegetables and meat and about half (50%) of their food servings from higher carbohydrate foods such as fruit, milk, and starchy foods, with a general target of about three servings of carbohydrate containing foods per meal (Halderson & Archuleta, 2007). More detailed goals and objectives of the KC curriculum are given below in Table 1.

Table 1.
Kitchen Creations Goals and Session Objectives

Kitchen Creations Goals:

- Increase knowledge of healthy food choices and meal planning for people with type 2 diabetes
- Present healthy versions of familiar foods and introduce new foods that are economical and easy to prepare
- Provide hands-on opportunities to learn cooking techniques that use new or more healthful ingredients
- Encourage healthier food choices by preparing and tasting healthy foods
- Provide opportunities for participants to share and learn from one another
- Demonstrate the potential of the Cooperative Extension Service to provide basic diabetes education in partnership with diabetes health professionals

Session One- Meal Planning

Objectives:

- Use the Diabetes Food Guide Pyramid to identify the different food groups that make up the Pyramid
- Learn how foods from each food group affect blood glucose, recognizing that foods high in carbohydrate cause a rise in blood glucose
- Learn that consuming foods low in carbohydrate helps control overall carbohydrate intake
- Identify the serving sizes of different foods
- Learn to use the Diabetes Food Guide Pyramid and 50/50 Method to plan three balanced meals and a snack
- Identify serving size, number of servings, total calories and grams of protein, carbohydrate, fat and sodium on food labels.

Session Two- Balancing Carbohydrates

Objectives:

- Recognize that carbohydrates raise blood glucose
- Learn to use the Diabetes Food Guide Pyramid to identify food groups high in carbohydrates
- Learn to identify serving size, number of servings, and grams of carbohydrates on food labels
- Learn cooking properties of sugars and artificial sweeteners
- Learn methods for using artificial sweeteners successfully in cooking

Session Three- Vegetables, Beans & Grains

Objectives:

- Learn that beans, grains and starchy vegetables are high-carbohydrate foods that can raise blood glucose

- Learn that many vegetables are low in carbohydrate
- Become familiar with the serving sizes of vegetables, beans and grains
- Identify the health benefits of increasing dietary fiber
- Learn that vegetables, beans and grains are good sources of dietary fiber
- Learn basic preparation for vegetables, beans and grains

Session Four- Heart Healthy Cooking

Objectives:

- Understand that "heart healthy" eating may help lower the risk of cardiovascular disease in persons with diabetes
- Learn to identify sources of saturated fat and cholesterol in foods
- Learn to identify sources of fat and sodium in foods, using food labels
- Learn low fat preparation methods for meat, fish and poultry
- Learn to use meat and cheese as "seasonings" in recipes
- Learn to use herbs and spices to add flavor to foods without adding fat and sodium

Cooking School Implementation

The New Mexico Department of Health's Diabetes Prevention and Control Program provides ongoing funding for implementation of KC throughout the state. Kitchen Creations cooking schools were advertised through community outlets, including the newspaper, radio, health clinics, and community sites. Both people with diabetes and their family members were targeted. A typical KC cooking school involved four weekly meetings for 3 hours each. Occasionally there were slight variations from this pattern, but content covered remained consistent. At each session, about half the time was used for teaching nutrition recommendations for people with type 2 diabetes, and the remaining time was used for preparing and eating a meal that used the nutrition principles taught in each lesson. All participants were involved in food preparation and cooking.

Typically, cooking schools were held in middle or high school family and consumer science classrooms. Because these classrooms have numerous cooking stations, it easily facilitated participants (usually grouped in twos or threes) preparing the various main and side dishes for the meal. Because cooking schools were often taught during evenings or weekends, use of these school classrooms was an example of ideal community partnership. Alternatively, when regular school facilities were not available, cooking schools were held in sites that accommodated groups and had kitchen facilities such as Extension offices or senior centers.

Most sessions were team taught by an Extension home economist and a health care professional. The initial target was for the health care professional to be a registered dietitian (RD) who was also a certified diabetes educator (CDE). Because of the shortage of this combination of credentials, RDs with experience in counseling people with diabetes and registered nurses (RNs) who were CDEs also served as instructors. Some county Extension offices did not have a home economist on staff, so the Extension office provided support for the cooking schools, and the health professional was the sole instructor. At the beginning of the series, it was emphasized that the classes did not provide individual prescriptions for diabetes diets and that the classes were intended to complement and not replace diabetes care or education by participants' health providers.

Cooking schools were conducted in either English or Spanish, or a blended language approach was used when participants were a mix of English- and Spanish-speakers. Participants received written curriculum materials, an American Diabetes Association cookbook (American Diabetes Association, 1998), and a supplemental cookbook of traditional New Mexican and Native American recipes that had been adapted to fit nutrition recommendations for people with diabetes and compiled by the New

Mexico Cooperative Extension Service. Because the American Diabetes Association cookbook was not available in Spanish, participants in classes conducted in Spanish used a culturally appropriate cookbook entitled *Healthy Mexican Cooking*. The Spanish translation of the cookbook was used (de la Garza, 2005). Meals at the cooking schools were prepared from recipes in these cookbooks. New ingredients and new cooking techniques were introduced, while still respecting long-standing cultural food traditions of participants.

Evaluation instruments were developed to assess knowledge and behavior change of participants. These instruments reflected main topics of each session and were reviewed by content experts and members of the target audience prior to use. All evaluation tools and procedures were approved by the New Mexico State University IRB prior to implementation of data collection. Demographic information was collected at the beginning of the class series. At the end of each session, participants completed evaluation instruments. They were asked if they had increased their awareness or knowledge of the material covered. They were also asked about behaviors prior to taking the class and intended future behaviors. One month following completion of the cooking school series, a reunion was held. The behavior questionnaires were repeated at the reunion to determine self-reported behavior change.

Kitchen Creations began in New Mexico in 2001 and continues today, reaching approximately 800 participants each year. For the study reported here, data were collected in 2004. There were a total of 649 participants over 18 who consented to participation in research. Of these, 193 had complete data for the behavioral score analysis. Generally, for each analysis, a complete cases analysis was performed. That is, only the variables needed for that analysis were considered and all data were used that were complete for that analysis. Consequently, some analyses were based on considerably more subjects than 193.

Computed Scores

A knowledge score was obtained by averaging all 12 knowledge gained self-assessment items. To obtain this average, numeric values were assigned to the responses. "Not at all" was assigned the value 1, "A little" the value 2, and "A lot" the value 3. To recover some data in the presence of relatively few missing items, the knowledge item average was computed as long as there were three or fewer missing items. This allowed recovery of data for individuals who missed a single entire session. Inter-item consistency (Cronbach's Alpha) for the 12 knowledge items was 0.78.

For each of the measurement occasions, a behavioral score was obtained by averaging across 12 items. As was the case for the knowledge score, a score was computed if there were three or fewer missing items. Numeric values were assigned to responses as follows. The value 1 was assigned to "Always," 2 to "Sometimes," and 3 to "Seldom." Four behavioral scores were computed. The first two were based on responses obtained at the close of each session. The before score was based on participants' self-reported behavior before participating in the class. At the same time, participants provided an after score indicating their planned future behavior. At the reunion, 1 month later, self-reports of both before training and after training behavior were again collected. Inter-item consistencies were 0.76, 0.78, 0.86, and 0.85 for the before, after, reunion before, and reunion after items, respectively.

Data Analysis

Individual items were summarized using frequencies and percents as well as means and standard deviations. Averaged (summed) scores were summarized using means and standard deviations. Inferential analyses used hierarchical (mixed) models to account for possible correlations among individuals within the same classes. A single analysis included data for all four behavioral scores. For the analysis reported here, the hierarchical model also accounted for possible correlations among responses within the same class and the same behavioral measurement, and for multiple responses from the same individual (Raudenbush & Bryk, 2002).

The explanatory variables age, gender (male, female), ethnicity (White, Hispanic, Native American, Other), and diabetes status (diabetic, not diabetic) were used in analyses of both the knowledge score and the behavioral scores. For the behavioral scores, measurement occasion (before, after, reunion before, reunion after) and all two-way interactions of other explanatory variables with measurement occasion were also included in the analysis. The behavioral analysis included only complete cases and therefore included only individuals for whom reunion data were available. An additional analysis included only data from the first two measurement occasions and explored whether individuals with complete data differed from individuals for whom reunion data were not available.

For each behavioral item, a hierarchical mixed model generalization of the sign test was used to assess whether respondents indicated intention to improve the behavior after training. This analysis was performed separately for the data obtained at the time of training and for the reunion data. As before, the hierarchical model accounted for possible correlations implied by the clustering

of data into classes. All analyses were executed using SAS[®] software, including PROC MIXED for the hierarchical models (SAS Institute Inc., 2004). Significance was defined at $p \leq 0.05$.

Results

Description of Participants

Of 614 participants reporting their gender, 80.1% were female. About 53.8% (out of $n=610$) reported having diabetes, while 46.2% reported that they were not diabetic or did not know their diabetes status. Out of 612 participants, 48.9% reported being Hispanic, 7.2% Native Americans, and 41.3% White, and 2.6% fell into other ethnicity categories. The average age was 58.4, with a range of 18-87 and a standard deviation of 13.2.

Summaries of Knowledge Items

Responses to individual knowledge increase items are summarized in Table 2. Summaries of individual items indicate that the sessions increased participants' knowledge. The largest percentage reporting no increase in knowledge was 4%. Consequently, for each of the 12 knowledge items 96% or more of the participants reported at least 'a little' increase in knowledge as a result of the training. Typically, 70-80% of participants reported learning "a lot" about each knowledge item.

Table 2.
Knowledge Improvement of New Mexico Cooperative Extension Service Kitchen Creations Cooking School (KC) Participants

Knowledge Item ¹	N ²	Not at all ³ %	A little ³ %	A lot ³ %	Mean ⁴	SD ⁴
Meal planning for people with diabetes	501	3	28	69	2.66	0.54
Effects of different foods on blood glucose	486	3	30	67	2.64	0.54
Serving sizes of different foods	481	3	22	75	2.72	0.51
Effects of carbohydrates on blood glucose	458	4	24	73	2.69	0.54
Food labels as source of information about carbohydrates	462	4	20	76	2.73	0.52
Cooking properties of sugar and artificial sweeteners	452	2	23	75	2.72	0.50
Health benefits of increasing fiber to the diet	432	1	25	74	2.72	0.47
Differences in carbohydrate and fiber contents of vegetables, grains and beans	432	2	24	74	2.73	0.48
Different cooking methods for vegetables, beans and grains	429	4	29	67	2.63	0.56
Eating heart healthy may help lower the risk of heart disease	415	2	17	82	2.80	0.44
Different types of fats	415	2	18	79	2.77	0.48
Using herbs and spices as flavorings	412	3	23	75	2.72	0.51
¹ Following each class session, participants responded to three statements indicating how much their knowledge of the topic had increased with possible responses of Not at all=1, A little=2 or A lot=3. ² Number of participants responding to a particular statement. The number varies because not all participants attended all classes or marked every response. ³ Percentage of participants indicating this response for knowledge item.						

Knowledge Score Analysis

Respondents reported a high level of knowledge gain, with an overall mean and SD of 2.72 and 0.28 (n=399). The maximum possible score was a 3, and the minimum a 1. The hierarchical model analysis (n=377) indicated that ethnicity (p=0.0004) and gender (p=0.0199) were significantly associated with self-reported knowledge gain, while age and diabetes status were not (p=0.2066, and 0.9627, respectively). While statistically significant, differences among model-based ethnicity group mean estimates were small. The means and standard errors were estimated to be 2.76±0.03, 2.67±0.05, 2.63±0.03, and 2.62±0.08 for the Hispanic, Native American, White, and Other ethnic groups, respectively. Hispanics reported learning more on average than Whites. Similarly, the gender difference was small, with females reporting higher estimated knowledge gain (2.72 ±0.03) than males (2.62±0.04).

Summaries of Behavioral Items

For each behavioral item, a significantly higher percentage of respondents reported an intention to improve their behavior than to regress after training (Table 3). This was true when comparing before and after self-assessments made at the time of training as well as the assessments made at the reunion.

The greatest improvements in behaviors at the time of the reunion were increased use of the Diabetes Food Guide Pyramid, measuring food portions, and using the 50/50 method. Nearly 60% or more participants showed improvement in level of use of these tools. About 50% of participants increased use of food labels. Food preparation techniques including using less sugar or substituting with artificial sweeteners, using herbs and spices instead of salt, consumption of non-starchy vegetables at dinner, and eating fruit as a dessert or snack also showed improvement of 46-49%. A smaller percentage (24-34%) improved in practices of using oil instead of solid fats and using less salt. However, most participants were already using these practices before attending the class.

Table 3.
Behavior Change of New Mexico Cooperative Extension Service Kitchen Creations Cooking School (KC) Participants

Behavioral Item ¹	Occasion	N ²	Before Seldom % ³	Before Occasionally % ³	Before Regularly % ³	After Seldom % ³	After Occasionally % ³	After Regularly % ³	Improved % ⁴	Regressed % ⁴
Use the Diabetes Food Guide Pyramid when planning a day's meals	End of class	506	65	25	10	5	29	65	80	1
	Reunion	243	55	35	11	10	53	37	58	5
Measure food portions	End of class	506	57	31	12	5	32	63	75	1
	Reunion	243	51	33	15	10	40	50	60	3
Control the amount of carbohydrate foods you eat at meals using the 50/50 method	End of class	504	56	30	14	4	23	73	76	2
	Reunion	240	51	33	16	4	38	58	64	3
Eat fruit as a dessert or snack	End of class	470	30	44	26	8	39	54	48	9
		239	25	47	28	7	33	60	46	3

	Reunion									
Read food labels to find amounts of carbohydrate in a serving	End of class	480	33	33	34	2	14	84	59	2
	Reunion	240	31	30	40	5	15	80	50	3
Cook with less added sugar or with artificial sweeteners	End of class	468	36	32	32	5	20	75	58	4
	Reunion	241	24	35	41	5	18	77	46	4
Eat at least 2 servings of whole grains per day	End of class	434	25	49	26	3	30	66	55	4
	Reunion	243	26	45	29	5	42	53	44	6
Eat at least 2 servings of non-starchy vegetables at dinner	End of class	433	20	53	27	4	28	68	54	6
	Reunion	243	33	42	25	7	37	56	49	6
Prepare beans with little or no added fat	End of class	424	32	30	38	7	27	66	44	5
	Reunion	235	26	31	43	9	27	64	37	6
Choose oils instead of solid fats when preparing foods	End of class	423	10	28	62	2	6	91	33	3
	Reunion	239	10	23	67	1	16	83	24	4
Use less salt in cooking or at the table	End of class	422	16	34	50	5	10	86	42	3
	Reunion	243	19	27	54	4	19	77	34	4
Use more herbs and spices to flavor foods instead of salt and fat	End of class	422	26	36	37	3	12	85	55	2
	Reunion	242	31	34	35	6	30	64	48	5

¹At the end of each class session, participants responded to three statements indicating their behavior prior to attending the class and their planned behavior after attending the class with possible responses of Seldom, Occasionally or Regularly. At the reunion, participants again indicated the level of the behavior practiced prior to attending the classes. At the reunion, they also indicated the level of the behavior they were now practicing with responses of Seldom, Occasionally or Regularly.

²Number of participants responding to a particular statement. The number varies because not all participants attended all classes, marked every response or attended the reunion.

³Percentage of participants indicating this response for behavioral item. "Before" indicates participants' response for the extent of the behavior they practiced prior to attending the classes. When "Occasion" is "End of Class", "After" indicates what participants planned to do after attending the class. When "Occasion" is "Reunion", "After" indicates what level of behavior participants are engaging in at the time of the reunion, one month after the classes ended.

⁴Percentage of participants that reported planning to improve or regress on a particular behavior item when "Occasion" is "End of class" or percentage of participants that actually report improving or regressing on a particular behavior item when "Occasion" is "Reunion".

Behavioral Score Analysis

On average, respondents (n=199) indicated an intention to improve behaviors after training. The mean and standard deviation of the before behavior score was 2.00±0.40, and the intention after training score mean was 1.29±0.29. Reunion scores reflected a similar pattern, with the reunion before score averaging 2.00±0.48 and the reunion after averaging 1.41± 0.35. (Recall that here, lower is better with 1=Always, 2=Sometimes, and 3=Seldom.)

The hierarchical model analysis (n=193) suggests that ethnicity (p=0.0434), gender (p=0.0040), measurement occasion (p<0.0001), and the measurement occasion by ethnicity interaction (p=0.0234) were significantly associated with the behavior score. Age (p=0.3982), diabetes status (p=0.1178), and other interactions with occasion were not significant. The analysis confirms that improvement (as measured by the difference between the before and after assessment) was significant at both the original sessions as well as reported behavior change at the reunion. Overall (averaging across levels of all control variables including ethnicity), respondents indicated intention to improve after training at the original measurement occasion (p<0.0001) and at the reunion measurement occasion (p<0.0001). Original and reunion estimates of mean behavior before training did not differ significantly. Despite the significant measurement occasion interaction, the pattern of differences was similar within each ethnicity.

Table 4 summarizes adjusted means for the significant measurement occasion by ethnicity interaction. While gender was significant, because the measurement occasion by gender interaction effect was not significant, there is no evidence that the intervention had a differential effect for females and males. Females had an overall score that was 0.16±0.05 below that of males suggesting that they scored slightly better than males at all measurement occasions.

Table 4.
Ethnicity by Occasion Interaction of Behavioral Means of New Mexico Cooperative Extension Service
Kitchen Creations Cooking School (KC) Participants

Ethnicity	Occasion Means ^{1,2}				Standard Error
	Pre class series	Post class series	Pre reunion	Post reunion	
Hispanic ³	2.1 ^a	1.3 ^c	2.1 ^a	1.4 ^b	0.06
Native American ³	2.3 ^a	1.5 ^b	2.2 ^a	1.5 ^b	0.11
White (non-Hispanic) ³	2.0 ^a	1.3 ^c	2.0 ^a	1.5 ^b	0.05
Other ³	2.1 ^{ab}	1.4 ^c	2.3 ^a	1.8 ^b	0.14

¹Occasion refers to when participants filled out the surveys. Surveys with identical behavior assessments were administered at the end of the series of four classes and again a month later at the reunion. The surveys asked participants to indicate to what extent they practiced a behavior prior to attending KC (pre class series and pre reunion) and the extent to which they were practicing the behavior at the end of the class series (post class series) and at the reunion (post reunion).
² Based on self-reported behavior changes of participants after participating in KC where 1=regularly, 2=occasionally, 3=seldom.
³ Numbers in row with unlike superscripts differ (P<0.05).

An additional analysis considered only the before and after scores from the original measurement occasion. This analysis included a total of 398 subjects, including 205 who did not have completed reunion scores as well as the 193 who did. The hierarchical model analysis included a variable indicating which completion group the respondent belonged to. Completion status was not significant (p=0.3752), nor was the completion status by measurement occasion interaction (p=0.6422). In this analysis, ethnicity and the ethnicity by measurement occasion interaction were no longer significant (p=0.0633 and 0.5531, respectively), but the

gender main effect was ($p=0.0024$). In this analysis the biggest change was that age and the age*occasion interaction were significant ($p=0.0003$ and 0.0225 , respectively). There was a slight negative slope with age, suggesting that with increasing age participants had lower (better) behavioral scores. This was most pronounced at the before measurement (slope= -0.00625), but the slope was only -0.00223 at the after measurement. Taken together this suggests that older participants tended to begin the program with slightly better behaviors but that other participants partially caught up after training.

Discussion

Kitchen Creations (KC) improved knowledge and behavior of people with type 2 diabetes and their family members. While some statistically significant interactions occurred in some parameters, these are likely of little importance clinically. The most important finding of the research study is that KC is an effective program for all ethnic groups in New Mexico, both genders, and a wide range of ages. A particularly important part of KC is hands-on meal preparation. Other Extension programs that included hands-on cooking and food preparation for people without diabetes have also led to improvements in food selection and preparation behaviors (Condrasky & Hegler, 2010).

Further, in an effort to determine if the cooking component specifically had an impact, Levy and Auld (2004) found that young adults without diabetes had greater improvements in attitudes and cooking behaviors than those involved in tastings and demonstrations only. The hands-on approach is more likely to encourage self-efficacy, which has been associated with improved diabetes self-management (Wolf et al, 2004). Further, having improved behaviors in family members without diabetes may help those with diabetes sustain a more healthful lifestyle because lack of family support is cited as a barrier for successfully managing diabetes.

Programs such as KC likely succeed because of the combination of providing the latest of research-based diabetes information, hands-on opportunities to practice new behaviors, and the relaxed atmosphere of people cooking and eating together. This learning environment led to significant interaction among participants and between the participants and instructors. Use of recipes and meals that are culturally familiar to communities can be a way to bring together ethnically diverse communities in a group setting for diabetes education. Extension is particularly poised to provide this type of education because of its history in effective nutrition education and connections with community partners, including health care providers. This was a showcase example of a successful Extension program. It was initiated because of a community need expressed by home economists throughout the state and was funded by a community partner (the Department of Health) because it also met their goal of providing more community-based education for people with type 2 diabetes.

The study has limitations, including use of a convenience sample instead of a randomized controlled design. Further, the observations were made 1 month after completing the program and did not determine if positive changes in behaviors were sustained beyond this time period or if behaviors affected physiologic parameters such as blood glucose or lipids. Also, knowledge and behaviors were self-reported and therefore dependent on the level of accuracy of participants' assessments of themselves. Community diabetes education conducted in groups also has limitations in that it provides general information and not detailed individual instruction that is also needed for people with diabetes. Thus, these types of programs should always be conducted in collaboration with diabetes health care professionals who can make referrals for individual diet counseling and other diabetes care.

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