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The Effects of a Community-Based, Culturally Tailored Diabetes Prevention Intervention for High-Risk Adults of Mexican Descent

Deborah Vincent, PhD, RN, FAANP, Marylyn M. McEwen, PhD, PHCNS-BC, FAAN, Joseph T. Hepworth, PhD, and Craig S. Stump, MD, PhD

University of Arizona, Tucson, Arizona, USA.

Abstract

Purpose—This article reports the results of a community-based, culturally tailored diabetes prevention program for overweight Mexican American adults on weight loss, waist circumference, diet and physical activity self-efficacy, and diet behaviors.

Methods—The intervention used content from the Diabetes Prevention Program but culturally tailored the delivery methods into a community-based program for Spanish-speaking adults of Mexican descent. The design was a randomized controlled trial (N = 58) comparing the effects of a 5-month educational intervention with an attention control group. The primary study outcome was weight loss. Secondary outcomes included change in waist circumference, body mass index, diet self-efficacy, and physical activity self-efficacy.

Results—There were significant intervention effects for weight, waist circumference, body mass index, and diet self-efficacy, with the intervention group doing better than the control group. These effects did not change over time.

Conclusions—Findings support the conclusion that a community-based, culturally tailored intervention is effective in reducing diabetes risk factors in a 5-month program.

Diabetes prevalence is estimated to include 25.8 million people of all ages in the United States, resulting in significant morbidity, mortality, and an economic burden of more than \$245 billion annually.^{1,2} As the fastest-growing minority population in the United States, Mexican Americans have one of the highest rates of diabetes: 11.8% versus 7.1% for non-Hispanic whites.² Even more concerning is the estimated 79 million adults in the United States who have prediabetes, most of whom will develop type 2 diabetes within 10 years.^{3,4} Prevention of diabetes is clearly a public health imperative.

The Diabetes Prevention Program (DPP) clearly demonstrated that intensive lifestyle modification delays or prevents the progression of prediabetes to diabetes, but it required costly resources to promote lifestyle change.⁵ Therefore, it is not easily replicated in resource-limited community settings. Community-based diabetes prevention programs offered in convenient and familiar locations have the potential to reach underserved

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Correspondence to Deborah Vincent, PhD, RN, FAANP, Associate Professor, University of Arizona College of Nursing, 1305 North Martin, PO Box 210203, Tucson, AZ 85721-0203, USA (dvincent@email.arizona.edu).

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populations and decrease barriers to participation, and they have achieved modest weight loss results using generic rather than culturally specific approaches.^{6,7} However, only 2% of participants in either study were of Hispanic ethnicity. Cultural tailoring has been found to be more effective than generic programs in improving weight loss in Mexican American adults, at least in those with type 2 diabetes.^{8–12} These studies employed cultural tailoring by incorporating key Mexican American cultural concepts of family (*familismo*) and personalism (*personalismo*), and most used *promotores* (community health workers). Culturally tailored interventions were effective in improving diabetes self-management behaviors and/or reducing risk factors such as overweight.

One of the purposes of this study was to evaluate the effectiveness of a community-based, culturally tailored intervention for overweight Spanish-speaking Mexican American adults and to examine the effect of this intervention on weight loss. Feasibility of the intervention, assessed by examining facilitators and barriers to recruitment and retention, has been reported in Vincent et al.¹³ This article focuses on the intervention's effect on weight loss, waist circumference, and lifestyle measures of diet and physical activity self-efficacy and diet behaviors. Our intervention program, Un Estilo De Vida Saludable (EVS; “healthy lifestyle” in Spanish), adopted the DPP goals of weight loss and increased physical activity and culturally tailored the content and delivery mechanisms into a community-based program for Mexican Americans.

Methods

Design

This study used a randomized 2-group attention control design. Unlike a usual care control group, an attention control engages participants in activities that are designed to account for possible treatment effects associated with attention received from research staff.¹⁴ The study was approved by the institutional review board of the University of Arizona. All participants provided signed informed consent. The study used cluster randomization to allocate sites into 2 arms: the EVS (intervention) arm and the attention control arm. Sites were randomized so that all participants within a site received the same condition. This was done to minimize contamination within a study site.¹⁵ Participants chose which site they wanted to attend but were blinded to the condition at the time of their choice.

Recruitment

The researcher team set a recruitment goal of 50 Spanish-speaking adults of Mexican descent to result in a final sample size of 40, allowing for an attrition rate of 20%. The estimated attrition rate was based on the literature^{16,17} and previous pilot studies conducted by the research team with the target population.¹¹ Participants were recruited via a variety of measures: widely distributed English and Spanish flyers advertising the study, use of social media to announce the study to employees of the university, provider referral, and presentations at churches and community health events. Inclusion criteria were as follows: Adults who were older than 25 years; who self-identified as being of Mexican origin; who had an American Diabetes Association (ADA) risk assessment score ≥ 10 , a body mass index (BMI) ≥ 25 kg/m², and a casual blood glucose between 100 and 199 mg/dL; who were

able to read and speak Spanish or were bilingual in Spanish and English; and who had a telephone were eligible to participate. Potential participants were excluded if they self-reported having a diagnosis of diabetes, were pregnant or breast-feeding, had been diagnosed with a cardiovascular condition (eg, stroke, congestive heart failure) in the previous 6 months, or were participating in a diet or exercise program.

Setting

The EVS research team had developed partnerships with many local community organizations, including churches.¹³ These churches were acutely aware of the problem of diabetes in the community and were interested in participating in efforts to prevent diabetes; in fact, several offered to serve as study sites. The study was conducted in community rooms of churches in the Tucson metropolitan area. Study participants attended the intervention or control sessions on Sunday afternoons after church services.

Intervention

The EVS intervention was a 5-month-long program consisting of an intensive phase of 8 weekly 2-hour sessions, followed by a maintenance phase of 3 monthly 1-hour sessions. Both phases were delivered by a bilingual (English/Spanish) and bicultural *promotora*. Social cognitive theory¹⁸ provided the framework for increasing self-efficacy and maintaining key DPP concepts. Culturally tailored messages and delivery mechanisms were developed for promoting healthful eating and for progressively increasing physical activity for Mexican American adults. Cultural tailoring included using an educational *fotonovela* (story with photographs and small dialogue bubbles), offering the intervention and all materials in Spanish and English, using culturally acceptable exercise strategies (eg, walking, dancing), providing cooking demonstrations of low-fat traditional Mexican American foods, and facilitating group meal sharing. Because of the cultural importance of family, participants were invited to bring a support person (family member or friend) to the intervention.^{19,20} Literacy needs were addressed by using pictures to illustrate and simplify complex concepts, engaging participants in activities that reinforced key concepts (eg, stretching or deep breathing for stress relief), modeling, and offering experiential teaching methods (eg, cooking demonstrations, eating healthy meals) at each session.^{11,21}

At the first study session, each participant received a personalized folder and a packet of materials in English and Spanish to take home and share with family members. These educational handouts were developed for the DPP and are available from the DPP *Lifestyle Balance Workbook*.²² Participants also received a step counter and simple logs with instructions and a demonstration on how to use them to track their physical activity and food intake.^{19,23}

Each of the 8 weekly EVS sessions included the following 4 delivery components to convey diabetes prevention content: a *fotonovela* episode that emphasized the take-home message for the week, brief presentation delivered by the *promotora*, cooking demonstrations and meal sharing, and *charlas* (short informal discussions). Each weekly session began with an episode of the *fotonovela*, which used PowerPoint slide presentations consisting of pictures and simple language to tell the story of a Mexican American family in which the

grandmother received a diagnosis of prediabetes and the lifestyle changes that she and her family made to improve her health. Each 5-minute episode highlighted key weekly content, and the *promotora* emphasized and expanded on these points as she presented the slides and read the story to the participants.

At the conclusion of each *fotonovela* episode, the *promotora* gave a brief lecture that emphasized and expanded on the healthful eating and activity behaviors addressed in the *fotonovela*. Next, the *promotora* gave a cooking demonstration and discussed key concepts of healthy eating, such as portion size, low-fat cooking, shopping strategies, techniques to address barriers and stay motivated, and tips for increasing daily physical activity. Cooking demonstrations emphasized low-fat yet tasty foods that reflect the flavors and smells favored by Mexican Americans and that could be prepared within 20 to 25 minutes. Participants were given the recipes for the foods prepared at each cooking demonstration so that they could prepare the food at home. The cooked food was served by the *promotora* to demonstrate portion size. During the meal sharing, the *promotora* facilitated the *charla* by asking how the previous week had gone and what challenges participants had faced. Content for each week of the EVS intervention (see Table 1) was based on the content from the DPP lifestyle intervention^{5,24} but was modified for delivery in a group setting. Each week, participants were given take-home assignments, such as label reading, that could be shared with family members and that reinforced the information provided in each session.

The *charlas* were designed to foster self-efficacy through problem solving and group support and have been found in other studies to be a culturally sensitive mode for delivering information and provoking discussion.^{25,26} The *charlas* provided opportunities to reinforce didactic content, discuss how to incorporate the lifestyle changes into family life, engage in problem solving, and address participant questions. At the end of the meal and the *charla*, the *promotora* facilitated a relaxation/stress management exercise, such as deep breathing or guided imagery.

The 3 monthly 1-hour sessions were facilitated by the *promotora* and emphasized problem solving and group support and employed the same *charla* format used in the 8 weekly sessions. In each monthly session, the *promotora* addressed challenges and successes that participants experienced during the previous month. Participants celebrated successes, discussed tips for staying motivated, and addressed problems or concerns that arose over the course of the month.

Control Group

The attention control group received 5 months of educational sessions composed of 8 weekly 2-hour sessions, followed by 3 monthly 1-hour sessions. The timing, length of time, and number of sessions were the same as the intervention group. These educational sessions provided general information on health promotion and disease prevention for several chronic (not including diabetes) and/or common conditions affecting adults, such as cancer prevention and insomnia. Content included general information on each condition, risk factors, and screening measures. All sessions were conducted in a lecture/discussion format by a bicultural/bilingual nurse who had been trained to deliver the content.

Study Measures

Demographic data were collected at baseline via a demographic collection form: age, marital status, years of education, sex, medications, current type and frequency of exercise, and contact information. Acculturation level was assessed at baseline through the 12-item Short Acculturation Scale for Hispanics. Acculturation level has been found to have a significant influence on lifestyle behaviors, chiefly in the form of food preferences, daily caloric intake, activity patterns, and levels of stress.^{27,28} The scale uses 5-point Likert items ranging from 1 to 5 (higher numbers indicating higher levels of acculturation) and has a reported Cronbach alpha of 0.92.²⁹

Physiologic and psychosocial data were collected at 3 times: baseline, 8 weeks (after the weekly sessions), and 5 months (after the maintenance phase). Casual blood glucose levels were measured with a One-Touch Ultra handheld glucometer that met the International Standards Organization (15197) requirements for accuracy and repeatability.³⁰ Weight was measured with a digital scale, with participants in street clothes but with shoes removed, and height was measured (only at baseline) with a portable stadiometer. BMI was calculated with the standard formula³¹ of weight (lb) / height (in)² × 703. Waist circumference was measured with the Gulick II tape measure, which is a no-stretch retractable tape with both centimeter and inch gradations. Two waist measures were taken at each data collection period and a mean waist circumference calculated. Blood pressure was measured with a digital sphygmomanometer, and a mean of 2 blood pressure measures, taken 2 minutes apart, was used.³²

Psychosocial measures include diet self-efficacy, physical activity self-efficacy, and diet behaviors. Diet self-efficacy was measured with the 20-item Weight Efficacy Lifestyle questionnaire, which contains questions about confidence to resist eating in tempting situations.^{33,34} Respondents rate their confidence using 10-point Likert items ranging from 0 (not confident) to 9 (very confident), with higher scores indicating greater confidence about being able to resist overeating. The questionnaire has been widely used in research and has reported Cronbach alphas of 0.69 to 0.84.³³ A Spanish version of the questionnaire has been found to be equivalent to the English version and has reported Cronbach alphas of 0.77 to 0.91.³⁵

Physical activity self-efficacy was measured with a 5-item scale that contains questions about one's confidence to exercise in various situations. Respondents rate their level of confidence on 5-point Likert items ranging from 1 (not at all confident) to 5 (completely confident), with higher scores indicating higher levels of self-efficacy. The English version of this scale has been found to be reliable and valid,^{36,37} and the Spanish version has been validated in Spanish speakers and has good internal consistency (Cronbach alpha = 0.86).³⁸ Intervention participants were given step counters and encouraged to track the number of steps taken each day. The research team collected and reviewed intervention participant activity logs, but this was not a study outcome measure.

Diet was measured with the Spanish-language version of 2 brief dietary screening measures: a fat-intake screener and a fruit and vegetable screener. These screeners allow for rapid

assessment of dietary intake, do not require computer analysis, and have been found to be reliable and valid in multiethnic populations.³⁹ The fat-screening measure has 16 items with 5 response categories, ranging from *once a month or less* to *five or more times per week*. The items are summed to produce a total score, with lower scores indicating a lower fat intake. The fruit and vegetable measurer has 7 items with 6 response categories, ranging from *less than one per week* to *two or more times per day*. A single score is computed for the number of fruits and vegetables consumed per day or week. A correlation coefficient of 0.87 was reported for the fat screener with a full-length nutrition questionnaire and 0.64 for the fruit and vegetable screener with actual fruit and vegetable intake.^{39,40}

Statistical Analysis

Frequencies were used to describe the groups, and χ^2 and t tests were used to assess difference between the groups on the demographic variables. Analyses of physiologic and survey measures were conducted with 2 (group) $\times$ 2 (time) analyses of covariance. The 2 groups were the intervention and attention control groups; the 2 time points were immediately after the intensive phase of 8 weekly sessions and postintervention (5 months); and the covariate was the baseline measure. The analysis yields a group main effect that assesses the intervention effect, a time main effect that assesses the stability of the intervention effect over time, and a group $\times$ time interaction effect assessing if there is differential change between the intervention group and the control group over time. All these results control for the baseline measure.

Results

Research team members spoke to a total of 279 individuals through the various recruitment strategies, and interested individuals ($N = 122$) received an in-person or telephone interview to determine preliminary eligibility. This interview included questions such as “How old are you?” “What medications, if any, do you take?” “Have you ever been told you have diabetes?” As a result of this preliminary screening, 31 individuals either chose not to participate or did not qualify, because they had been diagnosed with diabetes or had been prescribed metformin to treat prediabetes. Ultimately, 91 individuals consented and had baseline data obtained, and 58 (64%) met all inclusion criteria and were entered into the study. Of the 33 consented individuals who did not qualify for the study, 29 (31%) had casual blood glucose < 100 mg/dL.

Sample Characteristics

The majority of participants were female (77.6%), middle-aged ($M = 50.9$ years), and married (60.3%) (Table 2). Nearly 60% reported incomes of \$20 000 per year or less; about 75% were born in Mexico; all had lived in the United States for at least 5 years and most for more than 15 years. Slightly more than one quarter of the sample had 6 years of education or less, although nearly one half had one or more years of college. The mean ADA risk assessment score was 13.97 and ranged from 10 (minimum eligibility score) to 24. All participants were overweight or obese, with a mean BMI of 34.32, a mean weight of 198.24 pounds, and a mean waist circumference of 43.17 in. Mean casual blood glucose was 123.47 and ranged from the minimum enrollment criteria of 100 to 183 mg/dL.

There was no statistically significant difference between the intervention and control groups in demographic characteristics, with the exception of the ADA risk score. The control group had a higher risk score, $t(52.41) = 2.54$, $P = .014$. Baseline physiologic measures and survey responses also demonstrated no statistically significant differences between the groups (Table 3).

Physiologic and Healthy Behavior Measures

Controlling for the baseline measures, there were significant group main effects for weight, $F(1, 30) = 4.39$, $P = .045$; waist circumference, $F(1, 30) = 4.67$, $P = .039$; BMI, $F(1, 30) = 4.97$, $P = .033$; and diet self-efficacy, $F(1, 30) = 5.58$, $P = .025$, indicating that the intervention produced significant difference on these variables (Table 4). The intervention resulted in the intervention group having lower weight (188.23 vs 194.49), smaller waist circumference (41.34 vs 43.39), lower BMI (32.84 vs 34.04), and greater diet self-efficacy (7.78 vs 5.87) than the attention control group. There were no significant group $\times$ time interaction effects or time main effects for any of the physiologic or survey variables.

Post Hoc Internal Analysis

To more fully explicate the effects of the intervention, a post hoc internal analysis was performed. This analysis was used to assess the intervention group's changes over time from baseline (time 1) to postintensive phase (8 weeks, time 2) to postmaintenance phase (5 months, time 3) according to repeated measures analysis of variance. There were significant decreases from time 1 to time 2 for weight, $F(1, 24) = 16.08$, $P = .001$; waist circumference, $F(1, 24) = 12.57$, $P = .002$; BMI, $F(1, 24) = 15.33$, $P = .001$; and frequency of fat intake, $F(1, 24) = 26.11$, $P < .001$. In addition, there were significant increases in the diet self-efficacy score, $F(1, 24) = 9.16$, $P = .006$; the physical activity self-efficacy score, $F(1, 24) = 20.55$, $P < .001$; and the frequency of fruit and vegetable intake, $F(1, 24) = 12.46$, $P = .002$.

From time 1 to time 3, there were statistically significant decreases in weight, $F(1, 24) = 12.66$, $P = .002$; waist circumference, $F(1, 24) = 14.28$, $P = .001$; BMI, $F(1, 24) = 12.28$, $P = .002$; diet self-efficacy score, $F(1, 24) = 18.53$, $P < .001$; physical activity self-efficacy score, $F(1, 24) = 6.58$, $P = .013$; and frequency of fat intake, $F(1, 24) = 21.92$, $P < .001$. Although one outcome demonstrated an undesirable change, fruit and vegetable frequency decreased from time 1 to time 3, $F(1, 24) = 1.886$, $P = .182$; this was not significant. These results are presented in Table 5.

Lessons Learned

Preventing diabetes is a critical public health issue, and overweight and obesity are major risk factors for type 2 diabetes. The primary purpose of this study was to investigate the effect of a community-based, culturally tailored intervention on weight in overweight or obese adults of Mexican descent. The EVS intervention had significant effects on participants' weight, waist circumference, and BMI—all major risk factors for developing type 2 diabetes⁴¹—and there were significant improvements in the diet self-efficacy score. In addition, intervention participants had a mean weight loss of 6.2 lb, or approximately 3% of mean baseline body weight, and waist circumference decreased by a mean of 1.56 in at the conclusion of the 5-month intervention. The percentage of weight loss is somewhat

lower than the 5% to 7% weight loss reported by 2 other community-based diabetes prevention studies,^{42,43} but both these studies used a single-group design and were of 1 to 3 months longer in duration than the EVS study. This suggests that interventions of 6 months or more in duration may be necessary to obtain at least a 5% weight loss. The weight loss of 6.2 pounds has both statistical and clinical significance, as risk for developing diabetes decreases with a modest weight loss of 5% to 7% of total body weight.^{24,43} The decrease in waist circumference is consistent with the study by Ruggiero,⁴² while several other studies showed no significant changes in waist circumference.^{12,43,44}

Intervention participants also demonstrated a significant improvement in diet self-efficacy, indicating more confidence in their ability to choose and eat healthful foods. Additionally, intervention participants improved their eating habits. The mean number of weekly servings of fatty foods decreased from 24.2 servings at baseline to a mean of 14.9 at time 3 for intervention participants, and this decrease was statistically significant. While there was a statistically significant increase in consumption of fruits and vegetables from baseline to time 2, fruit and vegetable consumption decreased at time 3. However, fruit and vegetable intake was still higher at time 3 than at baseline, although this did not reach significance. The tapering off of healthy eating behaviors is consistent with findings from other studies.^{25,42} In the control group, mean weekly servings of fatty foods decreased somewhat, and fruit and vegetable intake increased slightly, but these changes were not statically significant. Strategies to sustain healthy behavior change are needed to prevent diabetes.

In contrast to other studies that reported negative attitudes of Latinos toward dietary change,^{25,45} the EVS study found participants to be engaged and interested in dietary information. The sustained weight loss and maintenance of dietary changes for the intervention group over the course of 5 months were encouraging and are consistent with a recent study that examined the effect of a culturally tailored intervention for Latinos with diabetes.²¹

Physical activity self-confidence increased for both intervention and control groups from baseline to time 3. However, these changes did not reach statistical significance. This is consistent with findings of other studies on physical activity in Latinos, which failed to produce significant improvements in physical activity in Latinos with type 2 diabetes.^{21,46,47} Intervention participants were given a step counter and asked to keep activity logs, and these were reviewed weekly by the research team. In addition, the *promotora* encouraged increased physical activity at every weekly session. However, these strategies may not have sufficiently emphasized the importance of increasing activity in decreasing risk for developing diabetes.

Although the attention control group did not receive specific diet or exercise information, the participants were aware that they were participating in a diabetes prevention study. Their eating and activity behaviors may have improved simply by participating in this type of study. Additionally, there was a high attrition rate among attention control group participants. As previously reported,¹³ only 40% of the control group completed the entire 5-month program. Control group participants who did complete the entire program appeared to be highly motivated and engaged in improving their health status. It is possible that any level of intervention focusing on health would result in improved physical activity in a group that

was sufficiently motivated to participate as a 5-month control.^{48,49} Other lessons learned about recruitment and retention barriers and facilitators have been reported.¹³

At the time that this study began, point-of-service (nonlaboratory) A1C testing had not been approved as a diagnostic test for prediabetes.⁵⁰ A finger-stick casual blood glucose, rather than fasting blood glucose, was used to assess risk for developing diabetes because data collection and the intervention generally took place in the early afternoon following church services. This timing, which was chosen by the community organizations in which the intervention or control group was being held, made use of fasting blood glucose testing impractical. Several studies suggested that a casual blood glucose of value of 100 to 199 mg/dL, when combined with a BMI ≥ 24 kg/m², was an efficient method for screening those at high risk for developing type 2 diabetes, such as this study's target population.^{16,51,52} Although blood glucose level results appeared to trend lower over the course of this study, no definitive conclusions can be drawn from these data. At the time that the casual glucose test was done, participants were asked to estimate how long it had been since they had eaten. Although the research team had initially thought that most people would have eaten breakfast and possibly lunch, there was great variability in the time since last food intake. Some participants had not eaten in 6 to 8 hours, while others had eaten within 1 hour of being tested. While casual glucose was useful in determining study eligibility, it was not useful as an outcome measure. A1C would be a more useful outcome measure for community-based studies in which obtaining fasting blood glucose levels is impractical, provided that these studies last longer than the 3 months needed to see a change in A1C levels.^{41,52}

This study has several limitations, including a relatively small sample size, a low participation rate among men, and a high attrition rate in the attention control group. The majority of the sample was composed of older Spanish-speaking married women whose household income was less than \$40 000 per year. More research is required to determine the effect of the intervention on younger individuals and those in different socioeconomic groups. In addition, the intervention was composed of multiple components, and it is not possible to determine the effect, if any, of cultural tailoring on the outcomes. Future research needs to be conducted to determine the effectiveness of cultural tailoring itself. This is consistent with other studies in which culturally tailored interventions were deemed to be effective for weight loss but were not tested against an equivalent but nonculturally tailored intervention.^{11–12,21} Nevertheless, intervention participants were engaged throughout the course of the 5-month study and expressed high satisfaction with the intervention. This engagement and satisfaction is supported by the high retention rate for intervention participants. Nearly 93% of those who attended the first intervention session went on to complete the 5-month study.¹³ Despite these limitations, results of this study provide additional support that a community-based, culturally tailored intervention can result in decreasing risk factors for type 2 diabetes. Future research should address the individual effect of cultural tailoring on the outcome of weight, and strategies to emphasize physical activity should be enhanced.

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Table 1**EVS^a Content by Session**

Session	Topics Covered
1: Week 1	Welcome to EVS program Diabetes overview Getting started being active and losing weight Stress management overview Food diaries
2: Week 2	Healthy eating Be a fat detective Modifying traditional Mexican American foods Move those muscles
3: Week 3	Food pyramid Being active: A way of life Family support Activity logs
4: Week 4	3 ways to eat less Portion control Make social cues work for you Including family in activities
5: Week 5	Take charge of what's around you Making healthy choices Diabetes health beliefs/home remedies
6: Week 6	4 keys to healthy eating outside of home You can manage stress Stress, eating, and blood sugar
7: Week 7	Tip the calorie balance Physical activity tips Review and celebrate successes
8: Week 8	The slippery slope of lifestyle change Talk back to negative thoughts Jump start your activity plan Ways to stay motivated
9: Month 1	Problem solving/staying motivated Celebrating successes Celebrating successes
10: Month 2	Problem solving/staying motivated Celebrating successes
11: Month 3	Problem solving/staying motivated Celebrating successes

^aUn Estilo De Vida Saludable ("healthy lifestyle") intervention.

Table 2

Demographic Characteristics of the Total Sample and Each Group

	Total (N = 58)	Intervention (n = 38)	Control (n = 20)	Difference	P
Sex, No. (%)					
Male	13 (22.4)	9 (23.7)	4 (20.0)	$\chi^2(1) = 0.10$	.749
Female	45 (77.6)	29 (76.3)	16 (80.0)		
Age, y					
Mean (SD)	50.93 (12.049)	49.97 (12.080)	52.75 (12.087)	$t(56) = 0.83$	.409
Range	29–84	29–84	31–76		
Marital status, No. (%)					
Single	7 (12.1)	5 (13.2)	2 (10.0)	$\chi^2(3) = 1.89$	.596
Married	35 (60.3)	22 (57.9)	13 (65.0)		
Separated/divorced	13 (22.4)	8 (21.1)	5 (25.0)		
Widowed	3 (5.2)	3 (7.9)	0 (0.0)		
Education, y					
Mean (SD)	11 (4.53)	10.37 (4.65)	12.20 (4.14)	$t(56) = 1.48$	.145
Range	1–19	1–19	4–17		
Income, No. (%)					
\$20 000	33 (56.9)	22 (59.5)	11 (55.0)	$\chi^2(4) = 4.70$	.319
\$20 001–30 000	9 (15.5)	7 (18.9)	2 (10.0)		
\$30 001–40 000	9 (15.5)	4 (10.8)	5 (25.0)		
\$40 001–50 000	5 (8.6)	4 (10.8)	1 (5.0)		
< \$50 000	1 (1.7)	0 (0.0)	1 (5.0)		
ADA risk score					
Mean (SD)	13.97 (2.88)	13.37 (3.08)	15.10 (2.08)	$t(52.41) = 2.54$	0.14
Range	10–24	10–24	10–20		
Acculturation					
Mean (SD)	2.23 (0.82)	2.15 (0.82)	2.34 (0.93)	$t(56) = 0.81$	.422
Range	1.00–2.00	1.00–3.90	1.17–4.00		

Abbreviation: ADA, American Diabetes Association.

Table 3
Baseline Physiologic and Survey Measures for Intervention and Control Groups

Measure	Intervention	Control	Difference	P
Weight				
Mean (SD)	200.11 (41.66)	194.70 (39.26)	$t(56) = 0.48$	.634
Range	140.6–321.2	132.8–280.2		
No.	38	20		
Waist circumference				
Mean (SD)	43.36 (5.11)	42.81 (8.161)	$t(55) = 0.31$	.758
No.	38	19		
Body mass index				
Mean (SD)	34.60 (5.78)	33.79 (7.15)	$t(56) = 0.47$	.643
No.	38	20		
Casual blood glucose				
Mean (SD)	124.39 (21.73)	121.70 (11.25)	$t(55.99) = 0.62$	.536
Range	100–183	104–140		
No.	38	20		
Diet self-efficacy				
Mean (SD)	5.90 (2.773)	5.78 (2.10)	$t(56) = 0.18$	.862
No.	38	20		
Physical activity self-efficacy				
Mean (SD)	2.88 (0.91)	3.04 (0.899)	$t(56) = 0.64$	.525
No.	38	20		
Fat frequency score				
Mean (SD)	22.5 (9.89)	23.85 (8.46)	$t(56) = 0.64$	.525
No.	38	20		
Fruit and vegetable				
Mean (SD)	12.89 (5.57)	11.65 (5.70)	$t(56) = 0.80$	.425
No.	38	20		

Adjusted Means and Standard Errors for Intervention and Control Groups and Analysis of Variance Results

Table 4

Measure	Time 2		Time 3		Main Effect ^d		Interaction Effect ^d
	Intervention	Control	Intervention	Control	Time	Group	
Weight							
Mean (SE)	189.82 (1.07)	194.50 (1.90)	188.23 (1.62)	194.49 (2.87)	0.07 (.801)	4.39 (.045) *	0.60 (.446)
No.	25	8	25	8			
Waist circumference							
Mean (SE)	41.44 (0.393)	42.55 (0.695)	41.34 (.39)	43.39 (.68)	0.22 (.639)	4.67 (.039) *	2.38 (.134)
No.	25	8	25	8			
Body mass index							
Mean (SE)	33.13 (0.191)	34.01 (0.337)	32.84 (0.29)	34.04 (0.51)	0.07 (.80)	4.97 (.033) *	0.79 (.380)
No.	25	8	25	8			
Casual blood glucose							
Mean (SE)	107.05 (4.29)	106.96 (7.69)	109.36 (4.75)	111.24 (8.51)	0.15 (.706)	0.02 (.898)	0.02 (.879)
No.	25	8	25	8			
Diet self-efficacy							
Mean (SD)	7.57 (0.44)	6.32 (0.78)	7.78 (0.33)	5.87 (0.59)	0.85 (.364)	5.58 (.025) *	0.55 (.464)
No.	25	8	25	8			
Physical activity self-efficacy							
Mean (SE)	3.48 (0.159)	2.28 (0.295)	3.37 (1.01)	6.18 (1.88)	0.014 (.908)	0.56 (.459)	3.37 (.077)
No.	24	7	24	7			
Fat frequency score							
Mean (SE)	15.21 (1.22)	19.82 (2.35)	14.38 (1.54)	18.08 (2.95)	0.87 (.360)	2.39 (.133)	0.11 (.748)
No.	25	7	25	7			
Fruit and vegetable							
Mean (SE)	18.23 (1.28)	14.89 (2.43)	14.95 (1.12)	12.88 (2.13)	3.37 (.077)	1.38 (.250)	0.30 (.591)
No.	25	7	25	7			

^a $F(1, 30)$ for each measure, except fat frequency score and fruit and vegetable—each, $F(1, 29)$. P value in parentheses.

$P < .50$
*

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Table 5

Means and Standard Deviations for Intervention Analysis of Variance Results (n = 25)

Measure	Time 1 ^a	Time 2 ^a	Time 3 ^a	Wilk's Λ ^b	Within-Subjects Contrasts ^c		
					Time 2 vs Time 1	Time 3 vs Time 1	
Weight	196.88 (35.39)	192.26 (34.79)	190.68 (35.92)	.595, 7.83 (.003)*	16.08 (.001)*	12.66 (.002)*	
Waist	43.08 (4.38)	41.61 (4.72)	41.52 (4.95)	.601, 7.64 (.003)*	12.57 (.002)*	14.28 (.001)*	
Body mass index	33.88 (5.21)	33.07 (5.04)	32.78 (5.13)	.607, 7.44 (.003)*	15.33 (.001)*	12.28 (.002)*	
Blood glucose	128.96 (23.28)	106.96 (21.40)	109.60 (20.48)	.629, 6.79 (.005)*	11.26 (.003)*	11.76 (.002)*	
Diet self-efficacy	5.82 (2.39)	7.64 (2.12)	7.89 (1.82)	.563, 8.92 (.001)*	9.16 (.006)	18.53 (<.001)*	
Physical activity self-efficacy	2.76 (0.85)	3.45 (0.89)	3.29 (0.80)	.528, 9.84 (.001)*	20.55 (<.001)*	6.58 (.013)	
Fat frequency score	24.20 (9.52)	15.68 (5.92)	14.92 (9.10)	.465, 13.239 (<.001)*	26.11 (<.001)*	21.92 (<.001)*	
Fruit and vegetable	13.00 (5.86)	18.04 (6.73)	14.72 (7.46)	.615, 7.20 (.004)*	12.46 (.002)*	1.89 (.182)	

^aValues in mean (SD).

^bValues in Λ , $F(2, 23)$. P values in parentheses.

^cValues in $F(1, 24)$. P values in parentheses.

* $P < .05$.