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Research Article

The *En Balance* Education Program Improves health Determinants in Hispanic Patients with *Type 2 Diabetes* through Changes in Dietary Choices and Physical Activity

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Abstract

Objective: To determine the role of changes in dietary choices and physical exercise promoted by the *En Balance* program on measures of health in Hispanics with type-2 diabetes mellitus.

Methodology: Thirty-four participants completed the pre and post Family Habits Frequency Questionnaire at baseline and after three months follow-up. Participants were Spanish-speaking Hispanics with *type 2 diabetes* aged 37-69 years. The changes in dietary behaviors and physical activity were determined. The body composition measurements by Dual-energy X-ray Absorptiometry (DXA), blood glucose, hemoglobin A1C (A1C) and lipid profile were reported.

Results: Participants showed a broad range of significant improvement in both dietary habits and physical exercise. For instance, participants read food labels significantly more often after the 3 months compared with baseline (P=0.0002). Also, there was a significant increase of physical activity among females such as doing 30 minutes of physical activity (P=0.04) and increasing in walking (P=0.01).Anthropometric measurements such aswaist circumference and DXA total fat decreased significantly after the educational program by (P= 0.015) and (P= 0.0005), respectively. There was a significant decrease inA1C from 7.87 ± 2.01 (63±22mmol/mol IFCC (the International Federation of Clinical Chemistry)) to 7.08 ± 1.67 (54±18 mmol/mol IFCC) (P<0.001; effect size= -0.43). Both HDL/cholesterol ratio (P=0.003) and HDL (P= 0.0023) improved after the educational program.

Conclusion: The culturally sensitive educational program among Hispanics with *type 2 diabetes* showed significant positive changes in participants' dietary behaviors and physical activities, associated with the improved health determinants of anthropometric changes, glycemic control, and lipid profiles.

Keywords: Food labels; Physical activity; Fasting plasma glucose; Cholesterol; Behaviors

Introduction

Diabetes continues to be a major health problem worldwide [1]. An estimated of 346 million people have diabetes throughout the world [2]. Around 28.9 million people (12.3%), 20 years or older, had diagnosed and undiagnosed diabetes in 2012 in the United States. The risk of developing *type 2 diabetes* is associated with obesity [3], older age [4], family history [4] and lack of physical activity [5]. The risk is increased for certain race/ethnicities with African American, Hispanic/Latino American, and American Indian, at the highest risk for *type 2 diabetes* compared to non-Hispanic whites [1]. *Type 2 diabetes* has been a burden, especially on ethnic minorities such as Hispanics in the United States. Diabetes is an important contributor to heart disease and stroke, kidney failure, non-traumatic lower-limb amputations, blindness and eye problems, hypertension, nervous system disease, and dental disease among American adults [5]. Death from diabetes is reported as the seventh cause of death in the United States [1,6]. The Centers of Disease Control and Prevention (CDC) has stated that diabetes is the fifth cause of death among Hispanics in the United States [7]. The prevalence of obesity among the Hispanic ethnic group aged 20 and older in the United State is 42.5% [8]. In addition, poor compliance and failure to attend conventional medical appointments and follow-up is the highest among Latinos compared to other ethnic groups [9]. Poor appointment keeping is associated with increasing the risk of elevated A1C, Low Density Lipoprotein (LDL), and high systolic blood pressure [9].

Moderate intensity and length of exercising are important factors to prevent diabetes [10]. Research has shown that physical activity can decrease blood glucose, decrease LDL cholesterol, raise High Density Lipoprotein (HDL) cholesterol, improve weight loss, and reduce body fat [11]. Eating healthy meals, being physically active, and losing excess weight can manage the blood glucose for most people with *type 2 diabetes* [1].

By taking steps such as acquiring and maintaining a support network and seeking the counsel of their health care providers, those with *type 2 diabetes* can control the risk of complications [1]. Cultural studies concerning diabetes management have shown that

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such intervention programs are necessary to reduce the incidence of diabetes and its complications in general and in Hispanic populations in specific [1,12,13]. Several studies have found that diabetes education programs decrease serum glucose, A1C, and body weight significantly among those with *type 2 diabetes* [10,14,15]. Diabetes education programs for Hispanics with *type 2 diabetes* specifically have improved several health outcomes (e.g. glucose, A1C) [6,16-18].

Our previous report showed significant improvement in blood glucose (glucose and A1C), lipid profile (cholesterol and HDL levels) and anthropometric (body weight and waist-to-hip ratio) levels among Hispanics with *type 2 diabetes* [19]. The purpose of this study was to assess pre/post effects of a culturally sensitive educational program on lifestyle and behavioral improvement as potential determinants of the beneficial changes in anthropometric measures, diabetes control and the lipid profile.

Materials and Methods

En balance diabetes education program

"*En Balance*" is specifically designed as a culturally sensitive diabetes education program to promote a healthier lifestyle for Hispanics who have *type 2 diabetes*. The study design was a prospective intervention pilot study where subjects served as their own control (i.e. comparing 3 months to baseline) which maximizes the control of extraneous and unmeasured confounders. The study was conducted at the School of Public Health at Loma Linda University by personnel from: Loma Linda University Center for Health Disparities and Molecular Medicine, School of Medicine and the School of Public Health. The educational classes were conducted once a week during the 3-month period of the study. All classes were presented in Spanish and each session lasted for two hours, the details of the details of the study methodology have been described previously [16,19,20]. The educational team included Spanish-speaking: registered dietitians, registered nurses, physicians and nutrition students. Registered dietitians and nutrition students were involved in the classroom education sessions. The study team collected the biological data.

Sample and setting

Participants were Spanish-speaking Hispanics with *type 2 diabetes* aged 37-69 years. Potential participants were excluded from the study if they had history of drug or alcohol abuse, impaired mental condition, history of major systemic disease, or did not speak Spanish. Pregnant and lactating women were excluded from the study as well. Out of 44 who were qualified and enrolled into this study, 34 completed the pre and post Family Habits Frequency Questionnaire at baseline and after 3 months of the study. The drop out was mainly due to transportation constraints. Participants attended the "*En Balance*" educational program in the evenings and participants' families were also encouraged to attend the education sessions. Informed consent was obtained from all participants and the study was approved by Loma Linda University Institutional Review Board.

Body composition

Dual-energy X-ray Absorptiometry (DXA) using a Hologic QDR-4500A instrument and body composition analysis software version 8.1A (Hologic, Inc, Waltham, MA) was used to measure total and regional body composition. For each assessment, scan time was around three minutes with a radiation exposure of 1.5 mrem. All scans by DXA were read and signed by a radiologist.

Table 1: Baseline subject characteristics.

Variable	N	Percent (%)
Sex		
Male	9	26.5
Female	25	73.5
Age (years)		
35-44	8	23.5
45-54	14	41.2
55-70	12	35.3
Mean age ± SD	52.0±9.3	
Height (cm)		
145-154	14	41.2
155-164	13	38.2
165-175	7	20.6
Mean height ± SD	158.4±7.4	
Weight (kg)		
45-74	14	41.2
75-94	13	38.2
95-122	7	20.6
Mean weight ± SD	81.2±17.8	
Body Mass Index (kg/m^2)		
18.5-24.9	5	14.7
25.0-29.9	10	29.4
30.0-39.9	13	38.2
>40.0	6	17.7
Mean BMI ± SD	32.2±7.0	
Education		
Elementary or less	12	44.4
Junior high or high school	10	37.0
College and above	5	18.5

Data collection

The pre and post Family Habits Frequency Questionnaire from the HEART (Health Education Awareness Research Team) program was used to evaluate participants' behavioral changes before and after the program [21]. The questionnaire used for this study has six major parts: 1) salt and sodium, 2) cholesterol and fat, 3) weight, 4) physical activity, 5) family activities and 6) smoking. This questionnaire has been utilized in many cardiovascular disease health promotions and prevention studies working with Hispanic populations and has shown to have good internal validity [21]. Blood as well as anthropometric measurements were obtained before and after the educational intervention.

Statistical analysis

Descriptive statistics for the participants included Wilcox on signed rank (non-parametric) test to measure the behavioral changes between baseline and three months.

Homeostatic model assessment insulin resistance (HOMA-IR)

Table 2: Distribution of eating behaviors frequency before and after the intervention.

Choose foods labeled low sodium, sodium free or no salt added	Baseline (%) N= 32	3 months (%) N= 32	*%Difference***	*P*-Value *
Never	34.38	12.50	-21.88	0.001
Sometimes	31.25	21.88	-9.37	
Usually	28.13	46.88	18.75	
Always	6.25	18.75	12.5	
Fill the salt shaker with a mixture of herbs	**N= 32**	**N= 32**		
Never	96.88	71.88	-25.0	0.018
Sometimes	3.13	21.88	18.75	
Usually	0	6.25	6.25	
Always	0	0	0.00	
Read the food label	**N= 30**	**N= 30**		
Never	30.00	10.00	-20.0	0.0002
Sometimes	33.33	16.67	-16.66	
Usually	26.67	30.00	3.33	
Always	10.00	43.33	33.33	
Cool soups and remove the layer of fat that rises to the top	**N= 34**	**N= 34**		
Never	26.47	11.76	-14.71	0.0137
Sometimes	26.47	14.71	-11.76	
Usually	17.65	23.53	5.88	
Always	29.41	50.00	20.59	
Choose fruits and vegetables	**N= 34**	**N= 34**		
Never	14.71	2.94	-11.77	0.0468
Sometimes	20.59	17.65	-2.94	
Usually	35.29	32.35	-2.94	
Always	29.41	47.06	17.65	
Read labels to choose foods lower in calories	**N= 33**	**N= 33**		
Never	30.30	9.09	-21.21	0.0025
Sometimes	30.30	24.24	-6.06	
Usually	18.18	33.33	15.15	
Always	21.21	33.33	12.12	
Bake fish instead of frying it	**N= 34**	**N= 34**		
Never	32.35	8.82	-23.53	0.0012
Sometimes	38.24	26.47	-11.77	
Usually	11.76	35.29	23.53	
Always	17.65	29.41	11.76	

*Signed Rank (Non-parametric) Test
**The percentage difference of 3 months minus baseline.
P-value based on equal sample size
- Sample size was not the same for each question due to varying degree of missing response to baseline, three months or both questions.

was calculated by the using the following equation: HOMA-IR= glucose (mmol/L) x insulin (mμ/L)/22.5 [22]. Effect size is included to measure the observed magnitude of anthropometric and blood parameters of the intervention (Effect size = mean (3 months) – mean (baseline) / SD pooled). Cronbach's alpha, a measure of internal consistency, was used to evaluate to what degree the individual questions in each created index were correlated. The post-test responses were used for this evaluation. Analyses were performed using SAS version 9.3 (SAS Institute, Cary, NC). *P*-values < 0.05 were considered to be statistically significant.

Results

Table 1 displays descriptive statistics of 34 participants at baseline. Participants' ages ranged from 37 to 69 years with mean of 52 years. There were more females (74%) than males. Also, the majority of participants had high school degree or lower (81%). The mean Body

Table 3: Distribution of physical activity frequency before and after the intervention.

<table>
<tr><th></th><th>Baseline (%)</th><th>3 months (%)</th><th>% Difference**</th><th>P-Value*</th></tr>
<tr><td>Do 30 minutes of physical activity female</td><td>N= 29</td><td>N= 29</td><td rowspan="2">-20.69</td><td rowspan="5">0.0405</td></tr>
<tr><td>Never</td><td>27.59</td><td>6.90</td></tr>
<tr><td>Sometimes</td><td>41.38</td><td>55.17</td><td>13.79</td></tr>
<tr><td>Usually</td><td>24.14</td><td>24.14</td><td>0.00</td></tr>
<tr><td>Always</td><td>6.90</td><td>13.79</td><td>6.89</td></tr>
<tr><td>Walk female</td><td>N= 22</td><td>N= 22</td><td></td><td></td></tr>
<tr><td>Never</td><td>4.55</td><td>0</td><td>-4.55</td><td rowspan="4">0.0176</td></tr>
<tr><td>Sometimes</td><td>54.55</td><td>31.82</td><td>-22.73</td></tr>
<tr><td>Usually</td><td>36.36</td><td>50.00</td><td>13.64</td></tr>
<tr><td>Always</td><td>4.55</td><td>18.18</td><td>13.63</td></tr>
<tr><td>Dance female</td><td>N= 24</td><td>N= 24</td><td></td><td></td></tr>
<tr><td>Never</td><td>41.67</td><td>20.83</td><td>-20.84</td><td rowspan="4">0.002</td></tr>
<tr><td>Sometimes</td><td>50.00</td><td>50.00</td><td>0.00</td></tr>
<tr><td>Usually</td><td>8.33</td><td>16.67</td><td>8.34</td></tr>
<tr><td>Always</td><td>0</td><td>12.50</td><td>12.50</td></tr>
<tr><td>Work in the garden female</td><td>N= 22</td><td>N= 22</td><td></td><td></td></tr>
<tr><td>Never</td><td>22.73</td><td>22.73</td><td>0.00</td><td rowspan="4">0.0195</td></tr>
<tr><td>Sometimes</td><td>50.00</td><td>22.73</td><td>-27.27</td></tr>
<tr><td>Usually</td><td>13.64</td><td>27.27</td><td>13.6</td></tr>
<tr><td>Always</td><td>13.64</td><td>27.27</td><td>13.6</td></tr>
<tr><td>Does aerobic dancing female</td><td>N= 27</td><td>N= 27</td><td></td><td></td></tr>
<tr><td>Never</td><td>74.07</td><td>37.04</td><td>-37.03</td><td rowspan="4">0.038</td></tr>
<tr><td>Sometimes</td><td>11.11</td><td>44.44</td><td>33.33</td></tr>
<tr><td>Usually</td><td>11.11</td><td>14.81</td><td>3.7</td></tr>
<tr><td>Always</td><td>3.70</td><td>3.70</td><td>0.00</td></tr>
</table>

*Signed Rank (Non-parametric) Test

**The percentage difference of 3 months minus baseline.

P-value based on equal sample size

- Sample size was not the same for each question due to varying degree of missing response to baseline, three months or both questions.

Mass Index (BMI) was 32 kg/m^2.

Table 2 compares the frequency of the eating behaviors of participants before and after the educational program. The listed items showed significant improvement toward acquiring healthier behaviors. For example, before the intervention, 30% of the participants reported they never read the food label and only about 12% of them reported they always read the food label. After the intervention, only 9% of them reported they never read the food label and about 44% of them reported they always read food label (*P*=0.0002). Table 3 compares the frequency of the physical activity behaviors before and after the intervention. There was a significant increase of physical activity among females such as doing 30 minutes of physical activity (*P*=0.04), increasing in walking (*P*=0.01), dancing (*P*=0.002), and working in the garden (*P*=0.01). Summation of all questions from Table 1 and 2 that had significant improvement was performed to develop an overall behavioral change score of the participants. Higher scores imply adoption of more frequent healthy behaviors. On average, participants had significantly higher score after 3 months (36.09) when compared to the baselines value (30.73), *P*-value <0.0001.

Table 4 demonstrates significant improvement in anthropometric and blood parameters. On average, there was about 14% reduction in blood glucose level (*P* = 0.003; effect size= -0.34), 10% improvement in A1C from 7.87 ± 2.01 (63±22 mmol/mol IFCC) to 7.08±1.67 (54±18 mmol/mol IFCC) (*P*<0.001; effect size= -0.43), and 23.5% improvement in Homeostatic Model Assessment (HOMA-IR) (*P*=0.0014; effect size= -0.32). Also, DXA total percent fat, DXA total fat, and DXA trunk fat showed about 2% (P = 0.0028; effect size= -0.42), 3% (*P*= 0.0005; effect size= -0.09), and 3.7% (*P* = 0.0008; effect size= -0.11) improvement (reduction in percentages), respectively. Moreover, there was a significant decrease in some of the anthropometric measurements after the educational program, which included 2.4% improvement in both waist circumference (*P*= 0.015; effect size= -0.19) and Waist to Hip Ratio (WHR) (*P*= 0.025; effect size= -0.27).Also, there was a 13.75% increase in HDL/cholesterol ratio (0.003; effect size= 0.57), and 9.5% increase in HDL (*P*= 0.0023; effect size= 0.41) after 3 months of the educational program.

For the Cronbach's alpha, salt and sodium index had 10 questions. Five questions that had low correlation with the primary index questions were removed. The Cronbach's alpha value for the

Table 4: Comparison of anthropometric and blood parameters before and after the program.

	Baseline Mean^{M1} ± SD	3 Months Mean^{M2} ± SD	Mean Difference*	*Effect Size*+	*P*-value**
Body mass index, kg/m^2	32.18 ± 7.02	31.73 ± 6.72	-0.448	-0.07	0.20
Waist Circumference	101.57 ± 13.37	99.12 ± 12.70	-2.45	-0.19	0.0115
Waist to Hip ratio	0.93 ± 0.077	0.91 ± 0.07	-0.023	-0.27	0.025
DXA Total fat (kg)	30.41 ± 10.68	29.50 ± 10.52	-0.91	-0.09	0.0003
DXA Trunk Fat (kg)	16.54 ± 5.73	15.93 ± 5.60	-0.61	-0.11	0.0003
DXA % Total fat	39.60 ± 10.62	35.77 ± 7.53	-0.60	-0.42	0.0004
Glucose (mg/dL)	166.41 ± 65.98	143.21 ± 57.89	-23.21	-0.34	0.0011
A1C (%)	7.87 ± 2.01	7.08 ± 1.67	-0.79	-0.43	<0.0001
IFCC, mmol/mol	63 ± 22	54 ± 18	-9.0	-0.45	<0.0001
HOMA-IR	4.72 ± 2.86	3.87 ± 2.47	-0.85	-0.32	0.0062
HDL, mg/dL	44.65 ± 8.87	48.85 ± 11.43	4.21	0.41	0.0023
LDL, mg/dL	123.38 ± 38.28	118.41 ± 37.64	-4.97	-0.13	0.21
HDL/Cholesterol ratio, %	0.24 ± 0.06	0.28 ± 0.08	0.033	0.57	0.0015

*The mean difference: 3 months minus baseline

**P-values are produced after log transformation based on t-test.

#SD= Standard Deviation

+Effect size = *M2 – M1* / SD pooled

DXA: Dual-energy X-ray Absorptiometry

HOMA-IR: Homeostatic Model Assessment Insulin Resistance-Insulin Resistant

HDL: High Density Lipoprotein

LDL: Low Density Lipoprotein

IFCC: The International Federation of Clinical Chemistry

remaining five questions was improved to 66.1%. The Cholesterol and fat index had 10 questions. Two questions were removed due to their low correlation values with the rest of the questions in this index. The resultant Cronbach's alpha for the remaining 8 questions was 64.9%. For the third index, there were five questions about weight. One question was taken out due to low correlation value with the others, the final Cronbach's alpha was 74.1%. For the mother's physical activity index, there were four questions. The obtained Cronbach's alpha was 77.7%. There were 6 questions in the family activities index. The obtained Cronbach's alpha was 73.8%. For the last index on smoking, Cronbach's alpha was not performed as the responses were binary.

Discussion

The "*En Balance*" is a culturally sensitive educational program for Hispanics with diabetes that improves the participants' lifestyle measured by dietary behaviors, physical activity resulting in improvements in anthropometric outcomes, glycemic control and lipid profile. Diabetes has a high prevalence among the Hispanic population and improvements in diet and physical activity can help improve outcomes in this enlarging ethnic group. This study found significant improvement in decreasing cholesterol and fat intake through behavioral changes by choosing food low in cholesterol and fat and making better lifestyle choices. Improvement in exercise frequency was also achieved and the group demonstrated decreases in waist circumference and WHR suggesting improvements in fat distribution within the body.

We found a clear improvement in the percent difference of eating behaviors and physical activities before and after the educational program. This improvement may have a positive effect size on the reduction of glucose (-0.34), A1C (-0.43), and HOMA-r (-0.32). Similar to our study, Rashed, et al. (2016) evaluated the effect of a pre/post diabetes educational program among 215 patients with *type 2 diabetes* and observed an increase in the participants' mean score of knowledge after attending a one-time four hour educational session. This study also found a significant reduction in mean fasting blood glucose, triglycerides over the period of two to three months of follow up. Similarly, apre/post study by Castillo et al. (2010) found that a diabetes educational program for the Hispanic population increased individual physical activity by an average of 30 minutes/day and increase in the consumption of more fruits and vegetables. The analysis of this study also showed positive reductions in fasting glucose, A1C, and HOMA-IR, and systolic blood pressure after enrolling in the weekly two-hour educational sessions for 10-weeks. Another pre/post-test design by Salinero-Fort et al. (2011) evaluating the effectiveness of 24 months PRECEDE (Predisposing, Reinforcing, Enabling, Causes in Educational Diagnosis, and Evaluation) educational model among patients with *type 2 diabetes* found a decrease in total cholesterol, triglycerides, LDL, A1C, and a significant increase in HDL after the study period. Another single-group pre/post-test study of 21 Mexican American adults with *type 2 diabetes* who participated in the six 4-hour training sessions for 8 weeks found that there was a significant decrease in total minutes of sitting activities resulting in the increasing of minutes/week for walking or for engaging in moderate activity [23].

The randomized controlled Diabetes Prevention Program [24], which provided lifestyle modification as one intervention, supported our findings that a lifestyle modification can help in reducing total energy intake and percent energy from fat among individuals with *type 2 diabetes*. A 6-month randomized controlled clinical trial [18] showed that participants in the intervention group increased their knowledge significantly after receiving 10-week of the culturally sensitive promotores-led diabetes self-management program which focused on teaching the participants on different topics such as the disease itself, complications, effect of exercise and nutrition, where the control group received the usual care from a provider at the clinic. This clinical trial demonstrated minor positive changes in the A1Clevels at 3 months. Furthermore, a qualitative study by Rise et al. [25] showed that diabetes self-management educational program among 23 *type 2 diabetes* patients increased participants' knowledge to improve their diet, medication, and physical activity habits.

We found a significant increase in physical activity among females after enrolling participants in our educational program. The small sample size of males (n=9) did not justify performing statistical testing. We found a clear improvement in the percent difference of the physical activities before and after the educational program. This improvement may have a positive effect size on the reduction of BMI (-0.07), waist circumference (-0.19), and DXA % total fat (-0.42). Previous studies have shown significant increase in physical activity behaviors for patients of both genders with *type 2 diabetes* after receiving educational programs [6,26,27].

A 2-arm randomized clinical trial by Allen et al. (2008) showed that participants with *type 2 diabetes* in the intervention group (which received 90 minutes of diabetes education plus counseling derived from self-efficacy theory that helps participants to change physical activity behaviors) increased the recommended 30 minutes per day of moderate physical activity compared to the control group (which received only 90 minute of diabetes education). This 8-weeks diabetes education program resulted in significant decreases in A1C and BMI. The study also showed a significant increase of 20 minutes of physical activity of most days of the week in a diabetes intervention program that emphasized physical activity. Similarly, a study by De Greef et al. [28] demonstrated that participants with *type 2 diabetes* who received a modification program on physical activity and sedentary behavior (intervention group) showed a significant increase in physical activity and reduction in sedentary behavior compared to the control group who received just the usual care.

A randomized clinical trial by Dutton et al. (2008) found that glucose monitoring and counseling increased the weekly physical activities by 22 minutes greater than those who were receiving the usual care [26]. This non-statistically significant increase might have been due to the short duration of the study, which was only 3 sessions lasting 3 hours each over 2 weeks.

The analysis showed a clear improvement in the percent difference of eating behaviors before and after the educational program. This enhancement may have improved effect size on decreasing LDL (-0.13), increasing HDL (0.41) and HDL/cholesterol (0.57). The analysis of our study also found significant reductions in total and percent fat and trunk fat. Results from our prior studies of the same approach to the *En Balance* Diabetes Education Program showed significant improvements in both cholesterol and fat levels, and reduction of fat intake after the diabetes educational program [16,19,20]. Results after enrolling participants in a 3-month diabetes educational study found significant reductions in dietary cholesterol, total fat intake and total cholesterol and LDL cholesterol [29]. Poor medical appointment keeping tends to be high among Latinos, which contributes to increasing levels of LDL, A1C, and systolic blood pressure [9]. Our study, however, indicated improvements in some of the measurements such as A1C, HDL, and HDL/cholesterol ratio. A study by Yates et al. (2010) on white Europeans and South Asians showed a significant positive association between physical activity and waist circumference in women and HDL cholesterol in South Asian men. This study also showed that white European individuals with high levels of physical activity had lower BMI, waist circumference, and significantly lower glucose levels compared with those with lower amounts of physical activity [30]. A study by Abbott et al. (2012) on the effectiveness of nutrition education from a diabetes cooking course reported that all participants had increased nutrition knowledge and cooking skills as they benefit from reducing fat and salt intake. They also increased the range of vegetables consumption, healthier shopping and reading food labels [31].

Our study showed that there was a significant improvement of participants' salt and sodium intake. This result is important given the fact that several pre/post and 2-arm randomized studies have found that health education programs with patients with *type 2 diabetes* improved the systolic blood pressure significantly [6,14,17].

A meta-analysis by Boule et al. [32] evaluating 14 clinical trials (12 aerobic exercise trials and 2 resistance exercise trials) that incorporated exercise intervention lasting at least 8 weeks showed that physical exercise decreased the A1C (weighted mean difference 0.66%, P-value <0.001). A more recent meta-analysis by Snow ling and Hopkins [33] combined 27 controlled clinical trials. They showed that physical exercise in various forms (aerobic, resistance and combined training) had a protective effect on glycemic control measure (A1C). The overall mean difference of A1C in studies lasting ≥12 weeks was reduced to 0.8 ± 0.3%. Noteworthy, these improvements in A1Cattained by physical exercise are close to the outcome made from long-term insulin or drug therapy (0.6-0.8%) [34,35].

The uniqueness of our study was because it looked at the improvement of lifestyle and behavioral changes in addition to the anthropometric and blood profile enhancement. Our study was also designed to accommodate potential cultural and language barriers. The educational team included members who speak the same language as the participants. Also, the measured activities before and after in this educational intervention were carefully selected to match and satisfy the majority of Hispanic communities. For instance, physical exercise was promoted through dancing and garden trimming for women and playing soccer for men. Another strength of this study was obtaining comprehensive measurement of the participants including anthropometric, blood samples and behavioral evaluation survey. Despite the three months study period, the percentage of loss-to-follow up was about 23%. Even though transportation was arranged, participants did not take full advantage of this support. Transportation barriers were shown to be the major reason for attrition.

The potential limitations of the current study include lack of long-term follow-up of participants. As documented from this study, the 3 months results were encouraging. However, there were no data to support any long-term maintenance of the achieved results. The relatively small sample size of the study limited us from doing multivariable analysis to control for appropriate confounders such as gender and age. However, the method of analysis where subjects served as their own controls in repeated measures of analysis (i.e. post-versus pre-) eliminated this type of confounding. We had far more females (74%) than males in this study. Also, the small sample size constrained us to use non-parametric statistics such as Wilcox on signed rank test. Reliability measure obtained through Cronbach's alpha suggests removal of some questions to improve the internal consistency of the questionnaire.

Conclusion

This culturally sensitive educational intervention, "*En Balance*", resulted in positive dietary and physical activity changes in Hispanics with *type 2 diabetes*. These favorable lifestyle changes were maintained for at least three months and were associated with improvements in recognized clinical surrogate measures. Participants improved their behaviors such as increasing the level of reading labels, choosing fruits and vegetables, and being more physically active, all of these changes resulted in an improvement in glycemic control (A1C), lipid profile and body fat distribution. Sustained improvements in these surrogate measures would be predicted to result in decreases in complications of diabetes and potentially decreased overall mortality in this highly vulnerable population.

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References

1. Centers for Disease Control and Prevention. National Diabetes Statistics Report. Atlanta, GA: U.S. Department of Health and Human Services. Centers for Disease Control and Prevention. 2014.
2. Centers for Disease Control and Prevention. High blood pressure. 2015.
3. Yan S, Hong X, Yu H, Yang Z, Liu S, Quan W, et al. Prevalence of Diabetes and Health-Related Quality of Life Among Rural-to-Urban Nong Zhuan Fei Migrants in an Urban Area of Northern China, 2013. Public Health Rep. 2016. 131: 167-176.
4. Nayak BS, Sobrian A, Latiff K, Pope D, Rampersad A, Lourenço K, et al. The association of age, gender, ethnicity, family history, obesity and hypertension with type 2 diabetes mellitus in Trinidad. Diabetes Metab Syndr. 2014; 8: 91-95.
5. Taylor R, Ram P, Zimmet P, Raper LR, Ringrose H. Physical activity and prevalence of diabetes in Melanesian and Indian men in Fiji. Diabetologia. 1984; 27: 578-582.
6. Castillo A, Giachello A, Bates R, Concha J, Ramirez V, Sanchez C, et al. Community-based Diabetes Education for Latinos: The Diabetes Empowerment Education Program. Diabetes Educ. 2010; 36: 586-594.
7. American Heart Association. High Blood Pressure. 2014.
8. Ogden CL, Margaret Carroll, Kit BK, Flegal KM. Prevalence of obesity among adults: United States. 2011-2012. 2013.
9. Parker MM, Moffet HH, Schillinger D, Adler N, Fernandez A, Ciechanowski P, et al. Ethnic differences in appointment-keeping and implications for the patient-centered medical home--findings from the Diabetes Study of Northern California (DISTANCE). Health Serv Res. 2012; 47: 572-593.
10. Nagi D, Gallen I. ABCD position statement on physical activity and exercise in diabetes. Practical Diabetes International. 2010; 27: 158-163.
11. National Institute of Diabetes and Digestive and Kidney Diseases. What I need to know about physical activity and diabetes. 2014.
12. Freimuth VS, Quinn SC. The contributions of health communication to eliminating health disparities. Am J Public Health. 2004; 94: 2053-2055.
13. Johnson DB, Eaton DL, Wahl PW, Gleason. Public health nutrition practice in the United States. J Am Diet Assoc. 2001; 101: 529-534.
14. Allen NA, Fain JA, Braun B, Chipkin SR. Continuous glucose monitoring counseling improves physical activity behaviors of individuals with type 2 diabetes: A randomized clinical trial. Diabetes Res Clin Pract. 2008; 80: 371-379.
15. Rashed OA,Sabbah HA, Younis MZ, Kisa A, Parkash J. Diabetes education program for people with type 2 diabetes: An international perspective. Eval Program Plann. 2016; 56: 64-68.
16. Peterson RM, Beeson L, Shulz E, Anthony Firek, Marino De Leon, Hector Balcazar, et al. Impacting obesity and glycemic control using a culturally-sensitive diabetes education program in Hispanic patients with type 2 diabetes. Int J Body Compos Res. 2010; 8: 85-94.
17. Salinero-Fort MA, Carrillo-de Santa Pau E, Arrieta-Blanco FJ, Abanades-Herranz JC, Martín-Madrazo C, Rodés-Soldevila B, et al. Effectiveness of PRECEDE model for health education on changes and level of control of HbA1c, blood pressure, lipids, and body mass index in patients with type 2 diabetes mellitus. BMC Public Health. 2011; 11: 267.
18. Sixta CS, Ostwald S. Texas-Mexico border intervention by promotores for patients with type 2 diabetes. Diabetes Educ. 2008; 34: 299-309.
19. Metghalchi S, Rivera M, Beeson L, Firek A, De Leon M, Balcazar H, et al. Improved clinical outcomes using a culturally sensitive diabetes education program in a Hispanic population. Diabetes Educ. 2008; 34: 698-706.
20. Salto LM, Cordero-MacIntyre Z, Beeson L, Schulz E, Firek A, De Leon M. En Balance participants decrease dietary fat and cholesterol intake as part of a culturally sensitive Hispanic diabetes education program. Diabetes Educ. 2011; 37: 239-253.
21. Balcazar HG, De Heer H, Rosenthal L, Aguirre M, Flores L, Puentes FA, et al. A promotores de salud intervention to reduce cardiovascular disease risk in a high-risk Hispanic border population, 2005-2008. Prev Chronic Dis. 2010; 7: 28.
22. Matthews DR, Hosker JP, Rudenski AS, Naylor BA, Treacher DF, Turner RC. Homeostasis model assessment: insulin resistance and beta-cell function from fasting plasma glucose and insulin concentrations in man. Diabetologia. 1985; 28: 412-419.
23. McEwen MM, Pasvogel A, Gallegos G, Barrera L. Type 2 diabetes self-management social support intervention at the U.S.-Mexico border. Public Health Nurs. 2010; 27: 310-319.
24. Mayer-Davis EJ, Sparks KC, Hirst K, Costacou T, Lovejoy JC, Regensteiner JG, et al. Dietary intake in the diabetes prevention program cohort: baseline and 1-year post randomization. Ann Epidemiol. 2004; 14: 763-772.
25. Rise MB, Pellerud A, Rygg LO, Steinsbekk A. Making and maintaining lifestyle changes after participating in group based type 2 diabetes self-management educations: a qualitative study. PLoS One. 2013; 8: e64009.
26. Dutton GR, Provost BC, Tan F, Smith D. A tailored print-based physical activity intervention for patients with type 2 diabetes. Prev Med. 2008; 47: 409-411.
27. Kirk AF, Mutrie N, Macintyre PD, Fisher MB. Promoting and maintaining physical activity in people with type 2 diabetes. Am J Prev Med. 2004; 27: 289-296.
28. De Greef KP, Deforche BI, Ruige JB, Bouckaert JJ, Tudor-Locke CE, Kaufman JM, et al. The effects of a pedometer-based behavioral modification program with telephone support on physical activity and sedentary behavior in type 2 diabetes patients. Patient Educ Couns. 2011; 84: 275-279.
29. Ojo E, Beeson L, Shulz E, Firek A, De Leon M, Balcazar H, et al. Effect of the EnBalance, a culturally and language-sensitive diabetes education program, on dietary changes and plasma lipid profile in Hispanic diabetics. Int J Body Compos Res. 2010; 8: 69-76.
30. Yates T, Davies MJ, Gray LJ, Webb D, Henson J, Gill JM, et al. Levels of physical activity and relationship with markers of diabetes and cardiovascular

disease risk in 5474 white European and South Asian adults screened for type 2 diabetes. Prev Med. 2010; 51: 290-294.

31. Abbott PA, Davison JE, Moore LF, Rubinstein R. Effective nutrition education for Aboriginal Australians: lessons from a diabetes cooking course. J Nutr Educ Behav. 2012; 44: 55-59.

32. Boule NG, Haddad E, Kenny GP, Wells GA, Sigal RJ. Effects of exercise on glycemic control and body mass in type 2 diabetes mellitus: a meta-analysis of controlled clinical trials. JAMA. 2001; 286: 1218-1227.

33. Snowling NJ, Hopkins WG. Effects of different modes of exercise training on glucose control and risk factors for complications in type 2 diabetic patients: a meta-analysis. Diabetes Care. 2006; 29: 2518-2527.

34. UK Prospective Diabetes Study (UKPDS) Group. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). UK Prospective Diabetes Study (UKPDS) Group. Lancet. 1998; 352: 837-853.

35. UK Prospective Diabetes Study (UKPDS) Group. Effect of intensive blood-glucose control with metformin on complications in overweight patients with type 2 diabetes (UKPDS 34). UK Prospective Diabetes Study (UKPDS) Group. Lancet. 1998; 352: 854-865.

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