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# En Balance

## The Effects of Spanish Diabetes Education on Physical Activity Changes and Diabetes Control

### Purpose

This study was designed to assess the feasibility of culturally and language-sensitive diabetes education as a way to increase physical activity and to improve health/diabetes management in a group of Spanish-speaking Hispanics in the Inland Empire region of Southern California.

### Methods

En Balance is a culturally sensitive diabetes education program designed for Spanish-speaking Hispanic adults. The 3-month educational intervention assessed 16 males and 23 females living in Riverside and San Bernardino counties of Southern California. Baseline and 3-month evaluations of physical activity were assessed using the validated Arizona Activity Frequency Questionnaire.

### Results

After 3 months on the En Balance program, there was a significant increase in moderate intensity physical activity energy expenditure ( $M = 368 \pm 894$  kcal/day,  $P < 0.01$ ) and high intensity physical activity energy expenditure ( $M = 405 \pm 2569$  kcal/day,  $P = 0.05$ ) compared to baseline and significant reductions in A1C ( $-0.90\%$ ,  $P = 0.01$ ), total cholesterol ( $-13.44$  mg/dl,  $P = 0.01$ ), LDL cholesterol ( $-10.28$  mg/dl,  $P = 0.03$ ), and waist circumference ( $-1.52$  cm,  $P = 0.04$ ).

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## Conclusion

En Balance program resulted in significant mean increases in both moderate and high intensity physical activity energy expenditure among this group of Hispanic diabetic participants, indicating that despite a general pattern of low physical activity in this group, an intervention that stresses both nutrition and exercise in culturally sensitive ways can positively impact participant's physical activity levels as well as impact nutritional changes.

## Keywords

Hispanic, diabetes, education, physical activity, glucose control

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**D**iabetes in the United States has grown in epidemic proportions. The most current data report that there are an estimated 18.8 million people who have diagnosed diabetes and another 7.0 million who are unaware they have the disease.<sup>1-3</sup> In 2010, the total prevalence of diabetes affected about 8.3% of the US population, reaching an estimated 25.8 million Americans who have either been diagnosed with diabetes or have diabetes and have yet to be diagnosed.<sup>1-3</sup> In addition, there are 79 million adults who have impaired fasting glucose placing them high risk for developing the disease.<sup>1-3</sup>

Racial and ethnic minority groups, particularly the elderly among these populations, are disproportionately affected by diabetes.<sup>4-7</sup> African American, Hispanic, American Indian, and Alaska Native adults are up to twice as likely as non-Hispanic white adults to have diabetes.<sup>8</sup> Hispanics are the largest and fastest growing minority group, representing 16.3% of the total population.<sup>9</sup> By 2050, predictions suggest that Hispanics will represent approximately 30% of the US population.<sup>4,9</sup> Many Hispanics are recent immigrants with limited acculturation to the United States.<sup>9</sup> Given the diversity of culture and English language limitations, culturally and linguistically sensitive programs are necessary to address the health care needs of this rapidly growing population with diabetes.<sup>10</sup>

Blood glucose control is a critical step for those at risk and those already diagnosed with diabetes.<sup>11</sup> For

Hispanics, many of the traditional foods or food preparation customs in conjunction with adaptations to the US fast food culture make dietary changes critical. In addition to diet, physical activity is also an important component of diabetes management. Furthermore, studies report lower levels of physical activity in the Hispanic population, and nationally, more Hispanics (56.3%) than non-Hispanic whites (48.9%) have not achieved the recommended levels of physical activity.<sup>12</sup> Data from the Third National Health and Nutrition Examination Survey (NHANES-III) and Behavioral Risk Factor Surveillance Survey (BRFSS) have shown lower levels of leisure time physical activity among Hispanics when compared with non-Hispanic whites.<sup>13</sup> In fact, the 2004 BRFSS showed an estimated 40% of Hispanics maintained insufficient levels of leisure time physical activity as compared to non-Hispanic whites.<sup>13</sup> This finding is consistent with other studies reporting low levels of leisure time physical activity in the Hispanic population.<sup>14</sup>

Research has consistently shown high benefits of physical activity with respect to morbidity and mortality.<sup>15</sup> It is considered one of the single most important lifestyle factors.<sup>13</sup> Physical activity provides important protective factors related to decreased risk for obesity, heart disease, hypertension, diabetes, certain cancers, and premature mortality.<sup>16</sup> It can also help reduce levels of stress and anxiety, increase feelings of well-being, reduce chronic disease, increase bone density, and reduce functional decline with age.<sup>15,16</sup> Regular physical activity may be particularly advantageous for people with diabetes because it produces physiological changes that affect muscle and liver insulin sensitivity, muscle glucose uptake and utilization, and overall glycemic control.<sup>15</sup> Additional consequences related to chronic hyperglycemia, such as neuropathy, retinopathy, and nephropathy, may be prevented or delayed.<sup>6,15,17</sup>

National guidelines to educate the public about the minimum amount of exercise required to achieve health benefits clearly suggest regular leisure time physical activity.<sup>13</sup> However, in light of the data that clearly show much lower levels of leisure time and other physical activity in Hispanics, we need more initiatives designed to tackle the disparity between the recommended level and the actual level of physically activity for this fast growing population that is at higher risk for diabetes and obesity. Furthermore, there are few studies investigating the role of physical activity in the treatment of type 2 diabetes in Hispanics. Despite this lack of data on

Hispanic people, it is clear that in addition to stressing nutrition, effective diabetes programs need to include a strong exercise component<sup>18</sup> and need to assure that these programs are culturally responsive by including program content that is based on cultural preferences and addresses lower levels of English proficiency if they involve recent immigrant Hispanics. This study was designed to assess the feasibility of culturally and language-sensitive diabetes education as a way to increase physical activity and to improve health/diabetes management in a group of Spanish-speaking Hispanics in the Inland Empire region of Southern California. The health education program was adapted from the American Diabetes Association Guidelines for cultural relevance for the Hispanic population in San Bernardino and Riverside counties.

## Methods

### Research Study Design

This study was a 3-month trial (March-June 2008) to test the impact of a Spanish language comprehensive diabetes education program (En Balance) in Hispanics with type 2 diabetes. The primary outcomes were changes in physical activity, blood glucose values, hemoglobin A1c values, and weight reduction. This study included the following phases: recruitment, collection of baseline data, 3 months of diabetes education, collection of data at the end of the 3 months, and final data analysis. Study participants were chosen to serve as their own controls in a before-after design as this maximizes the control of extraneous confounding.

### Sample

Thirty-nine participants (16 males and 23 females) participated in this longitudinal study looking at data from the En Balance diabetes education program. Bilingual research assistants recruited potential study participants from the medical offices of physicians serving the Hispanic community in the Inland Empire. Personal interviews were then used to qualify participants; obtain brief medical histories, medication lists, physical activity, and diet histories; and invite patients to participate. Inclusion criteria for subject participation included: Hispanic ethnicity; 20 to 75 years of age; Spanish speaking and understanding; medical diagnosis of type 2 diabetes mellitus; if taking anti-diabetic

medication, must have started at least 3 months prior to enrollment in the study; and a signed informed written consent. Forty-six individuals met the study participation criteria, acquired written information about the study, enrolled in the study, and signed consent forms for participation in the study. Exclusion criteria included: pregnant, lactating, history of drug or alcohol abuse, impaired mental condition such as Alzheimer's disease, steroid therapy (influences insulin resistance), clinically relevant history of hepatic, neurologic, endocrine, major systemic disease, or incomplete data. Of the 46 participants who enrolled in the program, 7 dropped out or had incomplete data; 39 completed the study resulting in an 85% retention rate. The protocol for this study was approved by the Institutional Review Board of Loma Linda University.

### Setting

The program was carried out in the School of Public Health at Loma Linda University. Study participants attended education classes that were conducted on weekday evenings. Fourteen-hour fasting blood collections were drawn on Sunday mornings. In addition to study participants, the En Balance program allowed and even encouraged family members to participate in the educational sessions.

### Diabetes Education

Diabetes education classes from the En Balance program were conducted weekly for the first month and were taught in Spanish by bilingual educators. Make-up classes were scheduled for anyone who had missed attendance previously. The education team included registered dietitians, registered nurses, physicians, and Hispanic students from the School of Public Health. Classes lasted for 2 to 3 hours and centered on ways to maintain glycemic control (stressing diet and exercise), content of which has been described elsewhere.<sup>19,20</sup>

Each participant was provided with a blood glucose monitor, test strips, and personal instruction on how to use the monitor as a way to reinforce the principles of blood glucose control. Log forms were also provided to as a way to record daily blood glucose levels. Participants were strongly encouraged to increase exercise and modify lifestyle habits.

## Data Collection

**Glucose, A1C, insulin, and serum lipids.** Following a 14-hour fast, 2 blood specimens were drawn from each participant at both baseline and 3 months. Blood samples were sent to Loma Linda University Medical Center Laboratory and analyzed for changes in fasting blood glucose (FBG), A1C, insulin, and serum lipids using standard methods.

**Anthropometric measures.** Anthropometric measures (height, weight, waist circumference, hip circumference, and waist/hip ratio) were also assessed at baseline and 3 months. Height was measured to the nearest 0.1 cm using a stadiometer, and weight was measured in pounds using a calibrated scale and converted to the nearest 0.1 kg, body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared ( $\text{kg}/\text{m}^2$ ), and waist and hip circumferences were measured to the nearest 0.1 cm using a soft anthropometric tape. Waist-to-hip ratio was then calculated.

**Body composition.** Total and regional body composition (trunk fat, total fat, bone mineral density, and bone mineral content) were analyzed at baseline and 3 months using whole body and regional scans, which were taken at baseline and 3 months using a fan beam dual X-ray absorptiometry (DXA) Hologic Discovery A software version 12.6 (Waltham, MA). Standard subject positioning was used, radiation time was approximately 3 minutes, and radiation exposure was 5 microsieverts. Qualified radiologists read and signed all scans.

**Physical activity.** Physical activity changes were assessed using the Arizona Activity Frequency Questionnaire (AAFQ), a validated questionnaire used with permission from the University of Arizona.<sup>21</sup> Given the low reading levels, questionnaire clinics were held as a way to help participants fill out the AAFQ, which was available in English and Spanish. The questionnaire was divided into two types of daily activities: occupational and nonoccupational activities. In this questionnaire, the description of occupational activities included both work-related activities and weekly volunteer activities including any routine activities. Nonoccupational activities (nonroutine) were included in the second portion of the questionnaire. These questions included activities that were done outside of work and regular volunteer

work and were divided into 5 separate categories (leisure, personal care, recreational, household chores, and household maintenance). Participants were asked how often they participated in each activity over the previous 4 weeks (28 days) and to record the time spent actually doing the activity.

## Statistical Analysis

Means and standard deviations as well as frequencies with percentages were used to present the descriptive statistics. Paired *t*-tests were used to compare postintervention measures to baseline measures. When underlying normality assumptions of paired *t*-test were not met, Wilcoxon Signed Rank Test was used. SPSS (version 18) was used for data analysis. Statistical significance was set at  $\alpha = 0.05$ . Pearson product moment correlations were estimated for bivariate comparisons of changes (3 months – baseline) in participant characteristics.

## Results

Table 1 describes baseline characteristics of the subjects ( $n = 39$ ). Study participants included 23 women and 16 men. Most of the participants were  $\geq 45$  years of age and had a BMI  $\geq 25$ .

Table 2 summarizes baseline and 3-month mean changes in A1C, fasting glucose, insulin, serum lipids, and low, medium, and high intensity physical activity energy expenditure. After 3 months of education, a significant reduction in means was observed for A1C ( $-0.90\%$ ,  $P = 0.01$ ), total cholesterol ( $-13.44$  mg/dl,  $P = 0.01$ ), LDL cholesterol ( $-10.28$  mg/dl,  $P = 0.03$ ), and HDL cholesterol ( $-2.84$ ,  $P = 0.01$ ) as compared with baseline. A significant increase in the means for moderate intensity physical activity energy expenditure ( $M = 368 \pm 894$  kcals/day,  $P < 0.01$ ) and for high intensity physical activity energy expenditure ( $M = 405 \pm 2569$  kcals/day,  $P = 0.05$ ) compared with baseline was observed. There was no significant mean change in insulin, cholesterol/HDL ratio, triglycerides, or low intensity physical activity energy expenditure.

Three month – baseline mean changes in anthropometric measures and body composition are summarized in Table 3. Following 3 months of education, a significant mean reduction in waist circumference ( $-1.52$  cm,  $P = 0.04$ ) was observed as compared to baseline. There was

Table 1  
Baseline Characteristics of Study Participants

Variable	Females (n = 23) %	Males (n = 16) %	Total (n = 39) %	P-Value <sup>a</sup>
Primary language				0.63
Spanish	87.0	93.8	89.7	
English	13.0	6.3	10.3	
Country of birth				0.37
USA	13.0	0.0	7.7	
Mexico	78.3	93.8	84.6	
Puerto Rico	4.3	6.3	5.1	
Dominican Republic	4.3	0.0	2.6	
Education level				0.62
No formal education	6.3	4.3	5.1	
Some finished primary	25.0	34.8	30.8	
Some/finished junior high	18.8	8.7	12.8	
Some/finished high school	18.8	26.1	23.1	
Some/finished college	25.0	17.4	20.5	
Some/finished master's	6.3	0.0	2.6	
Missing data	0.0	8.7	5.1	
Age (years)				0.80
25-44	14.3	9.1	11.1	
45-54	50.0	45.5	47.2	
≥55	35.7	45.5	41.7	
Weight (kg)				0.27
50.0-64.9	12.5	21.7	17.9	
65.0-79.9	56.3	30.4	41.0	
≥80.0	31.3	47.8	41.0	
Height (cm) <sup>b</sup>				<0.001
145.0-164.9	37.5	95.7	71.8	
≥165.0	62.5	4.3	28.2	
BMI (kg/m <sup>2</sup> )				0.13
18.5-24.9	18.8	4.3	10.5	
25.0-29.9	50.0	34.8	39.5	
≥30.0	31.3	60.9	50.0	

<sup>a</sup>P-values based on chi-square test for independence.  
<sup>b</sup>P ≤ 0.001.

no significant reduction in weight, BMI, hip circumference, waist/hip ratio, or body composition as measured by DXA.

Tables 4 and 5 summarize mean changes in dietary macronutrient intake, A1C, fasting glucose, insulin, serum lipids, and anthropometric and body composition measures compared with overall changes in physical activity expenditure (those who increased energy expenditure ≥300 kcal/day (n = 20) as compared to those

increased <300 kcal/day) (n = 19). Participants who increased energy expenditure ≥300 kcal/day showed a greater reduction in carbohydrate intake compared with those who increased energy expenditure <300 kcal/day. Reduction in total energy intake, protein, fat, dietary cholesterol, saturated fat, monounsaturated fat, and polyunsaturated fat were greater for those who increased their energy expenditure <300 kcal/day as compared to subjects who increased energy expenditure ≥300 kcal/day.

Table 2

Baseline and 3-Month Mean Change of A1C, Fasting Glucose, Insulin, Serum Lipids, Low, Medium, and High Intensity Physical Activity Energy Expenditure Following a 3-Month Culturally Sensitive Diabetes Education Program, Both Genders (n = 39)<sup>a</sup>

Variable	Baseline, Mean ± SD	3 months, Mean ± SD	Mean Difference ± SD	P-Value
Hemoglobin A1C (%)	8.53 ± 2.58	7.64 ± 1.72	-0.90 ± 1.77	0.01 <sup>b,c</sup>
Fasting glucose (mg/dl)	167.90 ± 82.46	154.26 ± 70.16	-13.64 ± 55.63	0.13 <sup>d</sup>
Insulin (mg/dl)	13.72 ± 11.32	16.73 ± 13.33	3.01 ± 9.28	0.15 <sup>c</sup>
Total cholesterol (mg/dl)	191.38 ± 34.31	177.95 ± 40.98	-13.44 ± 28.42	0.01 <sup>b,c</sup>
LDL cholesterol (mg/dl)	120.67 ± 32.27	110.38 ± 34.81	-10.28 ± 24.75	0.03 <sup>b,d</sup>
HDL cholesterol (mg/dl)	49.74 ± 10.49	46.90 ± 9.96	-2.84 ± 6.72	0.01 <sup>b,d</sup>
Cholesterol/HDL ratio	3.99 ± 1.05	3.94 ± 1.13	-0.05 ± 0.73	0.68 <sup>d</sup>
Triglycerides (mg/dl)	166.21 ± 83.67	170.79 ± 102.78	4.59 ± 60.97	0.64 <sup>d</sup>
Low intensity PA (kcal)	4013 ± 2888	3398 ± 1858	-616 ± 2566	0.23 <sup>d</sup>
Moderate intensity PA (kcal)	715 ± 980	1083 ± 949	368 ± 894	<0.01 <sup>b,c</sup>
High intensity PA (kcal)	331 ± 1457	736 ± 2085	405 ± 2569	0.05 <sup>a,b</sup>

Abbreviation: PA, physical activity.  
<sup>a</sup>Low intensity physical activity = metabolic equivalent of task (MET) score of <3.0, for example, leisurely walk. Moderate intensity physical activity = MET score of 3.0-6.0, for example, brisk walk. High intensity physical activity = MET score of >6.0, for example, running/jogging.  
<sup>b</sup>P ≤ 0.05.  
<sup>c</sup>Paired t-test.  
<sup>d</sup>Wilcoxon signed rank test.

Table 3

Baseline and 3-Month Mean Change of Anthropometric and Body Composition Measures Following a 3-Month Culturally Sensitive Diabetes Education Program, Both Genders (n = 39)

Variable	Baseline, Mean ± SD	3 months, Mean ± SD	Mean Difference ± SD
Weight (kg)	81.94 ± 17.55	81.54 ± 16.72	-0.40 ± 3.60 <sup>a</sup>
BMI (kg/m <sup>2</sup> )	31.76 ± 6.76	31.42 ± 6.46	-3.42 ± 1.12 <sup>a</sup>
Waist circ (cm)	100.17 ± 11.92	98.65 ± 12.69	-1.52 ± 4.55 <sup>b,c</sup>
Hip circ (cm)	108.65 ± 14.83	107.57 ± 14.24	-1.08 ± 3.48 <sup>a</sup>
Waist/hip circ ratio	0.93 ± 0.06	0.92 ± 0.06	-0.01 ± 0.05 <sup>a</sup>
DXA trunk fat (kg)	14.49 ± 6.60	14.39 ± 6.48	-1.02 ± 0.99 <sup>a</sup>
DXA tti fat (kg)	28.47 ± 12.92	28.21 ± 12.81	-0.26 ± 1.37 <sup>a</sup>
DXA trunk fat (%)	34.01 ± 10.27	33.84 ± 10.21	-0.17 ± 1.71 <sup>a</sup>
DXA tti fat (%)	33.64 ± 10.25	33.39 ± 10.36	-0.25 ± 1.07 <sup>a</sup>
DXA tti BMC (kg)	2.12 ± 0.37	2.12 ± 0.37	0.00 ± 0.04 <sup>a</sup>
DXA tti BMD (g/cm <sup>2</sup> )	1.01 ± 0.13	1.01 ± 0.13	0.00 ± 0.03 <sup>a</sup>

Abbreviations: BMC, bone mineral content; BMD, bone mineral density; circ, circumference; tti, total.  
<sup>a</sup>Paired t-test.  
<sup>b</sup>P ≤ 0.05.  
<sup>c</sup>Wilcoxon signed rank test.

Table 4

Baseline and 3-Month Mean Difference in Dietary Macronutrient Intake, Fasting Glucose, A1C, Insulin and Serum Lipids of Participants Who Increased Energy Expenditure  $\geq 300$  Kcal versus Those Who Increased Energy Expenditure  $< 300$  Kcal, Both Genders<sup>a</sup>

Dietary Intake and Blood Chemistry	$\geq 300$ Kcals Increased Energy Expenditure (n = 20)	$< 300$ Kcals Increased Energy Expenditure (n = 19)
Total energy intake (Kcals)	-308.60 (-1100.61, 483.41)	-464.20 (-959.23, 30.85)
Carbohydrate (g)	-54.06 (-171.77, 63.64)	-37.21 (-114.78, 40.36)
Protein (g)	-6.58 (-35.13, 21.97)	-23.87 (-45.33, -2.41) <sup>b</sup>
Fat (g)	-7.35 (-35.22, 20.52)	-23.51 (-43.25, -3.76) <sup>b</sup>
Cholesterol (g)	-35.36 (-198.19, 127.47)	-115.35 (-221.28, -9.42) <sup>b</sup>
Saturated fat (g)	-0.47 (-9.34, 8.41)	-8.57 (-15.54, -1.61) <sup>b</sup>
Monounsaturated fat (g)	-3.41 (-14.94, 8.12)	-8.88 (-16.72, -1.05) <sup>b</sup>
Polyunsaturated fat	-2.52 (-8.14, 3.11)	-3.98 (-7.81, -0.14) <sup>b</sup>
Glucose (mg/dl)	-18.95 (-47.00, 9.10)	-8.05 (-32.99, 16.88)
Hemoglobin A1C (%)	-1.13 (-2.10, -0.15) <sup>*</sup>	-0.65 (-1.31, 0.01)
Insulin (mg/dl)	1.99 (-0.49, 4.47)	4.08 (1.82, 9.99)
Total cholesterol (mg/dl)	-12.10 (-26.23, 2.03)	-14.84 (-27.94, -1.74) <sup>b</sup>
HDL cholesterol (mg/dl)	-3.35 (-6.78, 0.08)	-2.32 (-5.29, 0.66)
LDL cholesterol (mg/dl)	-6.16 (-17.04, 4.72)	-10.63 (-21.19, -0.08) <sup>b</sup>
Cholesterol/HDL ratio	0.05 (-2.8, 0.38)	-0.08 (-0.44, 0.28)
Triglycerides (mg/dl)	7.95 (-14.87, 30.77)	1.05 (-34.07, 36.18)

<sup>a</sup>Values represent mean (95% confidence interval).  
<sup>b</sup> $P \leq .05$ .

There was a greater reduction in A1C (-0.47%), fasting glucose (-10.9 mg/dl), HDL (-1.01 mg/dl), and total percent fat (-0.04) for those participants who increased energy expenditure  $\geq 300$  kcals/day as compared to those who increased  $< 300$  kcals/day. Participants who increased energy expenditure  $\geq 300$  kcals/day had reductions in weight (-0.55 kg) and total fat (-0.30 kg), but participants who increased energy expenditure  $< 300$  kcals/day gained weight (0.17 kg) and total fat (0.23 kg). Participants who increased energy expenditure  $< 300$  kcals/day showed a greater reduction in total serum cholesterol (-2.74 mg/dl), LDL cholesterol (-4.47 mg/dl), waist circumference (1.31 cm), and hip circumference (0.38 cm) as compared to those who increased energy expenditure  $\geq 300$  kcals/day.

Significant positive correlations were observed between moderate intensity physical activity with triglycerides ( $P = 0.04$ ), BMI with insulin ( $P = 0.03$ ), and BMI with trunk percent fat ( $P < 0.01$ ), and significant

negative correlations were observed between A1C with insulin ( $P < -0.01$ ) and A1C with BMI ( $P = -0.01$ ). (Data not shown.)

## Discussion

**Glucose control.** The En Balance diabetes education program demonstrated that culturally sensitive diabetes education that stresses both nutrition and exercise can lead to improvements in glucose control and improvements in moderate and high intensity physical activity. Following the 3-month intervention, there was a statistically significant reduction in mean A1C. This finding is consistent with other programs deemed culturally competent for the Hispanic population in terms of language, diet, social emphasis, family participation, incorporation of cultural health beliefs, or inclusion of community health workers.<sup>18,19,22-27</sup> Of the studies evaluating diabetes management in Hispanics, evidence suggests that culturally



Table 5

Baseline and 3-Month Mean Difference in Anthropometric and Body Composition Measures of Participants Who Increased Energy Expenditure  $\geq 300$  Kcal versus Those Who Increased Energy Expenditure  $< 300$  Kcal, Both Genders<sup>a</sup>

Body Composition	$\geq 300$ Kcals Increased Energy Expenditure (n = 20)	$< 300$ Kcals Increased Energy Expenditure (n = 19)
Weight (kg)	-0.55 (-1.89, 0.79)	0.17 (-1.75, 2.09)
BMI (kg/m <sup>2</sup> )	-0.03 (-0.51, 0.46)	0.05 (-0.37, 0.47)
Waist circumference (cm)	-0.83 (-3.37, 1.71)	-2.14 (-4.00, -0.27) <sup>b</sup>
Hip circumference (cm)	-0.85 (-2.76, 1.05)	-1.23 (-2.74, 0.27)
Waist/hip ratio	$< -0.01$ (-0.03, 0.03)	-0.01 (-0.03, 0.01)
Trunk fat (kg)	-0.09 (-0.59, 0.41)	-0.11 (-0.56, 0.33)
Total fat (kg)	-0.30 (-0.90, 0.31)	0.23 (-0.94, 0.49)
Total percent fat (%)	-0.27 (-0.84, 0.30)	-0.23 (-0.68, 0.22)
Total BMC (g)	-0.01 (-0.03, 0.01)	0.01 (-0.01, 0.03)
Total BMD (g/cm <sup>2</sup> )	$< 0.01$ (-0.01, 0.01)	$< -0.01$ (-0.02, 0.02)

Abbreviations: BMC, bone mineral content; BMD, bone mineral density.  
<sup>a</sup>Values represent mean (95% confidence interval).  
<sup>b</sup> $P \leq .05$ .

and language-sensitive education is an important part of a program. In 2007, Thompson et al demonstrated a successful model of diabetes education using Community Health Workers. Clinical outcome measures were taken at baseline, 6 months, and 1 year. If significant, the outcome measures were correlated with frequency of community health worker contact. The results showed a significant reduction in A1C from baseline to 1 year ( $P < 0.004$ ) and a higher frequency of community health worker contact with greater declines in A1c.<sup>23</sup> En Balance resulted in substantial changes in just 3 months, suggesting that a more comprehensive program may produce greater results.

**Serum lipids.** Serum lipid profiles also changed following the 3-month En Balance diabetes education program. Total cholesterol, LDL cholesterol, and HDL cholesterol were significantly reduced, with LDL cholesterol moving just over 10 mg/dl above the current recommendation for people with diabetes.<sup>28</sup> Elevated LDL cholesterol increases the risk of developing heart disease or having a heart attack.<sup>29</sup> Diabetes is also a known risk factor in the development of heart disease; the combination of increased LDL cholesterol with diabetes magnifies the risk.<sup>29</sup> However, a high HDL cholesterol level is

known to have a protective effect in regards to the development of heart disease.<sup>29</sup> Although En Balance resulted in a significant reduction of HDL cholesterol, a 3-month mean of 46.90 mg/dl remains within a desirable range. A few reasons that may explain this change include reductions in dietary cholesterol, mono- and poly-unsaturated fats, and saturated fat intake, as well as a decrease in total serum cholesterol.<sup>30</sup> These findings agree with other studies showing a significant reduction in total and LDL cholesterol.<sup>22,26,31</sup>

**Physical activity.** This study is unique in that it utilized a validated physical activity questionnaire to assess changes in physical activity energy expenditure in a Hispanic population with diabetes. Few tools are available that will simply and accurately assess physical activity in specific populations, such as the Hispanic population. The most important finding is that En Balance resulted in statistically significant increases in both moderate and high intensity physical activity energy expenditure in this Spanish-speaking Hispanic population with diabetes.

These results provide an extension of the literature regarding physical activity in the Hispanic population with diabetes. Only a few studies have considered the

unique needs of Hispanics when designing programs to increase physical activity. Staten et al<sup>32</sup> evaluated the effectiveness of a community-based chronic disease prevention program called “Pasos Adelante” or “Steps Forward.” Pasos Adelante is a curriculum designed to help prevent diabetes, cardiovascular disease, and other chronic diseases in Hispanics. Twelve 2-hour sessions, including a session in action as a way to reinforce the importance of physical activity, were provided so participants would have an opportunity to engage in physical activity while they were involved in the program. In addition, walking clubs were made available as a way to provide a coordinated, socially supported effort to increase physical activity. Following the intervention, the researchers found a significant increase in the amount of self-reported exercise.<sup>32</sup>

Considering that Hispanic people are motivated by family support, Teufel-Shone et al<sup>33</sup> developed and adapted a family-based diabetes program. Following the 12-week program, results showed significant increases in knowledge of 8 diabetes risk factors ( $P$ -values for 8 factors range from  $< 0.001$  to  $0.006$ ), a significant increase in family efficacy to change food ( $P < 0.001$ ) and activity behaviors ( $P < 0.001$ ). The researchers concluded that teaching the family as a group can improve health behaviors by increasing family-based physical activity, social support, and decreasing feelings of depression and isolation.<sup>33</sup> As reported earlier, participants in the En Balance diabetes education program were also encouraged to include their family members. This is believed to be a key factor in the overall success of the En Balance diabetes education program.

This study has demonstrated that comprehensive diabetes education that is culturally sensitive leads to better metabolic control. To characterize better the relationship between physical activity energy expenditure and the outcome variables, a cut-point of 300 kcals was established as a way to designate categories (improvement  $\geq 300$  kcals/day vs  $< 300$  kcals per day). These categories support the premise that increasing calorie expenditure and/or decreasing calorie intake by 3500 kcals per week (500 kcals/day) will result in achieving 1 pound weight loss per week. Nonetheless, overall changes in both diet and exercise may have produced the most favorable results.

Self-reported increased physical activity energy expenditure  $\geq 300$  kcals/day showed more favorable changes in FBG and A1C while self-reports of physical activity energy expenditure of  $< 300$  kcals/day showed

more favorable changes in lipids and lipoproteins. As participants increased energy expenditure  $< 300$  kcals/day, they also decreased total dietary calories, dietary cholesterol, and saturated fat intake. The beneficial effects of these dietary changes on blood lipids/lipoproteins were superior to the changes in physical activity energy expenditure  $\geq 300$  kcals/day.

## Conclusion

In conclusion, this study utilizing the En Balance Program demonstrated the effectiveness of culturally sensitive diabetes education as a method for increasing physical activity energy expenditure and gaining blood sugar control. Increased physical activity energy expenditure  $\geq 300$  kcals resulted in tighter glucose control. Also, dietary changes related to cholesterol and saturated fat decreased serum cholesterol. While these results are encouraging, further studies are needed with longer follow-up times to evaluate physical activity interventions in Hispanic people with diabetes.

## Implications for Diabetes Educators

There are many ways to increase physical activity, but finding ways that are culturally sensitive and meaningful to the Hispanic population with diabetes may encourage the most change and consistency. Family-oriented fitness provides a valued opportunity to spend time together while increasing fitness. Walking is an easy and cost-effective activity that can meet the need for spending time together while achieving the recommended level of activity. Most important is the educator's ability to assess and incorporate cultural values in a way that promotes health.

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