Published in final edited form as:
Diabetes Educ. 2012 ; 38(5): . doi:10.1177/0145721712457249.

En Balance:

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

Gina Wheeler, DrPH, **Susanne B. Montgomery, PhD**, **Larry Beeson, DrPH**, **Khaled Bahjri, MD**, **Eloy Shulz, MD**, **Anthony Firek, MD**, **Marino De Leon, PhD**, and **Zaida Cordero-MacIntyre, PhD**
Loma Linda University, School of Public Health, Preventive Care Program, Loma Linda, California (Dr Wheeler), Loma Linda University, Center for Health Disparities and Molecular Medicine (Dr De Leon, Dr Cordero-MacIntyre), School of Medicine, and School of Behavioral Health, Loma Linda, California (Dr Montgomery), Loma Linda University, School of Public Health, Department of Epidemiology and Biostatistics, Loma Linda, California (Dr Beeson, Dr Bahjri), Loma Linda University, School of Medicine, Department of Radiology, Loma Linda, California (Dr Shulz), Endocrinology Section, JL Pettis Memorial VA Medical Center, Loma Linda, California (Dr Firek), and Loma Linda University, School of Public Health, Department of Nutrition, Loma Linda, California (Dr Cordero-MacIntyre).

Abstract

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 ± 894 kcal/day, $P < 0.01$) and high intensity physical activity energy expenditure (M = 405 ± 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, $P = 0.04$).

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

Correspondence to Zaida Cordero-MacIntyre, PhD, Loma Linda University, School of Public Health, Nutrition, 24951 N Circle Dr., Loma Linda, CA 92354 (zcordero-macintyre@llu.edu)..

Diabetes 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.[1-3] 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.[1-3] In addition, there are 79 million adults who have impaired fasting glucose placing them high risk for developing the disease.[1-3]

Racial and ethnic minority groups, particularly the elderly among these populations, are disproportionately affected by diabetes.[4-7] African American, Hispanic, American Indian, and Alaska Native adults are up to twice as likely as non-Hispanic white adults to have diabetes.[8] Hispanics are the largest and fastest growing minority group, representing 16.3% of the total population.[9] By 2050, predictions suggest that Hispanics will represent approximately 30% of the US population.[4,9] Many Hispanics are recent immigrants with limited acculturation to the United States.[9] 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.[10]

Blood glucose control is a critical step for those at risk and those already diagnosed with diabetes.[11] 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.[12] 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.[13] 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.[13] This finding is consistent with other studies reporting low levels of leisure time physical activity in the Hispanic population.[14]

Research has consistently shown high benefits of physical activity with respect to morbidity and mortality.[15] It is considered one of the single most important lifestyle factors.[13] Physical activity provides important protective factors related to decreased risk for obesity, heart disease, hypertension, diabetes, certain cancers, and premature mortality.[16] 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.[15,16] 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.[15] Additional consequences related to chronic hyperglycemia, such as neuropathy, retinopathy, and nephropathy, may be prevented or delayed.[6,15,17]

National guidelines to educate the public about the minimum amount of exercise required to achieve health benefits clearly suggest regular leisure time physical activity.[13] 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,

NIH-PA Author Manuscript
NIH-PA Author Manuscript

effective diabetes programs need to include a strong exercise component[18] 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 week-day 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.[19,20]

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 (kg/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.[21] 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 ≥45 years of age and had a BMI ≥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 ± 894 kcals/day, $P < 0.01$) and for high intensity physical activity energy expenditure (M = 405 ± 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 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 kcals/day (n = 20) as compared to those increased <300 kcals/day) (n = 19). Participants who increased energy expenditure ≥300 kcals/day showed a greater reduction in carbohydrate intake compared with those who increased energy expenditure <300 kcals/day. Reduction in total energy intake, protein, fat, dietary cholesterol, saturated fat, monounsaturated fat, and poly-unsaturated fat were greater for those who increased their energy expenditure <300 kcals/day as compared to subjects who increased energy expenditure ≥300 kcals/day. 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 ≥300 kcals/day as compared to those who increased <300 kcals/day. Participants who increased energy expenditure ≥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 ≥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.[18,19,22-27] Of the studies evaluating diabetes management in Hispanics, evidence suggests that culturally 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.[23] 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.[28] Elevated LDL cholesterol increases the risk of developing heart disease or having a heart attack.[29] Diabetes is also a known risk factor in the development of heart disease; the combination of increased LDL cholesterol with diabetes magnifies the risk.[29] However, a high HDL cholesterol level is known to have a protective effect in regards to the development of heart disease.[29] 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.[30] These findings agree with other studies showing a significant reduction in total and LDL cholesterol.[22,26,31]

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[32] 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.[32]

Considering that Hispanic people are motivated by family support, Teufel-Shone et al[33] 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.[33] 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 ≥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 ≥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 ≥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 ≥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.

Acknowledgments

This project was supported by Grant NIH award 5P20MD001632.

References

1. American Diabetes Association. [Accessed October 1, 2011] Diabetes statistics. http://www.diabetes.org/diabetes-basics/diabetes-statistics/
2. National Institutes of Health. [Accessed October 1, 2011] National diabetes statistics 2011. http://diabetes.niddk.nih.gov/DM/PUBS/statistics/Updated February 2011
3. Centers for Disease Control and Prevention. [Accessed October 1, 2011] National diabetes fact sheet. http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2011.pdf
4. Narayan KM, Boyle JP, Geiss LS, Saaddine JB, Thompson TJ. Impact of recent increase in incidence on future diabetes burden: U.S., 2005-2050. Diabetes Care. 2006; 29(9):2114–2116. [PubMed: 16936162]
5. Cowie CC, Rust KF, Ford ES, et al. Full accounting of diabetes and pre-diabetes in the U.S. population in 1988-1994 and 2005-2006. Diabetes Care. 2009; 32(2):287–294. [PubMed: 19017771]
6. Wen LK, Shepherd MD, Parchman ML. Family support, diet, and exercise among older Mexican Americans with type 2 diabetes. Diabetes Educ. 2004; 30(6):980–993. [PubMed: 15641619]
7. National Institutes of Health. [Accessed October 1, 2011] The diabetes epidemic among Hispanics/Latinos. http://ndep.nih.gov/media/FS_HispLatino_Eng.pdfUpdated December 2009
8. Office of Minority Health. [Accessed October 1, 2011] Diabetes data/statistics. http://minorityhealth.hhs.gov/templates/browse.aspx?lvl=3&lvlid=62Updated September 28, 2010
9. U.S. Census Bureau. [Accessed October 1, 2011] Hispanic Heritage Month 2011: Sept. 15-Oct. 15. http://www.census.gov/newsroom/releases/pdf/cb11ff-18_hispanic.pdf
10. Donahue KE, Mielenz TJ, Sloane PD, Callahan LF, Devellis RF. Identifying supports and barriers to physical activity in patients at risk for diabetes. *Prev Chronic Dis*.. 2006; 3(4):A119. [PubMed: 16978494]
11. National Institutes of Heath. [Accessed October 1, 2011] Diabetes prevetion program. http://diabetes.niddk.nih.gov/dm/pubs/preventionprogram/DPP.pdfPublished October 2008
12. Mier N, Medina AA, Ory MG. Mexican Americans with type 2 diabetes: perspectives on definitions, motivators, and programs of physical activity. *Prev Chronic Dis*.. 2007; 4(2):A24. [PubMed: 17362615]
13. Prevalence of regular physical activity among adults—United States, 2001 and 2005. MMWR Morb Mortal Wkly Rep. 2007; 56(46):1209–1212. [PubMed: 18030281]
14. Martinez SM, Ainsworth BE, Elder JP. A review of physical activity measures used among US Latinos: guidelines for developing culturally appropriate measures. *Ann Behav Med*.. 2008; 36(2): 195–207. [PubMed: 18855091]
15. Hayes C, Kriska A. Role of physical activity in diabetes management and prevention. *J Am Diet Assoc*.. 2008; 108(4 suppl 1):S19–23. [PubMed: 18358249]
16. National Institutes of Health. [Accessed October 1, 2011] What I need to know about physical activity and diabetes. http://diabetes.niddk.nih.gov/dm/pubs/physical_ez/physactivity.pdfPublished March 2008
17. The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Engl J Med*.. 1993; 329(14):977–986. [PubMed: 8366922]
18. Two Feathers J, Kieffer EC, Palmisano G, et al. Racial and Ethnic Approaches to Community Health (REACH) Detroit partnership: improving diabetes-related outcomes among African American and Latino adults. *Am J Public Health*.. 2005; 95(9):1552–1560. [PubMed: 16051927]
19. Metghalchi S, Rivera M, Beeson L, et al. Improved clinical outcomes using a culturally sensitive diabetes education program in a Hispanic population. *Diabetes Educ*.. 2008; 34(4):698–706. [PubMed: 18669812]

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(2):239–253. [PubMed: 21343598]
21. Staten LK, Taren DL, Howell WH, et al. Validation of the Arizona Activity Frequency Questionnaire using doubly labeled water. *Med Sci Sports Exerc*.. 2001; 33(11):1959–1967. [PubMed: 11689750]
22. Philis-Tsimikas A, Walker C, Rivard L, et al. Improvement in diabetes care of underinsured patients enrolled in project dulce: a community-based, culturally appropriate, nurse case management and peer education diabetes care model. Diabetes Care. 2004:27–1. 110–115.
23. Thompson JR, Horton C, Flores C. Advancing diabetes self-management in the Mexican American population: a community health worker model in a primary care setting. *Diabetes Educ*.. 2007; 33(suppl 6):159S–165S. [PubMed: 17620396]
24. Brown SA, Garcia AA, Kouzekanani K, Hanis CL. Culturally competent diabetes self-management education for Mexican Americans: the Starr County border health initiative. Diabetes Care. 2002; 25(2):259–268. [PubMed: 11815493]
25. Culica D, Walton JW, Prezio EA. CoDE: Community Diabetes Education for uninsured Mexican Americans. *Proc (Bayl Univ Med Cent)*.. 2007; 20(2):111–117. [PubMed: 17431443]
26. Joshu CE, Rangel L, Garcia O, Brownson CA, O'Toole ML. Integration of a promotora-led self-management program into a system of care. *Diabetes Educ*.. 2007; 33(suppl 6):151S–158S. [PubMed: 17620395]
27. Rosal MC, White MJ, Restrepo A, et al. Design and methods for a randomized clinical trial of a diabetes self-management intervention for low-income Latinos: Latinos en Control. *BMC Med Res Methodol*.. 2009; 9:81. [PubMed: 20003208]
28. American Heart Association. [Accessed October 1, 2011] Cholesterol abnormalities and diabetes. http://www.heart.org/HEARTORG/Conditions/Diabetes/WhyDiabetesMatters/Cholesterol-Abnormalities-Diabetes_UCM_313868_Article.jspUpdated September 22, 2010
29. National Institutes of Health. [Accessed October 1, 2011] High blood cholesterol: what you need to know. http://www.nhlbi.nih.gov/health/public/heart/chol/wyntk.htmUpdated June 2005
30. Ojo E, Beeson L, Schulz E, et al. Effect of the En Balance, a culturally and language-sensitive diabetes education program, on dietary changes and plasma lipid profile in Hispanic diabetics. International Journal of Body Composition Research. 2010; 8(suppl):S69–S76. [PubMed: 21318091]
31. Rosal MC, Olendzki B, Reed GW, Gumieniak O, Scavron J, Ockene I. Diabetes self-management among low-income Spanish-speaking patients: a pilot study. *Ann Behav Med*.. 2005; 29(3):225–235. [PubMed: 15946117]
32. Staten LK, Scheu LL, Bronson D, Pena V, Elenes J. Pasos Adelante: the effectiveness of a community-based chronic disease prevention program. *Prev Chronic Dis*.. 2005; 2(1):A18. [PubMed: 15670471]
33. Teufel-Shone NI, Drummond R, Rawiel U. Developing and adapting a family-based diabetes program at the U.S.-Mexico border. *Prev Chronic Dis*.. 2005; 2(1):A20. [PubMed: 15670473]

Table 1

Baseline Characteristics of Study Participants

Variable	Females (n = 23) %	Males (n = 16) %	Total (n = 39) %	*P*-Value[a]
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)[b]				<0.001
145.0-164.9	37.5	95.7	71.8	
≥165.0	62.5	4.3	28.2	
BMI (kg/m^2)				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	

[a] *P*-values based on chi-square test for independence.

[b] $P \leq 0.001$.

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)[a]

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[b,c]
Fasting glucose (mg/dl)	167.90 ± 82.46	154.26 ± 70.16	−13.64 ± 55.63	0.13[d]
Insulin (mg/dl)	13.72 ± 11.32	16.73 ± 13.33	3.01 ± 9.28	0.15[c]
Total cholesterol (mg/dl)	191.38 ± 34.31	177.95 ± 40.98	−13.44 ± 28.42	0.01[b,c]
LDL cholesterol (mg/dl)	120.67 ± 32.27	110.38 ± 34.81	−10.28 ± 24.75	0.03[b,d]
HDL cholesterol (mg/dl)	49.74 ± 10.49	46.90 ± 9.96	−2.84 ± 6.72	0.01[b,d]
Cholesterol/HDL ratio	3.99 ± 1.05	3.94 ± 1.13	−0.05 ± 0.73	0.68[d]
Triglycerides (mg/dl)	166.21 ± 83.67	170.79 ± 102.78	4.59 ± 60.97	0.64[d]
Low intensity PA (kcals)	4013 ± 2888	3398 ± 1858	−616 ± 2566	0.23[d]
Moderate intensity PA (kcals)	715 ± 980	1083 ± 949	368 ± 894	<0.01[b,c]
High intensity PA (kcals)	331 ± 1457	736 ± 2085	405 ± 2569	0.05[a,b]

Abbreviation: PA, physical activity.

[a]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.

[b]$P \leq 0.05$.

[c]Paired *t*-test.

[d]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[a]
BMI (kg/m^2)	31.76 ± 6.76	31.42 ± 6.46	−3.42 ± 1.12[a]
Waist circ (cm)	100.17 ± 11.92	98.65 ± 12.69	−1.52 ± 4.55[b,c]
Hip circ (cm)	108.65 ± 14.83	107.57 ± 14.24	−1.08 ± 3.48[a]
Waist/hip circ ratio	0.93 ± 0.06	0.92 ± 0.06	−0.01 ± 0.05[a]
DXA trunk fat (kg)	14.49 ± 6.60	14.39 ± 6.48	−1.02 ± 0.99[a]
DXA ttl fat (kg)	28.47 ± 12.92	28.21 ± 12.81	−0.26 ± 1.37[a]
DXA trunk fat (%)	34.01 ± 10.27	33.84 ± 10.21	−0.17 ± 1.71[a]
DXA ttl fat (%)	33.64 ± 10.25	33.39 ± 10.36	−0.25 ± 1.07[a]
DXA ttl BMC (kg)	2.12 ± 0.37	2.12 ± 0.37	0.00 ± 0.04[a]
DXA ttl BMD (g/cm^2)	1.01 ± 0.13	1.01 ± 0.13	0.00 ± 0.03[a]

Abbreviations: BMC, bone mineral content; BMD, bone mineral density; circ, circumference; ttl, total.

[a] Paired *t*-test.

[b] $P \leq 0.05$.

[c] 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 ≥300 Kcal versus Those Who Increased Energy Expenditure < 300 Kcal, Both Genders[a]

Dietary Intake and Blood Chemistry	≥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)[b]
Fat (g)	−7.35 (−35.22, 20.52)	−23.51 (−43.25, −3.76)[b]
Cholesterol (g)	−35.36 (−198.19, 127.47)	−115.35 (−221.28, −9.42)[b]
Saturated fat (g)	−0.47 (−9.34, 8.41)	−8.57 (−15.54, −1.61)[b]
Monounsaturated fat (g)	−3.41 (−14.94, 8.12)	−8.88 (−16.72, −1.05)[b]
Polyunsaturated fat	−2.52 (−8.14, 3.11)	−3.98 (−7.81, −0.14)[b]
Glucose (mg/dl)	−18.95 (−47.00, 9.10)	−8.05 (−32.99, 16.88)
Hemoglobin A1C (%)	−1.13 (−2.10, −0.15)*	−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)[b]
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)[b]
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)

[a]Values represent mean (95% confidence interval).

[b]$P \leq .05$.

Table 5

Baseline and 3-Month Mean Difference in Anthropometric and Body Composition Measures of Participants Who Increased Energy Expenditure ≥300 Kcal versus Those Who Increased Energy Expenditure <300 Kcal, Both Genders[a]

Body Composition	≥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^2)	−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)[b]
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^2)	<1 (−0.01, 0.01)	<−0.01 (−0.02, 0.02)

Abbreviations: BMC, bone mineral content; BMD, bone mineral density.

[a]Values represent mean (95% confidence interval).

[b]$P \leq .05$.