The Effect of Nutrition Education and Pedometer Use on Type 2 Diabetes Risk Factors in Latino Immigrants

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Abstract:

More than one out of ten people of Mexican descent has diabetes, which is twice the rate of the general population. People of Latino descent score less on health eating questionnaires and report less physical activity per week than people of non-Hispanic descent. Poor nutrition and exercise habits can contribute to elevated blood glucose and undesirable lipid profiles, leading to increased risk for type 2 diabetes mellitus. The Mexican Consulate of St. Paul offers a course for recent Latino immigrants to encourage healthy diet and lifestyle behaviors to lower the risk of developing diabetes. **Purpose:** To assess if nutrition education and pedometer use improve weight, body composition, blood glucose, and lipid profile in recent Latino immigrants to lower risk for type 2 diabetes. **Methods:** This study was approved by the Institutional Review Board at the College of St. Benedict and St. John's University and informed consents were signed in Spanish. Fourteen Latino immigrants (n = three males, eleven females) agreed to participate and nine completed the study (n= one male, eight females). Participants were recruited from a class called, "I CAN prevent diabetes." A survey designed to measure diabetes knowledge, nutrition habits, and activity levels was given to class participants on the first and the last day of the class. Study participants received pedometers to track their activity levels and participated in nutrition education once a week for six weeks. Fasting blood glucose level, lipid profile, and weight were measured for each individual before and after the study to determine the effect of pedometer use and nutrition education. Paired t-tests and a one-way ANOVA were used for statistical analysis. **Results:** Nutrition education and pedometer use resulted in significant improvements in fasting blood glucose levels (p = 0.03). Total cholesterol and LDL cholesterol improved marginally, but not significantly (p = 0.192 and 0.065, respectively). HDL cholesterol decreased over the course of the study (p = 0.001). Activity levels increased gradually the first three weeks then declined the fourth and final week. Weight decreased marginally but not significantly (p = 0.60). In the post study survey regarding diet, 66% participants reported decreasing their serving size, 55% reported increasing vegetable intake, 66% reported eating fewer tortillas, 55% reported drinking more water, and 44% reported eating less sweets and desserts. **Conclusions:** Nutrition education and pedometer use is effective at improving dietary and activity habits in the selected Latino population. Contact with participants was limited and behavior change takes time. Positive results were shown, but a longer period and a greater number of participants would be necessary to obtain statistically significant results and sustained habits.

Introduction:

Latino immigrants make up sixteen percent of the U.S. population. Fifty percent of Latino women in the United States above the age of 70 have type 2 diabetes and forty-four percent of Latino men above the age of 70 have type 2 diabetes (1, 1). Second and third generation Latinos are more likely to develop diabetes than their parents, grandparents, and great grandparents due to greater acculturation to the "American Diet" (2, e45) (3, 358).

Factors such as language barriers, lack of physical activity, and poor dietary habits may negatively impact health and increase type 2 diabetes risks. One half of Latino immigrants with diabetes are unaware that they have the disease, and undiagnosed diabetes is 2.3 times more likely in Latinos than in non-Hispanic whites (4, 9). Many Latino immigrants are of low socioeconomic status and do not have health insurance, which makes it difficult to be properly diagnosed (4, 9). Latinos have lower rates of health insurance (77%) than blacks or non-Hispanic whites (93% and 95%, respectively) per The National Health and Nutrition Examination Survey. Poor comprehension of the English language, ineffective communication between physicians and clients, cultural differences, and poor patient literacy rates are barriers to obtaining healthcare in the United States. Among Hispanic immigrants 25 years of age or older, 27.3% have less than a 9^{th} grade education. Only 6% of Hispanics in the United States are fluent in Spanish and English. Twenty-five percent are only fluent in Spanish. Nearly 95% of the population struggles with the English language and their inability to read English can result in their inability to seek medical help (5, 11). In addition, Hispanics are four times more likely than areas with a high proportion of non-Hispanic whites to have a shortage of physicians, regardless of income level, potentially making healthcare access even more difficult (6, 12).

Research attempting to prevent type 2 diabetes is present for specific populations, but it is very limited for the Latino population (7, 1). Culture and language specific education and prevention strategies are necessary to decease risk for a Latino population (3, 358). Programs that included nutrition education and follow-up support groups were successful in lowering hemoglobin A1c in participants (8, 1). Areas that have a high Latino population often have a shortage of certified Diabetes educators able to translate and teach education effectively. Programs that include general interpretation on nutrition and diabetes need to be translated and delivered in a way that is motivating for the Latino population.

External factors can also pose barriers for being physically active. Poor weather or temperatures can make it difficult for anyone to get outside to be active. Latinos often have decreased access to health clubs and community gyms. Purchasing fresh fruits and vegetables is often expensive, making cheaper, fast food or convenience options easier to obtain. Immigrants may have family members outside of the United States, which results in a lack of social support, guidance, and encouragement (8, 2). Language barriers and economics hinder the prevention of type 2 diabetes and highlight the importance of culturally appropriate nutrition education classes tailored to the cultural needs of this select population.

Nutrition education and pedometer use are effective ways to increase the health status of Latino immigrants and are important components of preventing type 2 diabetes mellitus. However, delivering the information in a culturally relevant way to the selected population is important. The purpose of this study is to assess if nutrition education and pedometer use could improve weight, body composition, blood glucose, and lipid profile in an individual to lower risk for type 2 diabetes.

Methods:

Latino immigrants were recruited as subjects through an existing program entitled, “I Can Prevent Diabetes,” sponsored by the Mexican Consulate of St. Paul and St. Mary’s Health Clinic. Participants were at least eighteen years of age and considered “at risk” for the

development of diabetes. The class initially included three men and eleven females. One male and eight females completed the program. The initial intent of the course was to include three months of classes that met once per week, and then three months of classes meeting once per month. However, a week before the study began, funding for the course was cut and the schedule was changed to a duration of only six weeks.

The class met once a week for an hour and included nutrition education. The university's Institutional Review Board approved this study. Participants were recruited during the first-class period when the study was explained and informed consents were signed in Spanish. Participants took pre-study surveys in Spanish asking about their typical diet, activity habits, and knowledge about type 2 diabetes. Then participants took a post-study survey asking the same questions during the last class period. The surveys were analyzed to look for correlations and changes between the responses. The nutrition education component was taught in Spanish by Ioulia Peterson, a registered dietitian at St. Mary's Health Clinic. The topics covered throughout the course included, "detecting fat and calories, reducing fat and calories, healthy eating, moving muscles, staying active, tilting the balance of calories, taking charge of your surroundings, troubleshooting, four keys to eating out healthily, responding to negative thoughts, setbacks in the process of changing lifestyles, making social cues work in your favor, handling stress, and ways to stay motivated."

Participants were instructed to come to the second-class period and last class period fasted for at least four hours. No food or beverage consumption of anything other than water was considered "fasted." Height, weight, fasting blood glucose, HDL, LDL, VLDL and total cholesterol levels were measured during the second class and last class period, four weeks later. Fasting blood glucose, HDL, LDL, VLDL and total cholesterol levels were processed in approximately three to five minutes using a LDX Cholestech analyzer, and approximately 40 microliters of blood were collected to process results. Participants were given water, apples, and trail mix for a snack after their blood values were recorded. Participants were given immediate feedback on paper regarding blood values with the ranges and classifications for type 2 diabetes, shown below in figures 1.1 and 1.2.

Omron HJ-321 pedometers were given to participants to track activity levels and pedometer use was explained. The pedometers recorded daily steps and reset automatically after each day, but were capable of logging steps for up to a week. The researcher recorded participant steps for each day from the previous week at the beginning of each class. Participants kept the pedometers at the end of the study.

Data was analyzed using SPSS software (IBM). A paired T test was used to evaluate changes in weight, fasting blood glucose, HDL, LDL, and total cholesterol over the course of the 6-week study. A multivariable ANOVA was used to determine changes in number of steps walked/day over the 6-week period in relation to weight and fasting blood glucose. Significance was set at $P < 0.05$.

Figures 1.1 and 1.2

Your Fasting Blood Glucose _____

Results	**Fasting Blood Glucose (FPG)**
Normal	Less than 100 mg/dl

Prediabetes	100 mg/dl to 125 mg/dl
Diabetes	126 mg/dl or higher

Lipid Panel Results

Lipids	Desirable Results	My Results
Total Cholesterol	200-239 mg/dl or less	
LDL	100-129 mg/dl or less	
VLDL	130-159 mg/dl or less	
HDL	50 mg/dl or more	
Triglycerides	150 -199mg/dl or less	

** Original Spanish versions of charts found in the Appendix **

Results:

Blood Lipids and Glucose:

Mean fasting glucose was significantly lower after 4 weeks of nutrition education and pedometer use. HDL cholesterol decreased significantly. Total cholesterol and LDL cholesterol decreased slightly but not significantly (Figure 2). Sixty-six percent of participants began the study with fasting blood glucose within the "normal" range of below 100. Sixty-six percent of participants who did not begin the study with their blood glucose within normal range lowered it to the normal range by the last week.

Figure 2: Differences in Blood Lipids and Fasting Blood Glucose.

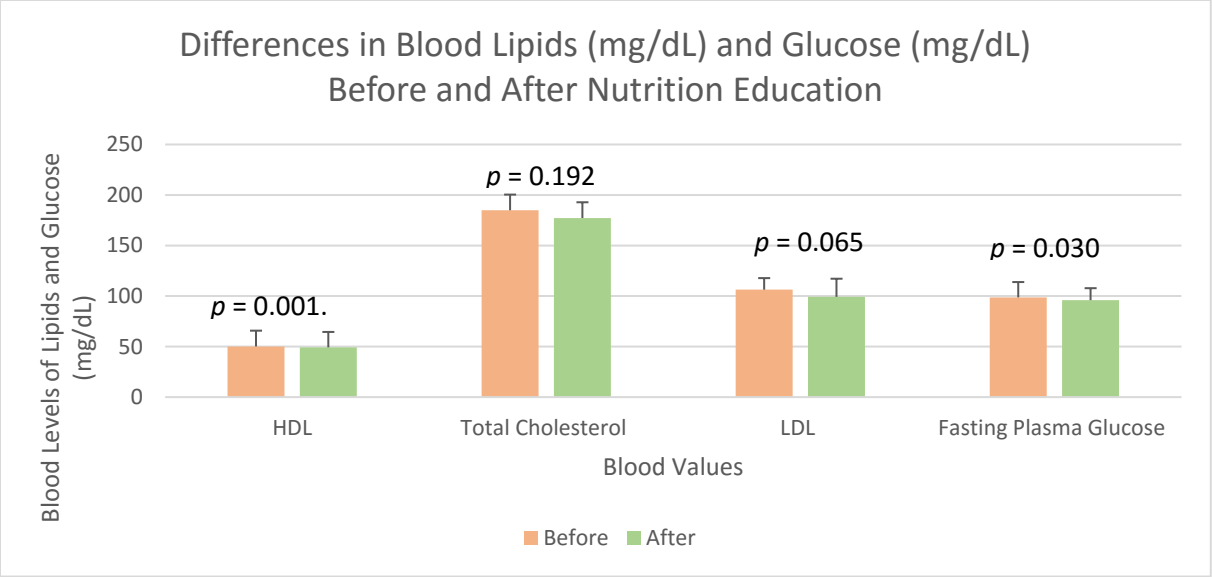


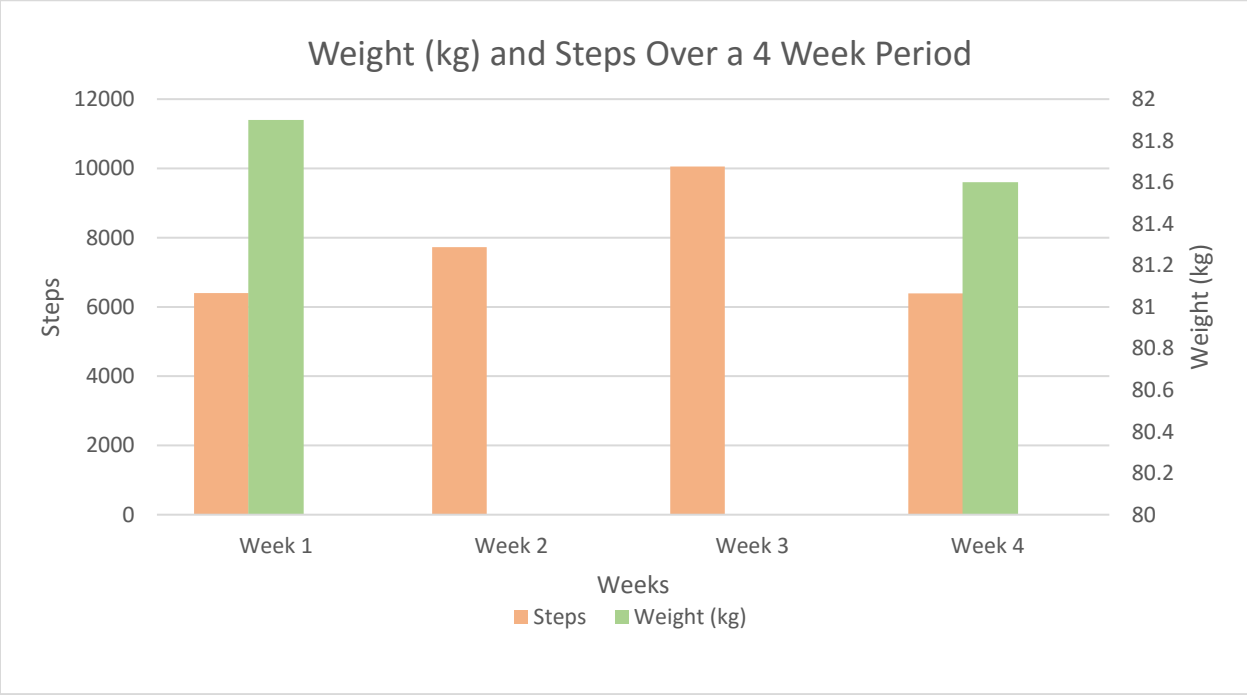
Table 1: Mean and Standard Deviation of Blood Values and Glucose

	Mean and Std. Deviation
HDL before	50.11 ± 15.88
HDL after	49.22 ± 15.27
Total Cholesterol Before	184.89 ± 15.52
Total Cholesterol After	177.22 ± 15.59
LDL before	106.33 ± 11.43
LDL after	99.22 ± 17.93
Fasting Blood Glucose before	98.67 ± 15.20
Fasting Blood Glucose after	95.89 ± 11.91

Activity Levels:

There was no significant difference over time between steps walked per day and weight status ($p = 0.372$). There was no significant difference over four weeks between steps walked and blood glucose values ($p = 0.373$). Fifty-five percent of participants increased their average steps from the beginning to the end of the study. Forty-four percent of participants who increased steps decreased their fasting blood glucose, and half of those also demonstrated a decrease in weight. Participants that decreased weight increased activity by 1,000-2,000 steps per day.

Figure 3: Average Steps Walked Each Week and Average Weight over Four Weeks. Averages of steps/day walked over the four-week period were as follows: 6,200, 7,900, 10,050, 6,100. ** Note- week 1 includes 9 participant's data on steps, but week 4 only includes 7 participant's data on steps.



Survey Results:

The following foods were the most commonly consumed by participants, per pre-study survey: rice, chicken, beans, tortillas, coffee, soda, sugar cereals, breakfast pastries, but minimal fruits and vegetables. Participants reported eating Chinese, hamburgers, Chipotle, or

buffet food when eating out. Changes participants made to their diet on the post-study survey include the following:

- 66% of participants reported smaller serving sizes
- 55% of participants reported increasing vegetable intake
- 66% of participants reported eating less tortillas
- 55% of participants reported drinking more water
- 44% of participants reported less desserts and sweets

The most important changes participants reported learning from the class were as follows:

- Reducing the portion size
- Reading the food label
- Making time to be active and exercise
- Eating more vegetables
- Drinking more water

Table 2: Pre-and Post Survey Results
** Denotes questions only asked on post survey

	Before	After
"Eating a healthy diet is important to my health" Yes or No	8/9	9/9
"Regular Exercise is important to my health" Yes or No	8/9	9/9
"It is important for me to prevent type 2 diabetes" Yes or No	8/9	9/9
"I feel like I will get diabetes no matter what I do" Yes or No	4/9	0/9
"I am confident I can prevent diabetes" Yes or No	7/9	9/9
"I do light physical activity but not every day" Yes or No	7/9	9/9
"I do light physical activity every week, but less than 3 days a week, or less than 30 minutes per day" Yes or No	4/9	8/9
"I do vigorous physical activity each week, but less than 3 days	1/9	5/9

a week or less than 20 minutes per day" Yes or No		
"I do 30 minutes of vigorous activity at least 3 days a week or for 20 minutes per day" Yes or No	2/9	6/9
"I do weight training once or twice a week" Yes or No	3/9	4/9
"I do flexibility exercises once or twice a week" Yes or No	3/9	6/9
"I do 30 minutes or more of moderate physical activity 5 days a week or more" Yes or No	2/9	7/9
**"The pedometer was more helpful than the nutrition education" Yes or No		9/9
**"The nutrition education was more helpful than the pedometers" Yes or No		0/9

Weight and Body Composition:
Body composition and weights were measured using an Omron HBF-516B Body Composition Monitor and Scale.

Table 3: Weight and Body Composition Averages Before and After

	Before (Mean and SD)	**After** (Mean and SD)
Weight (kg)	81.90 ± 14.09	81.60 ± 18.97
Body Fat %	44.39 ± 9.60	44.91 ± 10.22
Muscle %	24.47 ± 3.84	24.36 ± 4.27
Visceral Fat %	10.00 ± 2.92	9.89 ± 2.80
BMI	33.54 ± 6.92	33.96 ± 6.28
BMR	1516.78 ± 116.02	1505.5 ± 112.13

Discussion:

Mean fasting blood glucose was significantly lower after 4 weeks of nutrition education and pedometer use. In addition, HDL cholesterol was lowered significantly. Total cholesterol, LDL cholesterol, and weight decreased slightly, but were not significant. There was no correlation between steps walked or blood glucose values. Participants recorded eating smaller serving sizes, increasing vegetable intake, increasing water consumption, and decreasing dessert and tortilla consumption.

Weight loss in the current study decreased slightly, but not significantly, from 81.90 kg to 81.60 kg. A study completed by the American Diabetes Prevention Program experienced greater weight loss results than the current study. The program was similar in that it included a 12-month program, with the first 6 months including one-hour sessions once a week on basic lifestyle intervention. The following 6 months the group met once per month. The average weight loss was 5.6% at the end of the program (9, 1). Weight loss was associated with the number of education sessions participants of the program attended (9, 4). The American Diabetes Prevention Program was similar to the protocol of the current study, meeting once a week and including a lifestyle intervention. In contrast, weight loss for the current study was not found to be significant; potentially because of the much shorter time (4 weeks compared to 12 months) and a sample size of only 9 participants, versus 25 separate classes with a total of 1,735 participants.

Blood glucose significantly decreased in the current study (98 mg/dl vs. 95 mg/dl) while BMI demonstrated no significant change. There was no prescribed activity regime, and the average steps/day walked over the four-week period were as followed: 6,200, 7,900, 10,050, and 6,100. Similarly, a nutrition education program assessing pedometer use, resulted in decreased fasting blood glucose over a three-month period ($p = 0.052$). However, in the current study, BMI decreased by 0.9 kg/m, waist circumference by 3 cm and body fat by 1.1%. The number of steps walked per day increased incrementally over the three-month period, reaching a maximum of 10,000 steps per day as the goal. The control group received education, but did not increase activity levels, and significant changes in their body composition did not occur (10, 5). The results of the current study may have differed because an exercise protocol was not created for participants; they were given pedometers to track activity, with no requirement or prescribed plan to increase steps each day.

The study design had several limitations. One limitation was the small sample size. Although the initial intent of the study was that it would be carried out over a six-month time-period, it was hindered when changed to only six weeks' total, with a limited four weeks between blood measurements. Six weeks is the minimum to see strong changes in blood lipids and fasting blood glucose. A period of six weeks can indicate improvement and positive changes, but twelve to sixteen weeks may have demonstrated better results (11, 1). An Omron HBF-516B scale was used to take body composition measurements, measuring weight, body fat percentage, body mass index, skeletal muscle, visceral fat, and resting metabolic rate. The Omron HBF-516B is less invasive in nature compared to body fat estimation methods, such as skinfolds. However, when using the Omron scale, body fat can be overestimated by an average of 2.4% in males and 5% in females (12, 98). The Omron scale uses biological impedance and the accuracy can be influenced by hydration status, menstruation, and physical activity immediately before the measurement. Hydration status and physical activity were not

controlled prior to taking the measurements. Lastly, the study included self-reported pre-and post-surveys, which could be subject to error.

Future research should include a longer time-period, ranging from three months to one year of classes, to establish if a longer time-period with increased contact could result in long term significant changes. Future research should also include goal setting for step counts per week for participants, potentially increasing steps incrementally over the course of the study to reach a goal each day or each week. An effective way to set goals would be to create mini-competitions with prizes and motivators to be won each week. If participants consistently try to increase steps throughout the class, they will be more likely to continue the increased activity levels after the class is complete.

Conclusion:

Nutrition education and pedometer use was an effective way to improve dietary habits and activity levels in the selected Latino immigrant population. Contact with participants was limited and behavior change take time to become routine. Habits are formed after completing an activity for sixty-six consecutive days (13, 1). The target population started out relatively inactive and was able to increase steps for the first three weeks of the study and decrease their risk for diabetes by improving weight and fasting blood glucose values. Pedometer use and nutrition education are effective ways to decrease risk for the selected Latino immigrant population and similar classes should be implemented.

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Appendix:

Figures 1.1 and 1.2 in Spanish

Su Glucosa Plasmática en ayunas _____

Resultado	**Glucosa Plasmática en ayunas (FPG)**
Normal	Menos de 100 mg/dl
Prediabetes	100 mg/dl a 125 mg/dl
Diabetes	126 mg/dl o más alto

Los niveles de lípidos en sangre

Lípidos	**Desirble**	**Mi Resultado**
Total Cholesterol	**200-239 mg/dl o menos**	
LDL	**100-129 mg/dl o menos**	
VLDL	**130-159 mg/dl o menos**	
HDL	**50 mg/dl o más**	
Triglyceride	**150 -199mg/dl o menos**	

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