CME

Pasos Saludables

A Pilot Randomized Intervention Study to Reduce Obesity in an Immigrant Farmworker Population

Diane C. Mitchell, PhD, Teresa Andrews, MS, and Marc B. Schenker, MD, MPH

Objective: To evaluate a workplace-based diet and physical activity intervention to reduce obesity in a Latino farmworker population. **Methods:** 254 Latino farmworkers were allocated in a 1:2 control:intervention ratio to parallel groups in this randomized controlled study, [Clinical Trial ID# NCT01855282]. Intervention participants attended 10 weekly educational sessions led by promotoras. All participants had anthropometry and lifestyle habits recorded before randomization and at follow-up after 12–14 weeks. **Results:** Seventy percent (n = 112 intervention and 66 control) completed the study. Intervention females (not controls) decreased the primary outcome measures of weight, BMI, and waist circumference (mean [95% CI]) of −0.7 [−1.3 to −0.1] kg, −0.3 [−0.4 to −0.2] and −0.9 [−1.7 to −0.1] cm, respectively. Intervention participants increased water consumption, fruit and vegetable servings, and moderate physical activity in a dose-dependent fashion. **Conclusions:** The successful pilot workplace intervention offers a model to reach otherwise difficult-to-access Latino farmworkers.

M inority and low socioeconomic status (SES) groups suffer a disproportionate burden of morbidity and mortality from obesity and diabetes.[1,2] Higher prevalence of these metabolic conditions in the African American and Latino communities may be due to a combination of cultural, behavioral, lifestyle, and work factors.[3] Currently, nearly 69% of White non-Latina women in the USA are estimated to be overweight or obese (a body mass index [BMI] at least 25 kg/m^2), whereas 75.7% of Latina women fall in this category. For men, the equivalent figures are 74.0% of non-Latino and 81.7% of Latino men are overweight or obese.[4] In addition, the overall prevalence of age adjusted diabetes mellitus type 2 (DM II) for Mexican Americans was found to be 18.2% compared with 9.5% for non-Hispanic, White Americans.[4]

There is strong evidence that being overweight or obese increases the risk of developing DM II[5,6] and in a dose–response fashion.[7–10] It is not surprising, therefore, that weight loss is accepted as the best way of reducing the risk of DM II in obese individuals.[11–13] Evidence points to a combination of dietary changes and increases in physical activity as the most effective means of reducing the risk of DM II and its associated complications.[14,15]

Despite active farmwork, agricultural laborers have an obesity problem similar to other Latino subgroups.[16] Whereas some farm tasks involve high levels of exertion, many farmworkers do not sustain high cardiovascular exertion rates over the workday.[17] In a survey of immigrant farmworkers in California,[18] 79% of males and 74% of female immigrant farmworkers were determined to be overweight or obese. In a Michigan study,[19] 60% of the farmworkers were classified as obese and 39% had diabetes. Farmwork, as an occupation, was associated with an age adjusted prevalence of metabolic syndrome of 29.8% compared with an average prevalence in all occupations of 20%.[20] Goodman et al[21] found the prevalence of DM II in a Mexican migratory population of farmworkers and food-industry packers to be 26.2% (not age-adjusted).

Traditional public health efforts often fail to effectively reach farmworkers due to their seasonal work, migration, undocumented status, distrust or fear of government, transportation and child care problems, poverty, and cultural/linguistic barriers.[22] The workplace is one of the very few accessibility points in which to engage this population. We created a randomized controlled workplace-based interventional pilot program, *Pasos Saludables* (Healthy Steps), to motivate the adoption of a healthy lifestyle and reduce or prevent obesity, with the eventual aim of reducing the risk of developing of diabetes. The specific objectives of the study were to evaluate the intervention based on the following outcomes: (1) a reduction of measures of obesity and blood glucose; (2) behavioral changes toward a healthier lifestyle; and (3) participant satisfaction.

METHODS

Trial Design

The study was a randomized, controlled intervention with worker participants allocated in a 2 : 1 ratio of intervention to control in parallel groups. Based on data from a similar population,[16] we determined a sample size of 200 intervention to 100 control would have a power of 84% to see a 1 kg difference in weight change. Inclusion criteria were employee of the grower, age 18 years to 60 years, BMI between 20 kg/m^2 and 38 kg/m^2, as suggested by the clinic physician (the program aim was to prevent the occurrence and reduce the prevalence of obesity by promoting healthy behaviors, so normal weight workers were included). Other criteria included the expectation workers would remain in the area for the next 6 months, be willing to attend 10 weekly education sessions, and be able to

speak and read Spanish at a basic level. Participants had to carry medical insurance (a condition of the study sponsor). Most had worksite insurance (approximately 25% to 40% of the workforce) and the remainder had public (Medical) or private health insurance. Workers were excluded if they were a person with diabetes, were pregnant, trying to conceive, or breastfeeding, or if they were on therapeutic diets or on medications that affect weight, had a medical condition that proscribed activity, or their spouse/cohabitant was already in the study.

Study Staff and Randomization Process

The field team at each worksite was comprised of a field coordinator, two part-time research assistants and two part-time *promotoras* trained by the university research team staff. All were bilingual Latinas. The *promotoras* recruited participants at the ranches and conducted the intervention program in groups of 10 to 15 participants. The research assistants were responsible for screening, conducting baseline and follow-up assessments, and communicating with participants. They were blinded to the group assignment of the participant throughout the trial. Participants were randomly assigned to intervention or control in a 2 : 1 ratio using a computer random number generator at enrollment after the baseline interview was completed. The random order was applied to ascending subject identification numbers, which were given to each new participant in the order of enrollment by the field coordinator, who did not interview the participants.

Study Information

Pasos Saludables was implemented between April 2010 and January 2011. Participants were recruited through two workplace locations of a Californian berry grower, one in Oxnard, and one in Watsonville. The company sponsored the pilot intervention. The study is registered with ClinicalTrials.gov identification number NCT01855282. All participants signed an informed consent document. The study was approved by the university institutional review board.

Intervention Program

The *Pasos Saludables* program is based on the principles of participatory adult education, promoting open dialogue and active participation during the learning process. The intervention program consisted of nine sessions and a final review and was created by the educational and outreach specialist. The specialist, a native of Mexico and an expert in adapting materials to lower literacy groups, developed culturally and linguistically appropriate materials. The framework for the program was the "*Cinco Pasos para Vivir Mejor*" (Five Steps to Live Better) social media campaign launched by the Mexican Government.[23] The five steps are as follows: (1) drink water; (2) eat fruits and vegetables; (3) measure (what you eat and your waist); (4) move; and (5) share (the message). Each session started and finished with a brief review of the five steps. The sessions were conducted at the work sponsored clinic sites; workers participated on their own time, and were not paid to attend.

The content of the sessions was adapted from the "Your Heart, Your Life" program, created by the National Heart Lung and Blood Institute[24] to improve heart health and reduce obesity among Latinos. This program unlike many others is more accessible to lower literacy groups because it does not rely on written material, either in print or web-based.

The *promotoras* were trained to implement the intervention and were given an agenda for each session. To maintain the consistency of the educational program, the field coordinators frequently checked the session content delivery by the *promotoras*. Every agenda included the following guide to provide consistent instruction throughout the program:

1) Key information participants should understand.
2) Suggested activities and steps to accomplish them.
3) Suggested time to spend on each activity.

The session topics included a program overview; increasing physical activity; what is a healthy weight; what is a healthy diet for different ages and families; nutrition and its components; understanding and preventing diabetes; and the connection between feeling good, being healthy, mental health, diet, and exercise. Larger topics were spread over more than one session. The methods encouraged open dialogue and active participation, so each participant would be an active agent in the process of behavior change. Sessions were 90 min long, including at least 15 min to 20 min devoted to physical activity—a warm-up of 2 min to 3 min, moderate activity for at least 10 min, and a cool down of 2 min to 3 min. High-impact moves were avoided, and music was always included to inspire movement. The actual exercise was kept simple and did not need special equipment, so participants could practice similar sessions at home. After the session, participants could share a healthy snack and continue to bond as a group. Participants were encouraged to make each concept taught relevant in their daily life by making weekly promises to improve lifestyle. At the beginning of the next class, the *Cinco Pasos* were reviewed. If someone had difficulties keeping their promise, the group would devise solutions, which promoted cohesion between participants. Participants were encouraged to bring relatives, friends, and children (free childcare provided) to the sessions. Only the company worker was counted as a participant and fully monitored for the study. At follow-up intervention, participants who had attended less than three sessions were designated as "dropouts" and were not contacted. The remaining participants were called up to 10 times at various times of day and week before being classed as lost to follow-up.

Control Participants

Control participants received no dietary or physical activity information. They were contacted once between enrollment and the 12-week to 14-week follow-up to maintain communication. (Once a control had a follow-up interview, they were eligible to join the intervention program but were not counted or monitored a second time.)

Data Collection

All participants (whether designated a control or intervention) attended a pre-randomization interview wherein their anthropometric measurements were collected using standardized protocols, and an interviewer administered questionnaire was given in Spanish by a research assistant at a worksite clinic. Each participant's height was measured with a Seca 213 mobile stadiometer (SECA, Chino, CA) and weight with the EatSmart Precision Digital Bathroom Scale (Health Tools, LLC., Wyckoff, NJ). Waist girth was assessed with a Medline Disposable Paper Tape Measure (Medline Industries, Inc., Lathrop, CA). The measurement was conducted against the skin and measured at the natural waist. A voluntary fasting blood glucose measurement was taken (Accu-Check Advantage Blood Glucose Meter, Roche Diagnostics, Indianapolis, IN). If the reading was at least 7 mmol/L, the participant was referred to the clinic physician who decided whether it would be safe for them to participate. Demographic and medical histories were collected. The questionnaire also measured acculturation, dietary habits, physical activity, and health perception. Workers lost to follow-up or dropouts were invited to participate in an exit questionnaire to obtain their opinions of the program. The measures and a follow-up questionnaire were carried out a second time 12 weeks to 14 weeks from the baseline, at the end of the intervention for all participants, controls and intervention alike. (This allowed

the participants to take classes that they had missed from a subsequent session.)

Measures and Outcomes

The primary outcomes studied were change in weight, BMI, waist circumference, and fasting blood glucose concentration. These objective clinical assessments were performed by the research assistants blinded to participant status using well established standard procedures.

The secondary outcomes were dietary and physical activity changes, including fruit, vegetable, and fiber consumption, substituting water for calorific drinks, and frequency of eating fast food. All questions were taken from commonly used scales and questionnaires that have been extensively referenced and assessed for validity and reliability. Fruit and vegetable servings and fiber were assessed by a Block screener[25] under license from NutritionQuest (Berkeley, CA). This screener uses seven questions about fruit and vegetable consumption and three questions about foods high in fiber. From the responses, prediction equations are used to translate the scores into daily intake. These equations use linear regression techniques and include gender.[26] The short screener compared well with other validated tools, as the 100-item Block dietary questionnaire and data from food records, provides a reasonably reliable and accurate ranking of nutrient consumption.[26] A set of three questions was used to assess frequency of fast food, soda, and sweetened drink consumption in the last month adapted from the National Health and Nutrition Examination Survey 2009 dietary screener.[27] Similar questions have also been used in multiple versions of the Behavioral Risk Factor Surveillance System questionnaire.[28] The frequencies of consumption were condensed into two levels: never or rarely (less than weekly) versus regularly (at least weekly) for each question. Physical activity changes were assessed in the last 30 days as follows: (1) days per week performing at least 30 min of physical activity; (2) days per week performing at least 10 min of physical activity that produced moderate increases in heart beat and breathing rate (moderate activities); and (3) days per week performing at least 10 min of physical activity that produced large increases in heart rate and breathing rate. These physical activity questions were obtained from the Physical Activity Confidence scales[29] and from the Behavioral Risk Factor Surveillance System 2009 questionnaire.[30] Both studies have been validated as reliably able to classify groups of adults into low-medium and vigorous activity.[31,32] Although we only used a subset of their scales, the main focus of this study was to compare baseline with a final assessment, and therefore concentrated on the change between assessments. Acculturation was evaluated at baseline by a five-question screener.[33] The short acculturation scale for Hispanics was produced from a 12-item scale using the primary factor of language use (English versus Spanish). The questions were as follows: "what language was spoken and read, used as a child, spoken at home, used to think, and spoken with friends." The short version is highly correlated with the full scale and has adequate internal consistency.[33] All participants were categorized into the no acculturation, low acculturation, or medium acculturation; there were no participants assessed at the high or very high level. Satisfaction with the intervention program was assessed by questionnaire at follow-up.

Statistical Analysis

Data were analyzed using SAS 9.2 (SAS Institute, Inc., Cary, NC). The level of significance for all analyses was set at $\alpha = 0.05$. First order interactions between the predictor variables were examined and reported if $P \leq 0.05$. A demographic description of the total cohort and by control/intervention status at baseline used the t test or Mann-Whitney U test for continuous or ordinal variables and χ^2 for categorical variables. The anthropometric measurements and lifestyle habits of the control and intervention groups were compared at baseline using general linear models adjusting for age, site, and sex where appropriate. Other potential confounders considered included family income, educational level, acculturation, hours worked, food availability, and whether they received any social assistance. If a variable caused an at least 15% change in the estimation of the independent variable in a significant model, it was retained as a confounding covariable.

Change between baseline and follow-up anthropometry and lifestyle measures was assessed in those completing the study using analysis of covariance. Baseline measures were included in these models to adjust for any differences between groups. Analysis of covariance was also used to determine whether higher participation was associated with increased changes in health habits and anthropometry. Exposure to intervention was defined as zero (control), low (attended three to seven intervention sessions), and high (attended 8 to 10 sessions). For fast food, soda, and sweetened drinks, the responses were categorized into two levels, never-rarely versus regular consumption (at least once per week), and logistic regression models were used.

RESULTS

Recruitment and Retention

Approximately 20% of workers who were approached and invited to join the work-based intervention study participated. Thirty percent of those evaluated were determined not to be eligible. The most common reason was lack of health insurance or not enrolled as a clinic member (69%), whereas 9.4% moved or were laid off, 7.8% were not eligible because a spouse was already enrolled, and 7.8% were pregnant or breast feeding. Four percent of those evaluated were already living with diabetes and 2% were not able to understand Spanish sufficiently (spoke indigenous languages). Eighty workers were recruited into the control group, and 174 into the intervention (Fig. 1). Seventy percent (178/254) of the workers who completed the baseline assessment also completed a follow-up interview. The dropouts were more likely to be men ($P = 0.02$) had on average been in the United States for 1 year or less ($P = 0.06$), and were more likely to be in the lowest strata of income ($P = 0.03$). No other demographic or anthropometric characteristic differed significantly between those remaining or dropping out of the study. The control group achieved a higher retention rate than the intervention (82.5% vs. 64.4%, respectively, $P = 0.003$). Twenty-six intervention participants completed three to seven sessions, whereas the remaining 77.7% completed 8 to 10. Among intervention dropouts, 39 of 62 workers completed exit questionnaires (Fig. 1).

Demographics

Men comprised 28% (71) of the recruited population, but closer to 50% of the total work force (Table 1). Despite average US residency of less than 10 years, the acculturation level was low; only four participants stated they were comfortable thinking, reading, and speaking in both Spanish and English. The low SES profile was similar to other immigrant agricultural worker populations in California; 38% of men and 61% of women reported they had only attended school through the primary level (6th grade). Despite working in the food industry, only approximately half of the participants reported they always had both enough and good-quality food on their family table. Intervention workers were more likely to have a family income $10,000 or less but overall had a higher average income than controls ($P = 0.02$). No other demographic characteristics differed significantly ($P < 0.05$) between the control and intervention groups.
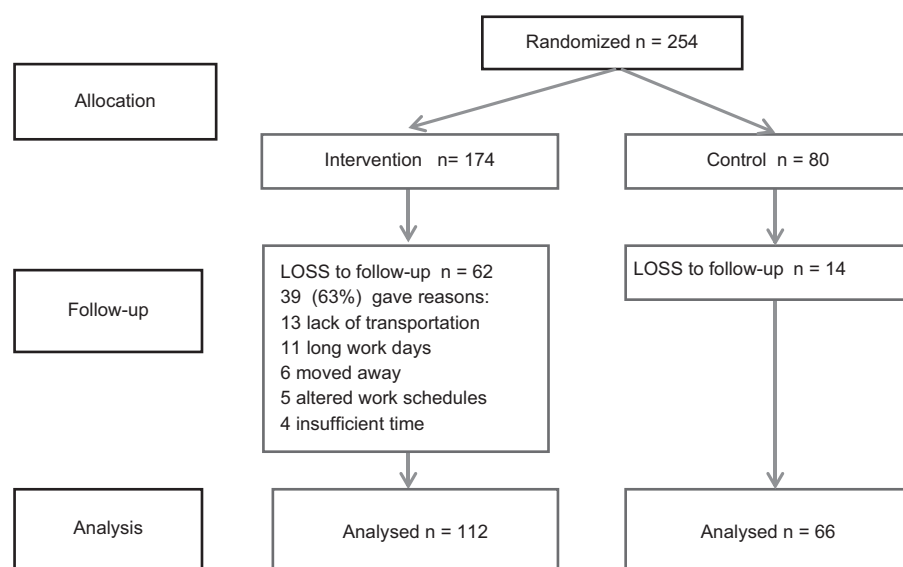
FIGURE 1. Recruitment, allocation to study groups, and retention flow diagram.

Anthropometric, Dietary, and Physical Characteristics at Baseline

Mean differences between control and intervention group anthropometry and lifestyle factors were adjusted for age and study site (Table 1). Weight, BMI, and waist circumference differed significantly at baseline between the control and intervention arms of the study; intervention participants weighed on average 4.2 kg more than the controls, and this was reflected in larger BMI and

TABLE 1. Demographics: Comparison of Control and Intervention at Baseline by Gender and Intervention Status

Characteristic	Total Mean (SD)		Control: Intervention Mean (SD)	
	Men 71	**Women 183**	**Control 80**	**Intervention 174**
Age (years)	30.2 (7.0)	33.2 (7.8)	32.5 (7.9)	32.3 (7.6)
Hours worked (wk)*	48.5 (11.9)	47.1 (12.1)	45.9 (12.7)	48.1 (11.7)
Years in United States*	10.1 (6.0)	12.0 (6.2)	11.2 (6.3)	(6.2)
Weight (kg)*	79.6 (1.4)	66.2 (0.8)	70.0 (1.3)	74.2 (1.0)
BMI*	29.3 (0.5)	28.0 (0.3)	27.7 (0.4)	29.1 (0.3)
Waist circumference (cm)*	95.7 (1.2)	87.5 (0.7)	89.4 (1.1)	92.5 (0.8)
Blood glucose‡	5.68 (0.08)	5.56 (0.05)	5.60 (0.1)	5.63 (0.06)
	N (%)	N (%)	N (%)	N (%)
Education level				
0–6 grade	26 (38.3)	109 (61.2)	47 (60.3)	88 (52.7)
7–9 grade	25 (37.3)	46 (25.8)	21 (26.9)	50 (29.9)
10 to college	16 (23.9)	23 (12.9)	10 (12.8)	29 (17.4)
Acculturation†				
None/little	59 (83.1)	169 (92.4)	73 (91.3)	155 (89.1)
Low	10 (14.1)	12 (6.6)	5 (6.3)	17 (9.8)
Moderate	2 (2.8)	2 (1.1)	2 (2.5)	2 (1.5)
Family income§				
≤$10,000	15 (21.4)	37 (21.3)	11 (14.3)	41 (24.6)
$10,001−20,000	25 (35.7)	64 (36.8)	38 (49.4)	51 (30.5)
$ 20,001−30,000	19 (27.1)	46 (26.4)	21 (27.3)	44 (26.4)
>$30,000	11 (15.7)	27 (15.5)	7 (9.1)	31 (18.6)
Social assistance§	27 (38.3)	72 (39.6)	31 (38.8)	68 (39.3)
Food availability				
Always enough	37 (52.1)	100 (55.0)	42 (52.5)	95 (54.9)
Enough quality varies	28 (39.4)	56 (30.8)	25 (31.3)	59 (34.1)
Not always enough	6 (8.5)	26 (14.3)	13 (16.2)	19 (11.0)

t test or Wilcoxon Mann-Whitney *U* test for continuous/ordinal variables, χ^2 for categorical variables. BMI, body mass index; SD, standard deviation.
*Adjusted for age, sex, and site.
†No subjects were classed as highly acculturated.
‡Smaller sample sizes for blood glucose. (Controls: men = 18, women = 54; intervention: men = 49, women = 121.)
§Received over last year.

waist measurements. No significant differences were found in nutritional consumption or physical activity levels between the two groups.

Evaluation of the Intervention

Measures of Obesity

A total of 66 controls and 112 intervention participants completed the follow-up assessment. Mean changes in anthropometry were adjusted for age, site, and baseline values of the anthropometric variable. None of the other potential confounders or effect modifiers (as for example income level) were associated with the outcomes. Changes in outcome measures were compared between the control group, those who attended three to seven intervention sessions and those with high attendance (8 to 10 sessions). Greater losses in weight, BMI, and waist circumference were associated with increasing attendance at intervention sessions. *P* values for the trends were 0.0002, 0.0001, and 0.001, respectively (Table 2). Fasting blood glucose concentrations did not change.

Intervention women significantly reduced all anthropometric measures except blood glucose. Compared with controls, intervention women reduced their weight by 0.7 kg ($P = 0.001$) and BMI by 0.3 ($P = 0.002$) (Fig. 2). The mean decrease in waist circumference in intervention women was 0.9 cm, whereas the controls' increased by 0.1 cm (not significant). These results were adjusted for the baseline weight and waist circumference. Men trended the same way, but the trends were not statistically significant.

Secondary Measures of Diet, Physical Activity, and Satisfaction

With increasing attendance at intervention sessions, reported water consumption, servings of fruits and vegetables and fiber increased significantly, whereas consumption of fast food and sweetened drinks decreased (Table 2). Total activity increased with greater attendance, except for the number of days of vigorous activity.

Satisfaction with the Program

The intervention participants provided program feedback after each session, and 93.8% of the time they ranked the sessions as very good and useful. Only 0.16% time did they indicate an unfavorable session. Over 75% of the intervention participants reported that they enjoyed making promises after each session and reviewing them at the next session. Eighty-seven percent thought the information presented was the most valuable aspect of the program, specifically the nutritional instruction. Eighty percent of intervention participants stated they had made changes in basic nutritional and food preparation habits, specifically eating more fruits and vegetables.

DISCUSSION

We aimed to devise a sustainable workplace-based program to reduce obesity, improve diet, and physical activity habits and so ultimately to reduce DM II prevalence in immigrant farmworkers. The *Pasos Saludables* study population is at increased risk of developing DM II. Overall, 73% of this cohort was classed as overweight or obese (BMI at least 25 kg/m²) and 33% as obese (BMI at least 30 kg/m²) with little differences between the sexes. These numbers are comparable with nationwide figures for Latinos (National Health and Nutrition Examination Survey).[4]

There are over 1.2 million hired farmworkers in the United States, with the vast majority being Latino.[34] Despite the size of this population, public health outreach concerning obesity and DM has largely ignored immigrant Latino farm laborers because they are difficult to access. The *Pasos Saludables* program is one of the first to focus on the large population of rural, agricultural families in California.

Modifying eating and physical activity habits may be one of the most difficult changes to accomplish, even under ideal conditions.[35] Our pilot study resulted in a small but significant decrease in weight, BMI, and waist circumference among intervention participants. Small changes in behavior observed across large populations are likely to have significant effects on disease risk.[36] In addition, the dose–response association of the intervention program and anthropometric changes suggests a causal association. This pilot intervention has the potential to reach a large population of agricultural workers and other low-wage immigrant Latino populations through the workplace in comparison to clinically based programs.

TABLE 2. Mean Differences and 95% Confidence Intervals for Changes in Diet and Physical Activity at Follow-up (Men and Women Combined)

Parameter at Follow-Up Estimate [95% CI]	Control n = 66 (No Intervention)	3–7 Sessions n = 26 (Lower Intervention Attendance)	8–10 Sessions n = 86 (Higher Intervention Attendance)	Change (P value Trend)
Weight (kg)	70.0 [69.3–70.7]	69.4 [68.2–70.5]	68.2 [67.5–68.9]	0.0002
BMI	28.6 [28.3–28.9]	28.3 [27.9–28.8]	27.9 [27.1–28.1]	0.0001
Waist (cm)	89.3 [88.4–90.3]	90.4 [88.9–91.8]	87.7 [86.9–88.6]	0.0012
* Blood (mmol/L) glucose	5.86 [5.7–6.1]	5.67 [5.4–6.0]	5.75 [5.6–5.9]	0.44
Water (8 oz glasses/day)	5.2 [4.6–5.9]	6.5 [5.4–7.6]	7.0 [6.4–7.6]	0.0006
Fruit and vegetable (servings/day)	5.4 [5.0–5.8]	5.6 [5.0–6.3]	6.1 [5.7–6.4]	0.041
Fiber (g/day)	20.3 [19.2–21.5]	21.8 [19.9–23.7]	23.0 [22.0–24.0]	0.002
Physical activity-non-work 30 min (days/week)	2.1 [1.6–2.6]	2.5 [1.7–3.3]	3.2 [2.8–3.7]	0.004
Moderate activity (days/week)	2.8 [2.2–3.4]	3.7 [2.8–4.7]	3.8 [3.3–4.3]	0.022
Vigorous activity (days/week)	1.4 [1.0–1.9]	1.3 [0.5–2.1]	1.7 [1.3–2.1]	0.60
†Fast food (never/rare vs regularly)	[Referent]	0.68 [0.25–1.90]	0.42 [0.21–0.87]	0.063
†Sweetened drinks (never/rare vs regularly)	[Referent]	0.54 [0.19–1.55]	0.31 [0.15–0.64]	0.006
†Soda drinks (never/rare vs regularly)	[Referent]	0.84 [0.28–2.49]	0.46 [0.22–0.97]	0.10

Analysis of covariance: models combining data from men and women, adjusted for age, site, sex, and baseline value of the outcome of interest. BMI, body mass index; SD, standard deviation.

*Fasting blood glucose measurements conducted on fewer participants. Men: control 13, lower intervention 6, higher intervention 18; women: control 50, lower intervention 16, higher intervention 63.

†Fast food, sweetened drinks, and soda consumption: analyzed by logistic regression with the control value as the referent.
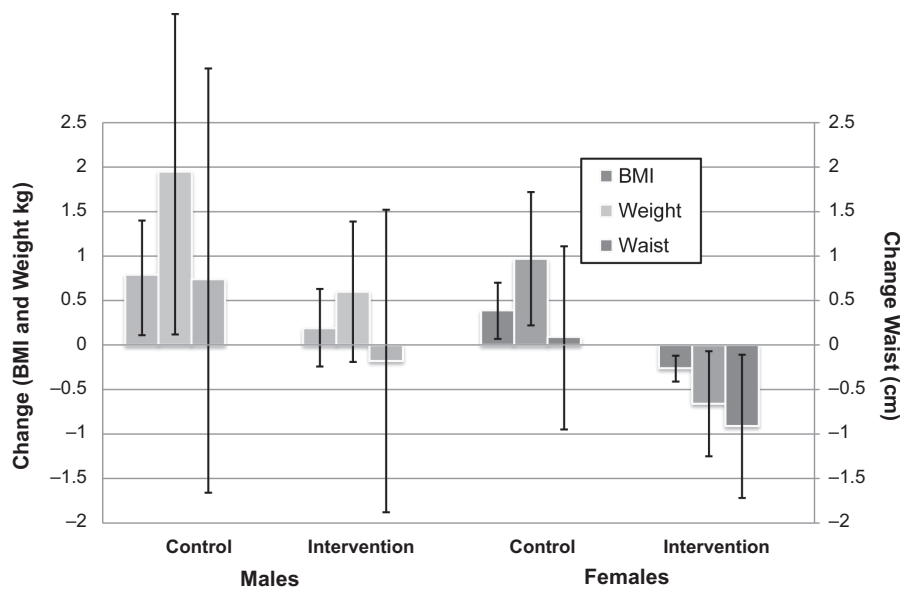
FIGURE 2. Mean change in body mass index, weight, and waist circumference. All changes were recorded as value at (follow-up—baseline) and adjusted for age, site, and measurement at baseline.

Workplace Interventions

Workplace interventions have previously focused on safety and risk reduction but have great potential in promoting beneficial dietary and physical activity habits.[37] Over the last 10 to 15 years, obesity reduction interventions have begun to be adopted by larger companies. A meta-analysis of workplace intervention programs found seven studies of suitable quality that resulted in at least 1.8 kg loss of weight, and the conclusion was that a combination of weight loss and activity gain were essential for success.[38] Return on investment in these programs indicates a positive return or at worst a modest cost per participant.[39] An analysis conducted on data collected from workplace programs found that a positive economic outcome was likely to benefit companies with healthier workers.[39,40] Few of these programs included manual employees, and the participants were likely to be higher earners who already have better health habits.[37,41] Very few workplace programs included substantial percentages of minorities[38]; we were unable to find any workplace program that focused on low SES Latino participants.

Evaluation and Comparison With Other Obesity Interventions

Our intervention achieved an overall retention rate of 70% approximately 3 months after enrollment, with the intervention arm at 64% retention. We suspect the difference in retention between the arms was due to the high time commitment and transportation barriers in the intervention group. The farmworkers had to attend on their own time after work, which may finish late at peak harvest times, and with low car ownership, many have to rely on others for transportation. Intensive clinical programs combining diet and exercise interventions experience retention rates between 55% and 90% after a year.[12,42] Smaller experimental programs, such as *Pasos Saludables*, are likely to experience lower retention rates.[5] For example, a 10-week program to prevent weight gain in low-income overweight mothers maintained a retention rate of 47% in the intervention and 65% in their control arm.[43] The mother study included low SES minority groups who shared many of the barriers to participating and staying in a program that immigrant farmworkers experience.

Dietary and physical activity interventions promoting substantial anthropometric changes usually involve intense interventions conducted through research clinics. Successful programs often include one-on-one counseling with individualized diets and frequent and continued monitoring for several months. Examples of large, intensive interventions are few because of their cost. The Diabetes Prevention Program (DPP) (restricted to those with pre-diabetes) enrolled 3234 participants, with one-third included in an intensive lifestyle intervention. This study arm used individual one-on-one weekly sessions for 24 weeks and resulted in a mean loss of 5.6 kg[12]; however, the recruitment cost, excluding staff, was about $1075 per randomized participant.[44] The Finnish DPP recruited 522 middle-age and overweight pre-diabetic participants.[45] The lifestyle modification group had seven 1 : 1 consultation sessions in the first year and every 3 months afterward. After 1 year, a mean loss of 4.5 kg was recorded.

Translation from intensive programs to sustainable and broader community programs remains difficult. The Good Aging in Lahti program, developed from the Finnish DPP, consisted of five group sessions at 2-week intervals and a booster session after 6 months in a primary health care rather than clinical setting. The average weight lost in the 352 participants was just 0.8 kg at 1 year (-0.8 kg, $P = 0.002$) but was maintained at a 3-year follow-up (-1.0 kg, $P = 0.003$).[45]

When assessing the efficacy of the *Pasos Saludables* intervention, appropriate comparisons should be drawn from programs with participants of similar SES and vulnerabilities, such as low acculturation, low education and low English proficiency. A review by Perez et al[6] summarized trials of weight loss reduction in obese Latino adults. Three of 22 trials achieved a large Cohen effect size. All were culturally appropriate, small (18 to 44 total participants), clinic or community-based and involved women exclusively. Using their criteria, a sufficient effect size was defined as between 0.21 and 0.79. The *Pasos Saludables* study had a total effect size of 0.3 (using BMI change as the outcome of interest), and in women the effect size was 0.32. Our intervention compares well with the reviewed studies considering our larger, mixed audience and higher participant: *promotora* or health instructor ratio.

Three recent community intervention studies in Latino populations included elements comparable with *Pasos Saludables*. The *Salud con Sabor Latino* intervention, taught by *promotores*, was a 4-week program that graduated 78 participants and met twice

weekly in an urban community.[46] Waist circumferences decreased by 3.8 cm ($P < 0.01$) and BMI by 0.18 units ($P < 0.01$) at a year follow-up. Another urban intervention recruited Latinos at a primary health care clinic.[47] Behavior was moderated but no anthropometric changes resulted. The SAving Lives Staying Active study[48] was an 8-week randomized controlled crossover study of 50 Latino women, alternating physical activity (dance) and web-based nutritional education. Moderate physical activity increased by approximately 105 min per week ($P < 0.01$), but fruit and vegetable consumption decreased, and there was no significant change in BMI. The *Pasos Saludables* pilot workplace intervention reached a larger audience and compared well with these other studies of urban, more easily accessed populations.

Limitations and Strengths

Some limitations to this pilot study should be noted, including the representativeness to the total immigrant Latino farmworker population. We believe that this convenience sample was less likely to include undocumented farmworkers or those who can only communicate in indigenous languages. The workplace was chosen because immigrant farmworkers frequently work 6 days a week; therefore, contact through work allows consistent access to a large segment of the population. Although the employer was the sponsor of the study, it is unlikely that workers felt coerced to enroll. For example, recruitment was hampered by the company's requirement to carry health insurance, which excluded much of the workforce, the study records were confidential and kept by the university research team, and all procedures except advertisement of the study were conducted out of work hours. The seasonal nature of the work (a winter low-work season when workers may relocate) also reduced enrollment and increased dropout rates. Fewer men were recruited, and retained, which seems to be a pattern in Latino populations.[49] Both recruitment and retention were constrained by difficulties in communications, such as intermittent cellphone access by participants and frequent number changes; transportation difficulties; and varying, but long, workdays. With limited funding we were unable to provide as much contact with the control participants compared with the intervention participants.[47] Although blinded research assistants randomly allocated the subjects to intervention or control, the intervention participants had significantly larger BMI than the controls. We adjusted for these differences by including baseline values in the model structure for anthropometric changes and for final anthropometry or assessed behavior status. This strategy should reduce the bias expected due to the tendency of differing groups to regress to the overall mean.

Future Goals

This intervention with modest adaptations, offers an effective model for wider application to agricultural workplaces composed of large Latino communities with low SES. We suggest modifications aimed at recruiting and retaining more men, (such as using male recruiters, *promotores* and group sports exercise sessions that could be single sex). Removing the barrier of a health insurance requirement and allowing anyone medically able to enroll. Staging intervention sessions within the work day would resolve the problems associated with transportation and varying/long work shifts. The long-term sustainability of the observed changes remains to be evaluated, and it is likely the workers would need long-term support. The pilot program has evolved and with additional funding from the National Institutes of Diabetes, Digestive and Kidney Diseases continues to expand at the original and new worksites with an aim of generalizing it to Latino farm populations in other areas of the United States and Mexico.

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