

# Effect of Fresh Fruit Availability at Worksites on the Fruit and Vegetable Consumption of Low-Wage Employees

Desiree Backman, DrPH, RD<sup>1</sup>; Gian Gonzaga, PhD<sup>2</sup>; Sharon Sugerman, MS, RD, FADA<sup>1</sup>; Dona Francis, MPH<sup>3</sup>; Sara Cook, MPH, CHES<sup>4</sup>

## ABSTRACT

**Objective:** To examine the impact of fresh fruit availability at worksites on the fruit and vegetable consumption and related psychosocial determinants of low-wage employees.

**Design:** A prospective, randomized block experimental design.

**Setting:** Seven apparel manufacturing and 2 food processing worksites.

**Participants:** A convenience sample of 391 low-wage employees in 6 intervention worksites and 137 low-wage employees in 3 control worksites in Los Angeles, CA.

**Intervention:** Fresh fruit deliveries with enough for 1 serving per employee, 3 days a week for 12 consecutive weeks. The control worksites did not receive the fruit deliveries.

**Main Outcome Measures:** Participants' fruit and vegetable consumption, fruit and vegetable purchasing habits, self-efficacy, job satisfaction, and overall health were measured at baseline, weeks 4 and 8, and following the 12-week intervention.

**Analysis:** Descriptive statistics and growth curve analysis using hierarchical linear modeling were employed to analyze the data.

**Results:** Participants in the intervention worksites showed a significant increase in fruit, vegetable, and total fruit and vegetable consumption, purchasing of fruit, family purchasing of vegetables, and self-efficacy toward eating 2 servings of fruit each day compared to the control worksites.

**Conclusions and Implications:** Improving access to fruit during the workday can improve fruit and vegetable consumption, purchasing habits, and self-efficacy of low-income employees.

**Key Words:** fruit, vegetable, worksite, self-efficacy, low income (*J Nutr Educ Behav.* 2011;43:S113-S121.)

## INTRODUCTION

Fruit and vegetable intake is 1 of the most important qualitative aspects of diet for disease prevention.<sup>1</sup> The *2010 Dietary Guidelines for Americans* recommends that adults eat 3½ to 6½ cups of fruits and vegetables every day. However, the majority of adults in the United States fall significantly short of this recommendation.<sup>2</sup> Not surprisingly, several health problems related to poor dietary habits either have increased or have not been reduced to the same extent among

lower-income Americans as compared to those of higher income during the past 3 decades.<sup>3</sup>

Greater consumption of fruits and vegetables is associated with a reduced risk of cardiovascular disease, stroke, certain types of cancer, and type 2 diabetes, as well as improved weight management.<sup>4-6</sup> These medical conditions and obesity cost the United States economy an estimated \$661 billion a year in direct costs (2004-2009 dollars, depending on health condition), a sizable portion of which is shouldered by employers and businesses.<sup>7-11</sup>

Worksites offer a unique opportunity to address unhealthful dietary practices, as they provide access to 65% of adults, many of whom spend a majority of their waking hours on the job.<sup>12</sup> In a review of the literature, Bachman and colleagues conclude that behavioral health promotion interventions for obesity and weight management in the worksite setting provide cost savings from the employer's perspective.<sup>13</sup> A more specific example from John and colleagues demonstrates that a worksite intervention featuring education about cardiovascular disease prevention, identification of drug therapy problems, and routine monitoring of blood pressure, pulse, and weight measurements with physician referrals as needed resulted in a significant reduction in diastolic blood pressure among workers who did not have diabetes.<sup>14</sup>

Self-efficacy, the belief that one is capable of accomplishing a certain level of behavior, has been identified as 1 of the strongest psychosocial predictors of fruit and vegetable consumption.<sup>15</sup> Changes to the workplace

<sup>1</sup>*Network for a Healthy California*, California Department of Public Health and Public Health Institute, Sacramento, CA

<sup>2</sup>eHarmony Labs, Pasadena, CA

<sup>3</sup>Prince Edward Island Department of Health, Prince Edward Island, Canada

<sup>4</sup>California Medical Association Foundation, Sacramento, CA

STATEMENT OF POTENTIAL CONFLICT OF INTEREST AND FUNDING/SUPPORT: See page S120.

Address for correspondence: Desiree Backman, DrPH, RD, 1616 Capitol Avenue, MS 7204, Sacramento, CA 95814; Phone: (916) 440-7609; Fax: (916) 449-5415; E-mail: [desiree.backman@cdph.ca.gov](mailto:desiree.backman@cdph.ca.gov)

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environment that make it easy to consume fruits and vegetables provide employees with the basis for building self-efficacy by having ready opportunities to master greater consumption, observing social models, and experiencing social persuasion to consume more fruits and vegetables.<sup>16</sup> Strategies to improve self-efficacy are especially important among low-wage workers. Employees tend to report less-healthy diets when they have low-status jobs, poor occupational conditions, high workloads, low control, and a lack of acceptable food at work.<sup>17</sup> These conditions result in dissatisfaction and perceived limited time and resources for health-promoting behaviors, such as healthful eating, not only for the individual employees, but also for their families.<sup>17</sup>

A number of studies have been conducted to assess the impact of workplace interventions on the dietary choices and psychosocial determinants of workers in different types of worksites. Changes to the workplace environment to provide low-cost, healthful vending machine choices and attractive, affordable, healthful options in on-site cafeterias have been successful in improving employees' food choice behaviors.<sup>18-21</sup> Modifications of company wellness policies, flexible schedules, and perceived management support for the health of their employees have also resulted in positive outcomes for employee health and well-being.<sup>22</sup> Educational approaches to increasing fruit and vegetable consumption have been evaluated using point-of-sale displays, signs, and informational brochures to inform employees about the importance of fruit and vegetable consumption.<sup>23</sup> Although these interventions overall have had some level of success, changes were primarily in the short term, and evidence for the effectiveness of worksite interventions was based on a small number of studies implemented primarily with middle- to upper-income employees.<sup>24</sup>

A review of the literature revealed a gap in studying both the effects of produce availability at the workplace, as well as worksite interventions targeting lower-wage earners. In an effort to effectively serve this population and contribute to the growing evidence base, the authors of the present study sought to determine the effect

of fresh fruit availability on fruit and vegetable consumption, fruit and vegetable purchasing, self-efficacy, job satisfaction, and perceived health of low-wage employees. The researchers hypothesized that fresh fruit availability would significantly increase fruit consumption, purchasing, and fruit-related self-efficacy and would not significantly improve vegetable consumption, vegetable purchasing, job satisfaction, and perceived health.

## METHODS

### Subjects and Recruitment

**Subjects.** Prior to engaging subjects in the study, the research protocol was accepted by the Public Health Institute's Institutional Review Board for Protection of Human Subjects. A convenience sample of 559 low-wage workers from 9 worksites in Los Angeles, CA participated in the study from June to September 2005. Based on previous research, the investigators conducted a power analysis to ensure the sample size achieved 80% power.

Worksites were recruited that had an existing relationship with Worksite Wellness Los Angeles, an organization that provides health and health care information to low-income workers in the central Los Angeles area. The worksites that were chosen for this study had not received diet-related information or incentives from Worksite Wellness Los Angeles previously, nor had they received health-related information, incentives, or worksite wellness programming during the study.

The participating worksites had between 50 and 300 workers who earned an average of \$7.75 per hour, or approximately \$15,500 per year, and the majority of workers did not receive employer-sponsored health benefits. The worksites were apparel manufacturers (7 worksites) or food processors (2 worksites), and a significant proportion of employees worked in large warehouses. Produce and other food items were processed at the food processor worksites, and employees were strictly forbidden from eating the food at any time. The characteristics of the study participants are shown in Table 1.

**Recruitment.** All employees in the intervention and control worksites were invited to participate in the study by

the English- and Spanish-speaking research team. The employees were recruited during morning breaks, at lunchtime, and during afternoon breaks. Recruitment occurred 1 week prior to the commencement of the intervention.

Because of fluctuating time schedules, absences, and new hires, employees were allowed to join the study at any of the 4 assessment periods during the 12-week intervention. The research team explained that they were interested in understanding employees' dietary habits and would be asking them to fill out a total of 4 questionnaires during the course of the study. Employees in both the control and intervention groups were not told that fruit deliveries were part of the evaluation. Employees who entered the study after the first time period were told how many weeks were left in the study and the subsequent number of questionnaires they would be asked to complete. The employees were told that their participation would be completely voluntary and would not affect their employment with the company in any way, and that their responses would be kept confidential.

Employees who participated in the study were offered opportunities to win incentive prizes. Employees who completed each questionnaire were entered into a lottery to win a \$25 or \$50 cash prize after each assessment period. At the final assessment, participants who completed more than 1 questionnaire were entered into a drawing to win a bicycle.

### Study Design

A pilot study took place during a 3-week period, 2 months prior to the implementation of the main study to test the readability and comprehension of the questionnaire, assess the time needed to complete the questionnaire, identify the most efficient and effective fruit delivery and distribution system, train the research team, and determine the best way to collect completed questionnaires. Two worksites located in Los Angeles, each with approximately 50 low-income, primarily Latino employees, received fruit deliveries 3 times per week for 3 weeks. The employees

**Table 1.** Demographic Characteristics of the Participants in the Low-Wage Worksites

	Intervention Worksites <sup>a</sup> (n = 391)		Control Worksites <sup>a</sup> (n = 137)	
	Females (n = 164)	Males (n = 135)	Females (n = 84)	Males (n = 46)
Age (y), mean (SD)	33.2 (8.8)	32.6 (8.3)	33.4 (8.9)	33.9 (10.1)
No. in household, mean (SD)	4.4 (1.7)	4.4 (1.8)	4.7 (1.8)	4.7 (1.9)
Race/ethnicity, n (%)				
Latino/Hispanic	162 (100)	123 (95.3)	80 (98.8)	44 (95.7)
Other <sup>b</sup>	0 (0)	6 (4.7)	1 (1.2)	2 (4.3)
Education level, n (%)				
< High school	131 (92.2)	103 (90.4)	63 (90.0)	39 (92.9)
High school graduate or GED	11 (7.8)	11 (9.6)	7 (10.0)	3 (7.1)
Annual household income, n (%)				
≤ \$10,000	50 (36.2)	18 (14.8)	21 (30.9)	6 (17.1)
\$10,001-\$15,000	44 (31.9)	32 (26.2)	20 (29.4)	10 (28.6)
\$15,001-\$20,000	14 (10.1)	24 (19.7)	7 (10.3)	6 (17.1)
\$20,001-\$25,000	20 (14.5)	33 (27.0)	15 (22.1)	6 (17.1)
\$25,001-\$35,000	7 (5.1)	11 (9.0)	3 (4.4)	4 (11.4)
≥ \$35,000	3 (2.2)	4 (3.3)	2 (2.9)	3 (8.6)

GED indicates General Equivalency Degree.

<sup>a</sup>The female and male sample sizes do not add up to the total sample size for the intervention and control worksites because not all participants identified whether they were male or female on the survey. Similarly, the percentages are based on the number of participants that responded to the other demographic questions rather than the total sample; <sup>b</sup>The “Other” races/ethnicities were evenly distributed between white/Caucasian, African American/black, and Asian/Pacific Islander.

participated in the pilot study only and were not part of the main study. Questionnaires were administered to employees immediately prior to and after the 3-week period. Nearly all participants reported they understood the questions, and the questionnaire took approximately 15 minutes to complete. The fruit delivery protocol and data collection noted in the main study were based upon the recommendations from the pilot study.

Using a randomized block experimental design with intervention and control groups, the main study was conducted over a 12-week period. The 9 participating worksites had a wide variation in the total number of employees and therefore were divided into 2 equally sized groups to ensure that an equal number of employees was exposed to the intervention and control conditions. The investigators randomly assigned these 2 groups to the intervention or control group. The intervention group included 6 worksites, and the control group included 3 worksites. Each group started with 250 to 300 employees.

Of the 559 employees who agreed to participate in the study, 31 were excluded from the final analysis because they completed the demographic sec-

tion of the questionnaire, but did not complete the questions that measured the outcome variables. Excluding these subjects, the intervention was completed with 391 participants and the control with 137 participants. Although invitations to be in the study were the same across all worksites, the percentage of control group employees who agreed to participate was much smaller than the percentage of employees in the intervention group.

### Instrumentation and Data

#### Collection

**Instrumentation.** An English- and Spanish-language questionnaire was constructed using valid and reliable measures drawn from other instruments, which assessed the outcome variables during a 30-day recall period.<sup>25-30</sup> A 30-day recall period was chosen because the participants were assessed at 1-month intervals beginning at baseline, week 4, week 8, and week 12. Self-reported fruit and vegetable consumption was measured using the National Cancer Institute's By-Meal Fruit and Vegetable Screener, a 27-item fruit and vegetable food frequency questionnaire that assessed both frequency and portion

size of intake over the past month.<sup>25,26</sup>

Although the intervention focused on fruit availability, vegetable consumption was measured to determine whether the intervention in some way influenced overall produce consumption. A family norms question, “Most people in my family think that eating fruits and vegetables each day is a good thing to do,” evaluated general support for fruit and vegetable consumption.<sup>27</sup> Two self-efficacy items were used to measure participants' confidence in their ability to consume the recommended amounts of fruits and vegetables each day.<sup>28</sup> The items were taken from the National 5-A-Day for Better Health grantee's common research questions.<sup>31</sup> The questions were “How sure are you that you can eat 2 servings of fruit each day?” and “How sure are you that you can eat 3 servings of vegetables each day?” They were rated on an ascending 5-point Likert scale, ranging from “very unsure” to “very sure.” Four items compared the quantity of fruits and vegetables that participants and their family members were eating and buying, compared to that of the prior month. Job satisfaction was measured

using 3 items, including workers' satisfaction with their jobs, supervisors/managers, and companies.<sup>29</sup>

Perceived health was measured using 2 modified and 3 unmodified items from a 36-item RAND Health Survey Questionnaire.<sup>30</sup> Perceived general health was measured with 2 questions, including "Over the past month, my health has been: poor, fair, good, very good, or excellent" and "Compared to 1 month ago, my health is: much worse, somewhat worse, about the same, somewhat better, or much better." Feelings of pep, energy, and tiredness in the past month were measured on an ascending 5-point Likert scale, from "not at all" to "a great amount."

Demographic questions were included to determine the participants' age, sex, race/ethnicity, and education level, as well as the number of people living in the household and annual household income. Workers were also asked to report any medical conditions that might alter their food consumption. The questionnaire contained brief instructions, the anticipated time necessary to complete the questionnaire, and 2 sample questions to acquaint the participants with how to review each question and consider the response that best reflects their answer.

**Data Collection.** Employees who expressed interest in participating in the study were asked by the research team to read and sign a consent form, and then complete the baseline questionnaire. The research team was available to answer questions about these documents when the participants needed clarification. The participants submitted their signed consent forms and completed questionnaires to the research team.

After 4 weeks of the intervention, the research team administered the second of 4 questionnaires to both the intervention and control worksites. The remaining 2 questionnaires were administered 4 weeks apart thereafter. Each questionnaire, coded to ensure confidentiality, was administered to the participants during regularly scheduled work breaks. The final assessment was administered within 1 week after the intervention was completed.

## Intervention and Control

### Worksites

**Intervention worksites.** The intervention worksites, all of which were apparel manufacturers, received United Parcel Service deliveries of fresh fruit 3 days a week for 12 consecutive weeks. Fruit was provided by The Fruit-Guys, a San Francisco-based company that delivers fruit to businesses nationwide. The fruit cost \$0.67/serving or \$2.01/wk per employee. Fruit was typically delivered by 10:00 AM on Monday, Wednesday, and Friday. Several deliveries were scheduled to occur on holidays, and on such occasions, delivery of fruit was shifted to an alternate day so the worksites still received 3 deliveries of fruit per week. Each delivery contained enough fruit for each employee to receive 1 serving.

The boxes of fruit were placed in a convenient and accessible location within each worksite by selected supervisors/managers. Each supervisor/manager ensured all employees had an equal chance of getting fruit by asking them to take no more than 1 piece of fruit and ensuring all employees had access to the fruit during scheduled breaks. Approximately 1 week after the first fruit delivery, the research team visited each worksite to make sure the fruit had been delivered as scheduled and that the fruit was being given to the employees as planned. At each subsequent assessment, the research team checked with employees to confirm they had access to the fruit. Throughout the course of the study, there was 1 instance when a box of fruit was not delivered as a result of changes in management at the worksite.

**Control worksites.** The control worksites, which included food processors and apparel manufacturers, did not receive fruit deliveries during the intervention period, but they followed the same assessment schedule as the intervention worksites. As an incentive to the businesses, approximately 1 week after the study was completed, fruit deliveries began at the control worksites. The deliveries continued 3 times per week for a 12-week period.

### Data Analysis

The data were transformed to improve normality prior to data analysis.

Descriptive statistics were used to analyze the demographic data with SPSS (version 12.0, SPSS Inc, Chicago, IL, 2003). To test whether the intervention had an effect on fruit and vegetable consumption, purchasing, and other study variables, and to account for the fact that study participants were allowed to enter the study at any of the 4 assessment periods, the researchers employed Growth Curve Analysis (GCA) using the Hierarchical Linear Modeling statistical program (version 5.05, Scientific Software International, Lincolnwood, IL, 2000).

Hierarchical Linear Modeling is a statistical analysis software that is able to account for missing data using a weighted estimate based on the individuals' own data, as well as the group-level data. When the individual's own data are more reliable (ie, they provide more questionnaires across time), their own slope estimates are more heavily weighted in replacing the missing data. Similarly, when the participant's data are less reliable, the average of the group at that specific time point is weighted more heavily in the final estimate of the missing data. There were many reasons for missing data, including employees skipping specific questions, new hires joining the study after its commencement, and absence of employees on the days that the questionnaires were distributed. Of the 528 employees who provided usable data for the study, 175 completed the baseline questionnaire, 221 completed the questionnaire at week 4, 251 completed the questionnaire at week 8, and 328 completed the questionnaire after week 12.

The GCA analysis was done in 2 stages. First, growth curves, or changes over time, were estimated for each study participant using data collected over multiple time points. This analysis accounted for baseline differences in individuals in the control and intervention groups. Parameters that summarized this change were saved as an individual-level variable. At the second stage, the parameters that estimated change for each study participant were used as dependent measures. A level 2 (intervention) dataset was constructed that included variables for exposure to the intervention (yes/no) and time (weeks 4, 8, and 12). Growth Curve Analysis with

Hierarchical Linear Modeling uses both the individual and intervention data sets together. With this approach, the researchers were able to determine whether individual deviations from average parameters were associated with between-subjects variables (individual characteristics) or by exposure to the intervention. For all analyses, a statistical significance level of  $P < .05$  was selected.

In viewing the GCA findings, the intercept coefficients and the  $P$  values indicated whether there was a significant difference between the control and intervention groups at the time of the baseline assessment on each measured variable. A positive coefficient ( $P < .05$ ) indicated that the initial value in the intervention group was significantly higher on the measured variable as compared to the control group. A negative coefficient ( $P < .05$ ) indicated that the initial value in the control group was significantly higher on the measured variable as compared to the intervention group during the baseline assessment.

In contrast, the slope coefficients and the  $P$  values indicate whether there was a significant change over the 4 assessments between the control and intervention groups on each measured variable. A positive coefficient ( $P < .05$ ) indicated that the change in the intervention group was significantly higher on the measured variable as compared to the control group throughout the study. A negative coefficient ( $P < .05$ ) indicated that the change in the control group was significantly higher on the mea-

sured variable as compared to the intervention group throughout the study. Significant slope coefficients essentially tell the researcher whether the intervention was effective or not. Variance components and goodness of fit are displayed in each table.

## RESULTS

### Sample Characteristics

The participants in the intervention and control worksites were not statistically different in terms of age, race/ethnicity, education level, number of people living in the household, and annual household income (Table 1). The sample overwhelmingly identified themselves as Latino/Hispanic (97%), and the average age of the participants was 33 years. The vast majority of the participants (91%) had not completed high school and had an annual household income of less than \$25,000 (88%). In 2005, the 185% Federal Poverty Guidelines household income limit—to qualify for federal nutrition assistance programs such as the Special Supplemental Nutrition Program for Women, Infants, and Children and reduced-price school meals—was \$28,990 for a household of 3.<sup>32,33</sup> At that time, Hispanic Californians had an average household size of 3.8.<sup>34</sup>

*Fruit and vegetable consumption.* As shown by the intercept coefficients and  $P$  values in Table 2, compared to the intervention worksites, the control worksites had significantly higher

vegetable and total fruit and vegetable consumption at the baseline assessment.

More importantly, there were statistically significant effects on fruit and vegetable consumption throughout the course of the study, as shown by the slope coefficients and  $P$  values in Table 2. Participants in the intervention worksites showed a significant increase in fruit, vegetable, and total fruit and vegetable consumption as a result of the intervention, compared to the control worksites, which did not show an increase.

*Fruit and vegetable purchasing.* As shown by the intercept coefficients and  $P$  values in Table 3, there were no statistically significant differences between the intervention and control worksites in their initial levels of self and family purchasing of fruits or vegetables.

Most notably, as shown by the slope coefficients and  $P$  values in Table 3, there were statistically significant increases in self-purchasing of fruit and family purchasing of vegetables in the intervention worksites, compared to the control worksites. There were no statistically significant changes in self-purchasing of vegetables and family purchasing of fruit in the intervention and control worksites.

*Self-efficacy, job satisfaction, and perceived health.* As shown by the intercept coefficients and  $P$  values in Table 4, compared to the intervention

**Table 2.** The Effect of the Intervention on Fruit and Vegetable Consumption of Low-Wage Employees

	Fruit Consumption			Vegetable Consumption			Total Fruit and Vegetable Consumption		
	Coeff.	$P$ value	SE	Coeff.	$P$ value	SE	Coeff.	$P$ value	SE
Intercepts	-0.21	NS	0.12	-0.51	< .01	0.09	-0.34	.01	0.13
Slopes	0.09	.02	0.04	0.09	< .01	0.03	0.13	< .01	0.04
df	518			513			508		
Variance components									
Intercepts	0.19			0.10			0.25		
Slopes	0.02			0.01			0.02		
Chi-square									
Intercepts	360.45	< .01		364.32	< .01		377.17	< .01	
Slopes	335.42	< .01		336.24	< .01		352.94	< .01	
df (chi-square)	263			261			258		

Coeff indicates coefficient; df, degrees of freedom; NS, not significant.

**Table 3.** The Effect of the Intervention on Self- and Family-Purchasing of Fruits and Vegetables

	Self-Purchasing Fruit			Self-Purchasing Vegetables			Family-Purchasing Fruit			Family-Purchasing Vegetables		
	Coeff.	P value	SE	Coeff.	P value	SE	Coeff.	P value	SE	Coeff.	P value	SE
Intercepts	-0.32	NS	0.17	-0.29	NS	0.16	-0.09	NS	0.16	-0.2	NS	0.17
Slopes	0.16	< .01	0.05	0.08	NS	0.05	0.08	NS	0.05	0.14	< .01	0.05
df	512			495			519			522		
Variance components												
Intercepts	0.31			0.14			0.42			0.27		
Slopes	0.01			0.00			0.03			0.01		
Chi-square												
Intercepts	319.19	0.02		263.21	NS		291.35	0.09		291.19	0.07	
Slopes	296.35	NS		256.41	NS		255.67	NS		258.91	NS	
df (chi-square)	266			237			259			257		

Coeff indicates coefficient; df, degrees of freedom; NS, not significant.

worksites, the control worksites had significantly higher self-efficacy toward eating 2 servings of fruit each day at the baseline assessment. There were no statistically significant intercept differences between the intervention and control worksites on the remaining measures.

As shown by the slope coefficients and *P* values in Table 4, there was a statistically significant increase in self-efficacy toward eating 2 servings of fruit each day among the intervention worksites, compared to the control worksites throughout the course of the study. This finding demonstrates the positive impact that the intervention had on fruit consumption-related self-efficacy. However, there were no significant differences over

time in self-efficacy toward eating 3 servings of vegetables each day, job satisfaction, and perceived health in the intervention and control worksites.

## DISCUSSION

The results of this study demonstrate that improving access to fruit during the work day has a positive effect on fruit and vegetable consumption, fruit purchasing habits, family vegetable purchasing habits, and self-efficacy for fruit consumption among low-income workers. Although no studies of an analogous nature are known to have been conducted among adult populations, there are a number of

similar studies in children that, along with the results of this study, provide evidence for the effectiveness of environmental interventions on dietary behavior.<sup>35-37</sup>

Workers in the intervention condition had significant increases in fruit consumption and vegetable consumption, as well as total fruit and vegetable consumption, whereas those in the control condition did not increase. Availability and accessibility of fruits and vegetables is cited as an important determinant of fruit and vegetable consumption among children and adolescents. Schoolchildren with high availability and accessibility to fruits and vegetables at school have a higher fruit and vegetable intake than those with less availability/accessibility.<sup>35-37</sup>

**Table 4.** The Effect of the Intervention on Self-Efficacy, Job Satisfaction, and Perceived Health

	Self-Efficacy toward Eating 2 Servings of Fruit Each Day			Self-Efficacy toward Eating 3 Servings of Vegetables Each Day			Job Satisfaction			Perceived Health		
	Coeff.	P value	SE	Coeff.	P value	SE	Coeff.	P value	SE	Coeff.	P value	SE
Intercepts	-0.52	0.04	0.27	-0.25	NS	0.25	0.32	NS	0.20	0.09	NS	0.17
Slopes	0.18	0.03	0.09	0.11	NS	0.08	0.05	NS	0.06	0.04	NS	0.05
df	524			502			524			528		
Variance components												
Intercepts	1.18			0.87			0.66			0.34		
Slopes	0.09			0.06			0.00			0.01		
Chi-square												
Intercepts	387.83	< .01		317.87	< .01		408.15	< .01		369.70	< .01	
Slopes	356.04	< .01		293.07	< .01		264.06	NS		306.10	< .05	
df (chi-square)	264			237			262			265		

Coeff indicates coefficient; df, degrees of freedom; NS, not significant.

Presuming that consumption patterns of working adults would mimic those of schoolchildren provided with free fruit, the authors can attribute the significant increase of fruit consumption to the heightened availability/accessibility of fruit at the worksites.<sup>38</sup> Workers in the intervention condition also reported a significant increase in vegetable consumption despite the fact that vegetables were not offered at the worksites, so there may be more than availability affecting consumption.

Self-efficacy is considered to be a major motivator of action and mediator of behavior change.<sup>39</sup> There was a statistically significant increase among those in the intervention group in their confidence to eat 2 servings of fruit daily, as compared to the control worksites. The fruit deliveries increased workers' exposure to fresh, tasty, and visually attractive fruit that they may have been previously hesitant to purchase and try on their own. However, with continued exposure to high quality fruit, they likely began to purchase more fruit outside of the workplace.

Other studies have found a concurrent relationship between increased fruit and vegetable consumption and increased self-efficacy for eating fruits and vegetables following an intervention. Resnicow and colleagues observed an increase in both self-efficacy for eating fruits and vegetables, as well as an increase in fruit and vegetable consumption, in a collaborative study that combined environmental and individual intervention activities in 15 church sites serving primarily African American congregations.<sup>40</sup> Low-income women from 15 sites participating in the 5-A-Day Promotion Program of the Maryland Special Supplemental Nutrition Program for Women, Infants, and Children also reported a positive change in self-efficacy concurrent with an increase in fruit and vegetable consumption post-intervention.<sup>41</sup> However, although no known research has been conducted among adults specific to only fruit consumption and self-efficacy, Thompson et al report that fruit self-efficacy is significantly related to fruit consumption among fifth-grade students.<sup>42</sup> Participants reported higher self-efficacy for fruit than vegetables.

This finding is consistent with the domain specificity of self-efficacy. Continued, positive exposure to fruit will increase a person's confidence in his/her ability to consume fruit; however, feeling self-efficacious about consuming fruit will not directly translate into feeling the same way about vegetables.<sup>43</sup>

The change in fruit and vegetable purchasing offers valuable insight into the effect the intervention had on both the participants and their families. Family purchasing of fruit showed no significant change over the course of the intervention, but self-purchasing of fruit demonstrated significant gains. Workers also reported a significant increase in family vegetable purchasing. This finding may help to explain why vegetable consumption among the participants increased significantly, even though their personal purchasing did not.

There were no significant findings in terms of job satisfaction or perceived health among either the intervention or control groups. Baseline and follow-up job satisfaction in both groups was relatively high. Likewise, employees' perceived health remained good throughout the 3-month intervention period.

### Limitations to the Study

Despite the information gained, there are limitations to this study. First, fruit and vegetable consumption and purchasing behaviors were measured by self-report and subject to possible comprehension, memory, and reporting errors. The dietary intake methods employed, however, have been shown to be reliable and valid.<sup>25,26</sup> Second, there was a self-selection bias involved among those individuals who completed the consumption reports, and it is impossible to know whether these results are applicable to those who did not respond. The investigators have limited information on potential selection bias from the 31 employees who completed at least the demographic section of the survey but did not complete the fruit and vegetable consumption measures. These employees did not differ in the mix of race/ethnicity, age, job classification, or sex as compared to the sample that responded. However, it must

be acknowledged that employees who did not complete the fruit and vegetable consumption measures also provided incomplete responses on the demographic questions; thus the fact that there are no differences between these 2 groups is not strong evidence against a selection bias.

Third, the response rate in the control worksites was low, and although this finding does not invalidate the results, it does weaken the ability to generalize the findings. Fourth, it is possible that participants may have connected the survey with the delivery of fruit and upwardly biased their reports in follow-up surveys because of social desirability. Although the investigators consider this a possibility with fruit consumption and related factors, it is even more unlikely that participants would have upwardly biased their reports of vegetable consumption and related factors because of the fruit deliveries. Fifth, it is possible that existing employees may have shared with new employees that the company offered free fruit. These new employees may have then enrolled in the study during future assessment periods. Finally, the study population may not be entirely representative of the population of low-income Californians, because of its significant skew toward the Latino population.

### IMPLICATIONS FOR RESEARCH AND PRACTICE

The results of this study demonstrate that fresh fruit deliveries to worksites are a way to significantly improve the fruit and vegetable consumption of low-wage workers and deliver commensurate chronic disease risk reduction benefits. As business owners and worksite wellness professionals consider health promotion benefits for employees, the findings of this study may help inform future decisions about the role a fruit snack program could play as part of a comprehensive worksite wellness approach.

Despite the positive results of this study, additional research is needed. Future studies in this area should mitigate for the limitations presented in this study as much as possible and include longer term follow-up

assessments to determine how fruit and vegetable consumption is influenced beyond the intervention, especially when free fruit snacks are no longer provided. A more in-depth understanding of the linkage between fresh fruit snacks at the workplace and vegetable consumption, produce purchasing, family behaviors, perceived health, and job satisfaction is warranted. It would also be informative to understand the role of vegetable snacks and a combination of fruit and vegetable snacks on fruit and vegetable consumption and relevant determinants among low-wage and non-low-wage workers.

### STATEMENT OF POTENTIAL CONFLICT OF INTEREST

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