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Cooking and Gardening Behaviors and Improvements in Dietary Intake in Hispanic/Latino Youth

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Abstract

Background: School gardening interventions typically include cooking and gardening (CG) components; however, few studies have examined associations between CG psychosocial behaviors (attitudes, self-efficacy, and motivation), dietary intake, and obesity parameters. This study assessed the association between changes in CG behaviors with changes in dietary intake and obesity in participants of the LA Sprouts study, an after-school, 12-week, randomized controlled CG intervention conducted in four inner-city elementary schools in Los Angeles.

Methods: Process analysis using data from 290 low-income, primarily Hispanic/Latino third through fifth-grade students who were randomized to either the LA Sprouts intervention ($n = 160$) or control group ($n = 130$). Height, weight, waist circumference, dietary intake via questionnaire, and CG behaviors were collected at baseline and postintervention. Linear regressions determined whether changes in CG behaviors predicted changes in dietary intake and obesity outcomes.

Results: There were no differences in changes in CG psychosocial behaviors between intervention and control groups, therefore groups were combined. Participants were 49% male, 87% Hispanic/Latino, and an average age of nine. Increases in cooking behaviors significantly predicted increases in dietary fiber intake ($p = 0.004$) and increases in vegetable intake ($p = 0.03$). Increases in gardening behaviors significantly predicted increased intake of dietary fiber ($p = 0.02$). Changes in CG behaviors were not associated with changes in BMI z-score or waist circumference.

Conclusions: Results from this study suggest that school-based interventions should incorporate CG components, despite their potentially costly and time-intensive nature, as these behaviors may be responsible for improvements in dietary intake of high-risk minority youth.

Keywords: childhood obesity; cooking and gardening; cooking behaviors; dietary intake; fruit and vegetable intake; fiber intake; school-based intervention

Introduction

Childhood obesity continues to be a major problem in the United States with 17.5% of children between the ages of 6 and 11 years characterized as obese in 2011–2014.[1] Hispanic/Latino youth are affected by obesity and obesity-related diseases at a disproportionately higher rate than non-Hispanic whites, with 25.0% of Hispanic children (6–11 years) being obese compared with 13.6% of non-Hispanic white children of the same age.[1] Children who are obese are more likely than their normal weight counterparts to exhibit cardiovascular disease risk factors such as high blood pressure, increased triglycerides, type 2 diabetes (T2D), and nonalcoholic fatty liver disease.[2–4] Lower socioeconomic status is also associated with higher rates of obesity in youth in the United States.[5] It is crucial to decrease obesity and metabolic disease risk especially in low-income, minority populations.

Increasing fruit and vegetable (FV) intake may be an effective method to prevent obesity.[6–9] FV consumption is associated with reduced risk of T2D, and vegetable consumption is linked to decreased visceral fat, liver fat, and insulin resistance in Hispanic/Latino youth.[10] Dietary fiber intake is inversely associated with waist circumference,

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visceral adiposity, T2D risk factors, inflammation, and the metabolic syndrome.[11–14] Children in the United States do not meet the recommended intake for FV or dietary fiber, and intake is lower in low-income and Hispanic/Latino populations often due to limited access to affordable and fresh FV.[15–17] Interventions that provide access to fresh FV and target increasing FV and dietary fiber intake to reduce risk of obesity and metabolic disease are warranted, especially in low-income, Hispanic populations.

Increased exposure to a food is associated with increased preference for that food, and food preferences are formed during childhood.[18,19] Thus, it is important to expose children to nutritious choices such as FV and other high-fiber foods early on. Children's preference for FV has been shown to predict FV consumption, so exposure to FV, specifically early in life, may lead to increased FV preference and consumption in childhood and into adulthood.[19–21] Psychosocial variables such as self-efficacy, attitudes, and knowledge of FV have been identified as key contributors in determining dietary behaviors in children.[19,22]

School cooking and gardening (CG) programs are becoming popular tools to teach children about nutrition and improve dietary intake, however, the CG components and strategies in these programs as well as their duration vary widely.[23,24] Consistently, cooking and/or gardening interventions are effective at increasing FV preference and intake, and some even show reductions in obesity measures such as BMI and waist circumference.[25–38] The majority of CG programs use a hands-on approach and involve children in the planting and growing of FV, as well as the tasting and/or preparation of the produce. Evidence suggests that CG programs that expose children to FV improve FV preference and dietary intake,[25–38] but it is important to determine which component(s) of these programs are most likely to yield a positive impact.

The present study examined data from the 12-week CG randomized controlled intervention, LA Sprouts,[39] which demonstrated significant increases in dietary fiber and vegetable intakes as well as significant decreases in BMI and waist circumference in the intervention group compared with controls in low-income, primarily Hispanic/Latino third through fifth grade students.[29] The goal of the present study was to examine whether changes in CG psychosocial variables (attitudes, self-efficacy, and motivation) were associated with the changes in dietary fiber and vegetable intakes, BMI, and/or waist circumference changes that were observed in the LA Sprouts intervention group.

Subjects and Methods

Subjects

The original LA Sprouts study involved 375 third through fifth grade students from four different schools in the Los Angeles Unified School District (LAUSD) who were all enrolled in the LAs Better Educated Students for Tomorrow (LAs BEST) afterschool program. The four schools were randomly assigned to either the intervention or control (delayed intervention). Schools were eligible for the study if they met the following criteria: (1) participation in LAs BEST, (2) at least 75% Hispanic/Latino, (3) 75% were eligible for free or reduced meals on the National School Lunch program, (4) located within 10 miles of the University of Southern California Health Science Campus, (5) approval from LAUSD, and (6) expression of interest in being involved in the study. The main outcomes of the LA Sprouts intervention have been previously reported.[29,40] Analyses discussed here are based on 290 children ($n = 160$, LA Sprouts; $n = 130$, controls) who had complete data. A flow of participants through this study and analysis is outlined in Figure 1. The study was approved by the Institutional Review Boards of The University of Texas at Austin and the University of Southern California. The trial is registered at ClinicalTrials.gov (NCT02291146).

Description of the LA Sprouts Intervention

In 2012–2014, the LA Sprouts intervention took place afterschool on each school campus. Raised-bed gardens were built at each school, and classes were taught in designated teaching spaces near the gardens. The 12 classes were 90 minutes in length and taught once per week to each grade during either the fall or spring semester. Each class consisted of 45 minutes of cooking and nutrition curriculum in addition to 45 minutes of gardening curriculum. Educators with nutrition and/or gardening experience were hired for this intervention to teach the lessons. Students worked in small groups to prepare a recipe that featured fruit and/or vegetables as ingredients. Students would then eat that prepared dish together. Children also actively participated in gardening activities and were included in planting, growing, and harvesting FV. The average class size was 20 students. Participants learned about various aspects of healthy eating and gardening, such as the importance of dietary fiber, the benefits of eating fruits and vegetables, planning and planting a garden, and composting. More detailed information on the methodology, curriculum, and protocol is published elsewhere.[39,40]

Measures

Measures were collected by study research staff who were trained by key investigators. Obesity and anthropometric data were measured and questionnaires were collected pre- and postintervention (within 7–14 days of instruction beginning or ending). The following anthropometric measures were collected: height via stadiometer (Seca, Birmingham, United Kingdom), weight and percent body fat via bioelectrical impedance (Tanita TBF 300A, Arlington Heights, IL), and waist circumference via tape measure using NHANES protocol.[41] The Centers for Disease Control cutoffs were used to calculate BMI z-scores and percentiles.[42] Dietary intake was assessed using the 41-item Block Kids Food Screener for Ages 2–17, 2007, which is designed to gather information on foods eaten

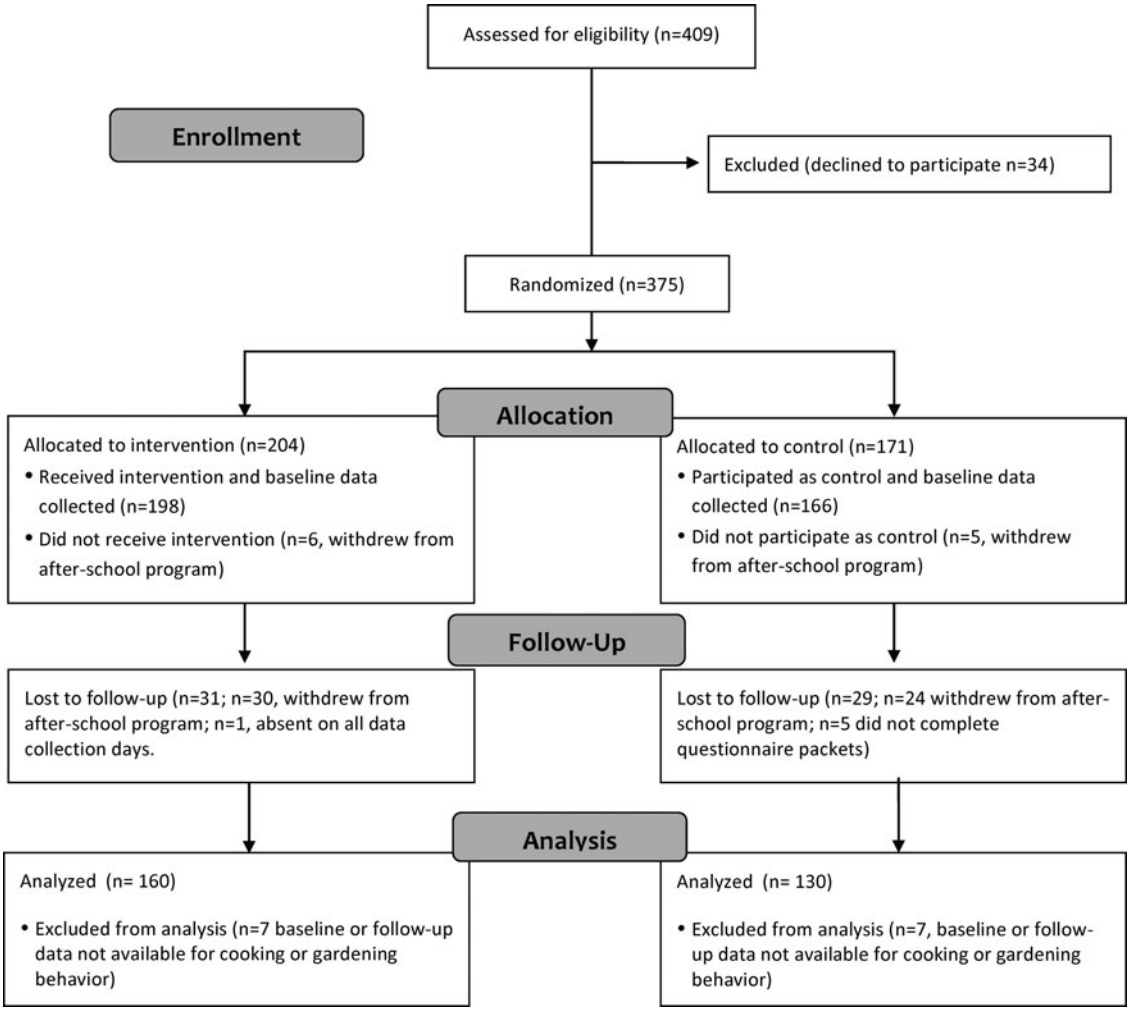

Figure 1. Flow of participants through LA Sprouts, including participants included in enrollment, baseline, and follow-up testing and analysis.

''yesterday'' and measures intake by food group.[43] The dietary fiber variable included grams of dietary fiber coming from fruit, vegetables, and grains. Changes in BMI z-score, waist circumference, and dietary fiber and vegetable intakes that were observed between control and intervention participants are published elsewhere.[29]

Self-efficacy to cook fruits and vegetables was assessed using an adapted questionnaire from Baranowski et al.,[44] and CG attitudes were assessed using a scale developed by the researchers.[39] An adapted version of the Motivation for Health Behaving from the Treatment and Self-Regulation Questionnaire was used to assess motivation to cook and garden FV.[45,46] Researchers also grouped psychosocial variables to create a total cooking behaviors and a total gardening behaviors variable by summing responses from attitudes, self-efficacy, and motivation scales. Table 1 provides a complete list of the CG attitudes, self-efficacy, and motivation psychosocial questions from the questionnaires that were used in this analysis.

All child questionnaire scales were tested for internal consistency and intrarater reliability using data from focus groups with 19 Hispanic/Latino third through fifth grade students who were not part of LA Sprouts. Intrarater reliability was tested using a test–retest method, in which focus group participants completed the questionnaires at two time points with 7 days in between each test, and was calculated with bivariate correlations that used averaged scale values of each participant. Internal consistency for each construct was calculated by Cronbach's alpha using baseline data from participants in the focus group. Both intrarater reliability and internal consistency were satisfactory (alpha >0.7). These data have been previously published.[39]

Statistics

Normality of all independent variables (attitudes, self-efficacy, and motivation to cook and garden) was assessed using histograms and box plots, and all variables included in the analysis were distributed normally. Change scores were calculated using postintervention minus preintervention values of all variables. Multiple linear regression models were run to assess differences in changes in CG

Table 1. LA Sprouts Cooking and Gardening Psychosocial Behavior Items on Questionnaire

Cooking psychosocial behaviors	Questionnaire items	Response categories
Attitudes	• Cooking is fun. • Cooking is easy. • I like to cook.	1: I disagree very much 2: I disagree a little 3: I agree a little 4: I agree very much
Self-efficacy "I think I can…"	• Help cook a dish with vegetables. • Help cook a dish with fruits. • Read a recipe. • Can use a sharp knife to chop FV	1: I disagree very much 2: I disagree a little 3: I agree a little 4: I agree very much
Motivation "The reason I would cook regularly is because…"	• It is something we can do together as a family. • I believe it is a good thing for my health. • I have carefully thought about it and believe it is important for me. • My friends do this. • It is an important choice I want to make. • I want to set a good example for family and friends. • I am concerned about my family's health.	1: Very untrue 2: A little untrue 3: A little true 4: Very true
Gardening psychosocial behaviors	**Questionnaire items**	**Response categories**
Attitudes	• Growing FV is fun • Growing FV is easy. • I like to garden.	1: I disagree very much 2: I disagree a little 3: I agree a little 4: I agree very much
Self-Efficacy "I think I can…"	• Grow FV at my house • Grow FV at a community garden	1: I disagree very much 2: I disagree a little 3: I agree a little 4: I agree very much
Motivation "The reason I would garden regularly is because…"	• It is something we can do together as a family. • I believe it is a good thing for my health. • I have carefully thought about it and believe it is important for me. • My friends do this. • It was an important choice I want to make. • I want to set a good example for my family and friends. • I am concerned about my family's health. • To make the world beautiful with plants and flowers. • It is fun to grow things.	1: Very untrue 2: A little untrue 3: A little true 4: Very true

FV, fruits and vegetables.

behaviors between treatment and control groups. Models were adjusted for covariates identified *a priori*, including age, sex, ethnicity, and baseline values, for the dependent variable of interest. There were no significant differences between control and intervention groups, and therefore, a mediation analysis was not appropriate and groups were combined for further analysis. Linear regressions were run to assess how changes in CG behaviors (independent variables) predict changes in dietary fiber, vegetable intake, waist circumference, and BMI z-score (dependent variables). Regression models were adjusted for covariates identified *a priori*, including treatment group, age, sex, ethnicity,

changes in energy intake (for dietary variables), and baseline values for the independent variable of interest (cooking or gardening behavior) and baseline values for the dependent variable of interest (fiber, vegetables, waist circumference, and BMI z-score). All data were analyzed using SPSS Statistics for Macintosh, Version 24.0 (IBM Corp, Armonk, NY), and an alpha level of $p = 0.05$ was used for significance.

Results

Baseline demographic information, dietary intake, obesity measures, and CG variables are presented in Table 2. Study participants were 49% male and 87% Hispanic/Latino with an average age of 9.3 years. Fifty-one percent of the participants were either overweight or obese, and 91% received free or reduced lunch through the National School Lunch Program. Average energy, vegetable, and dietary fiber intakes were 1371 kcal/day, 0.96 cup/day, and 13.7 g/day, respectively. There were no significant differences between students randomized to the intervention or control in baseline demographic information, dietary intake, obesity measures at baseline. Baseline and post-intervention scale scores for psychosocial variables are provided in Table 3. Possible ranges of responses are provided in the footnotes of the table. Increases in cooking behaviors significantly predicted increases in dietary fiber intake ($p = 0.004$) and increases in vegetable intake ($p = 0.03$) (Table 4). Increases in gardening behaviors significantly predicted increased dietary fiber intake ($p = 0.02$) Changes in CG behaviors were not associated with changes in BMI z-score or waist circumference.

Discussion

This process analysis sought to determine whether changes in CG behaviors predicted improvements in the dietary fiber and vegetable intake and reductions in adiposity measures observed in LA Sprouts intervention and control participants. Independent of intervention effects, increased cooking attitudes, self-efficacy, and motivation were associated with increases in dietary fiber intake and vegetable intake in low-income primarily Hispanic/Latino

Table 2. Baseline Characteristics of LA Sprouts Control and Intervention Participants

Characteristics[a]	Control ($n = 130$)	Intervention ($n = 160$)	p[b]
Demographics			
Male	67 (51.5)	75 (46.9)	0.43
Hispanic/Latino	112 (88.2)	141 (88.1)	0.99
Eligible for free or reduced meals in NSLP	117 (90)	147 (91.9)	0.58
Age, years	9.2 ± 0.9	9.2 ± 0.9	0.94
Anthropometrics			
Height, cm	135.0 ± 8.5	134.8 ± 8.6	0.82
Weight, kg	38.3 ± 12.6	35.9 ± 10.2	0.09
BMI, kg/m^2	20.7 ± 4.7	19.6 ± 4.1	0.05
BMI z-score	1.1 ± 1.1	0.9 ± 1.0	0.08
Waist circumference, cm	72.5 ± 13.1	69.8 ± 11.0	0.07
Overweight or obese, ≥85th percentile	71 (56.3)	77 (50.3)	0.32
Obese, ≥95th percentile	52 (41.3)	52 (34.0)	0.21
Dietary intake			
Energy, kcal/day	1395 ± 1227	1347 ± 1092	0.73
Protein, g/day	66.8 ± 74.9	61.7 ± 62.8	0.53
Fat, g/day	65.5 ± 73.6	60.6 ± 63.9	0.55
Carbohydrates, g/day	180.4 ± 173.0	170.8 ± 145.0	0.61
Dietary fiber, g/day	14.5 ± 15.0	12.8 ± 10.5	0.25
Vegetables, cups/day	1.0 ± 1.1	0.9 ± 0.9	0.37

[a]Data are mean ± SD or *n* (%).

[b]*p* was calculated using *t*-tests for continuous variables and chi-square (χ^2) tests for categorical variables.

NSLP, National School Lunch Program; SD, standard deviation.

Table 3. Baseline and Postintervention Cooking and Gardening Behaviors of LA Sprouts Intervention Versus Control Participants

Cooking/gardening variables	Control			Intervention			Change p[b]
	Baseline[a]	Postintervention[a]	Change[a]	Baseline[a]	Postintervention[a]	Change[a]	
Cooking							
Attitudes[c]	10.1 ± 2.2	10.1 ± 2.2	0.0 ± 2.3	10.2 ± 2.2	10.2 ± 2.6	0.07 ± 2.5	0.96
Self-Efficacy[d]	12.9 ± 2.9	13.0 ± 3.0	0.09 ± 3.6	12.5 ± 3.2	12.97 ± 2.9	0.46 ± 3.3	0.30
Motivation[e]	22.1 ± 5.4	20.5 ± 5.6	−1.6 ± 6.3	22.2 ± 5.1	21.5 ± 5.3	−0.05 ± 6.6	0.37
Total Cooking Behaviors[f]	45.2 ± 8.9	43.6 ± 9.0	−1.6 ± 9.5	44.8 ± 8.1	44.8 ± 8.8	0.05 ± 9.6	0.83
Gardening							
Attitudes[c]	9.9 ± 2.4	9.7 ± 2.4	−0.14 ± 2.4	10.3 ± 2.2	10.2 ± 2.5	−0.1 ± 2.8	0.10
Self-efficacy[g]	6.5 ± 1.7	6.6 ± 1.7	0.2 ± 1.90	6.3 ± 1.8	6.6 ± 1.7	0.30 ± 2.0	0.40
Motivation[h]	27.8 ± 6.5	25.5 ± 6.8	−2.3 ± 7.8	28.0 ± 6.5	26.7 ± 7.0	−1.4 ± 8.2	0.31
Total gardening behaviors[f]	44.2 ± 9.0	41.9 ± 9.4	−2.3 ± 9.4	44.6 ± 8.8	43.5 ± 9.3	−1.1 ± 10.3	0.36

[a]Data are mean ± SD.

[b]p-Value reflects linear regression model adjusted for age, sex, ethnicity, and baseline values for the dependent variable of interest.

[c]Range of responses (3–12).

[d]Range of responses (4–16).

[e]Range of responses (7–28).

[f]Range of responses (14–56).

[g]Range of responses (2–8).

[h]Range of responses (9–36).

Table 4. Linear Regression of Changes in Cooking and Gardening Behaviors Predicting Changes in Dietary Fiber, Vegetable Intake, Waist Circumference, and BMI z-Score

	Unstandardized β	Standard error	Standardized β	95% Confidence intervals	p
Cooking behaviors					
Dietary fiber, g/day[a]	0.092	0.032	0.081	0.030–0.154	0.004**
Vegetables, CE[a]	0.009	0.004	0.091	0.001–0.017	0.03*
Waist circumference, cm[b]	−0.012	0.023	−0.036	−0.058 to 0.034	0.603
BMI z-score[b]	−0.001	0.001	−0.029	−0.004 to 0.002	0.684
Gardening behaviors					
Dietary fiber, g/day[a]	0.073	0.032	0.068	0.010–0.137	0.024*
Vegetables, CE[a]	0.008	0.004	0.082	0.000–0.016	0.062
Waist circumference, cm[b]	−0.042	0.023	−0.0132	−0.087 to 0.002	0.061
BMI z-score[b]	−0.002	0.001	−0.088	−0.005 to 0.001	0.219

[a]Adjusted for age (continuous), sex, ethnicity (Hispanic/non-Hispanic), group (control/intervention), baseline-dependent variable (fiber, vegetables waist circumference, BMI z-score), baseline-independent variable (cooking or gardening behavior), and energy (kcal).

[b]Not adjusted for energy (kcal).

*$p < 0.05$, **$p < 0.01$.

CE, cup equivalents.

youth. Similarly, gardening attitudes, self-efficacy, and motivation were associated with increased intake of dietary fiber.

This is the first study to examine how changes in CG attitudes, self-efficacy, and motivation psychosocial behaviors relate to changes in dietary intake and health outcomes in Hispanic/Latino youth. Although most cooking or garden-based interventions are multifaceted with varying degrees of cooking, gardening, and nutrition components,[25–38] it is unclear which aspect of these interventions were most closely associated with positive outcomes on intervention participants.

The cooking component of an interventions can be costly and labor-intensive, so it is often the first to be eliminated from a program once it is scaled up from a pilot study or implemented by teachers in school.[27] Interventions may implement cooking demonstrations or taste tests rather than hands-on cooking instruction due to these barriers.[27,47]

Children enjoy learning actively by participating in gardening activities and by direct involvement in food preparation, which has been shown to result in greater improvements in cooking attitudes and behaviors.[47,48] Children who have greater improved attitudes and motivation regarding FV and fiber-rich food preparation may adopt healthier eating habits. It is also possible that the ''seed to mouth'' nature of CG interventions assists in the child identifying with foods that they had never heard of before. Perhaps after planting, children adopt a personal connection with ''their'' produce, and may be more likely to consume it after having had that experience and connection with it. It is likely that the children who become interested in preparing/cooking healthful, fiber-rich foods and vegetables would be more inclined to consume these foods than children who had no such exposure to the cooking process.

The present study found that the intervention did not have a significant effect on CG behaviors. This may have been a result of the small sample size or short duration of the intervention. All schools chosen to participate in the LA Sprouts program were schools that were interested in having a school garden program, and all participants signed consent forms that described the intervention. While the control group received a delayed intervention, their initial motivation in the program could potentially explain why the control group would see increases in CG behaviors without receiving the intervention. When treatment groups were combined, improvements in self-efficacy, motivation, and attitudes toward CG activities were associated with beneficial effects on dietary fiber and vegetable intake. This provides support that interventions can utilize CG components to increases in psychosocial behaviors and in turn improve dietary intake.

Limitations

While the Block Kids Food Screener is a validated[43] and frequently utilized food frequency questionnaire, the screener has several intrinsic limitations, including that it utilizes a closed-ended question design, can result in recall bias, and uses the intake reference frame of foods eaten ''yesterday,'' which may not be representative of usual intake.[49] Future studies can use a stronger measure of self-reported dietary assessment such as a 24-hour dietary recall, or better yet, a nonsubjective method of assessment. Only four schools, within in the same city, were involved in the study, limiting the generalizability of the findings. Although change in cooking behavior was associated with a statistically significant increase in dietary fiber and vegetable intake, and change in gardening behavior was associated with a statistically significant increase in dietary fiber, the regression beta coefficients were small. Other personal, behavioral, and socioenvironmental factors may be contributing to changes in intake of vegetables and dietary fiber.[50]

Conclusions

It is important to understand how components of school-based interventions impact dietary intake and health outcomes to tailor future interventions to focus on the component(s) that are eliciting the greatest positive outcomes. Our results suggest that attitudes, self-efficacy, and motivation to cook are linked with increased dietary fiber and vegetable intake in Hispanic/Latino youth. Future school-based interventions should incorporate cooking aspects in interventions despite their potentially costly nature. Improving children's perceptions toward cooking and engaging them in these hands-on processes may promote improvements in their dietary intakes and the adoption of healthier habits that will hopefully accompany them into adulthood.

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Author Disclosure Statement

No competing financial interests exist.

References

1. Ogden CL, Carroll MD, Lawman HG, et al. Trends in obesity prevalence among children and adolescents in the United States, 1988–1994 through 2013–2014. *JAMA* 2016;315:2292–2299.
2. Daniels SR, Arnett DK, Eckel RH, et al. Overweight in children and adolescents: Pathophysiology, consequences, prevention, and treatment. *Circulation* 2005;111:1999–2012.
3. Halfon N, Larson K, Slusser W. Associations between obesity and comorbid mental health, developmental, and physical health conditions in a nationally representative sample of US children aged 10 to 17. *Acad Pediatr* 2013;13:6–13.

4. Krebs NF, Jacobson MS, American Academy of Pediatrics Committee on Nutrition. Prevention of pediatric overweight and obesity. *Pediatrics* 2003;112:424–430.
5. McLaren L. Socioeconomic status and obesity. *Epidemiol Rev* 2007;29:29–48.
6. Buijsse B, Feskens EJ, Schulze MB, et al. Fruit and vegetable intakes and subsequent changes in body weight in European populations: Results from the project on Diet, Obesity, and Genes (DiOGenes). *Am J Clin Nutr* 2009;90:202–209.
7. He K, Hu F, Colditz G, et al. Changes in intake of fruits and vegetables in relation to risk of obesity and weight gain among middle-aged women. *Int J Obes (Lond)* 2004;28:1569.
8. Ledoux T, Hingle M, Baranowski T. Relationship of fruit and vegetable intake with adiposity: A systematic review. *Obes Rev* 2011;12:e143–e150.
9. Vioque J, Weinbrenner T, Castelló A, et al. Intake of fruits and vegetables in relation to 10-year weight gain among Spanish adults. *Obesity (Silver Spring)* 2008;16:664–670.
10. Cook LT, O'Reilly GA, Goran MI, et al. Vegetable consumption is linked to decreased visceral and liver fat and improved insulin resistance in overweight Latino youth. *J Acad Nutr Diet* 2014;114: 1776–1783.
11. Davis JN, Alexander KE, Ventura EE, et al. Inverse relation between dietary fiber intake and visceral adiposity in overweight Latino youth. *Am J Clin Nutr* 2009;90:1160–1166.
12. Miller SJ, Batra AK, Shearrer GE, et al. Dietary fibre linked to decreased inflammation in overweight minority youth. *Pediatr Obes* 2016;11:33–39.
13. Ventura E, Davis J, Byrd-Williams C, et al. Reduction in risk factors for type 2 diabetes mellitus in response to a low-sugar, high-fiber dietary intervention in overweight Latino adolescents. *Arch Pediatr Adolesc Med* 2009;163:320–327.
14. Ventura EE, Davis JN, Alexander KE, et al. Dietary intake and the metabolic syndrome in overweight Latino children. *J Am Diet Assoc* 2008;108:1355–1359.
15. Kim SA, Moore LV, Galuska D, et al. Vital signs: Fruit and vegetable intake among children-United States, 2003–2010. *MMWR Morb Mortal Wkly Rep* 2014;63:671–676.
16. Kranz S, Brauchla M, Slavin JL, Miller KB. What do we know about dietary fiber intake in children and health? The effects of fiber intake on constipation, obesity, and diabetes in children. *Adv Nutr* 2012;3:47–53.
17. Storey M, Anderson P. Income and race/ethnicity influence dietary fiber intake and vegetable consumption. *Nutr Res* 2014;34:844–850.
18. Birch LL, Marlin DW. I don't like it; I never tried it: Effects of exposure on two-year-old children's food preferences. *Appetite* 1982;3:353–360.
19. Domel S, Thompson W, Davis H, et al. Psychosocial predictors of fruit and vegetable consumption among elementary school children. *Health Educ Res* 1996;11:299–308.
20. Bere E, Klepp K-I. Changes in accessibility and preferences predict children's future fruit and vegetable intake. *Int J Behav Nutr Phys Act* 2005;2:15.
21. Domel SB, Baranowski T, Davis H, et al. Measuring fruit and vegetable preferences among 4th-and 5th-grade students. *Prev Med* 1993;22:866–879.
22. Rasmussen M, Krølner R, Klepp K-I, et al. Determinants of fruit and vegetable consumption among children and adolescents: A review of the literature. Part I: Quantitative studies. *Int J Behav Nutr Phys Act* 2006;3:22.
23. Ohly H, Gentry S, Wigglesworth R, et al. A systematic review of the health and well-being impacts of school gardening: Synthesis of quantitative and qualitative evidence. *BMC Public Health* 2016; 16:286.
24. Robinson-O'Brien R, Story M, Heim S. Impact of garden-based youth nutrition intervention programs: A review. *J Am Diet Assoc* 2009;109:273–280.
25. Caraher M, Seeley A, Wu M, Lloyd S. When chefs adopt a school? An evaluation of a cooking intervention in English primary schools. *Appetite* 2013;62:50–59.
26. Castro DC, Samuels M, Harman AE. Growing healthy kids: A community garden–based obesity prevention program. *Am J Prev Med* 2013;44:S193–S199.
27. Cunningham-Sabo L, Lohse B. Cooking with kids positively affects fourth graders' vegetable preferences and attitudes and self-efficacy for food and cooking. *Child Obes* 2013;9:549–556.
28. Duncan MJ, Eyre E, Bryant E, et al. The impact of a school-based gardening intervention on intentions and behaviour related to fruit and vegetable consumption in children. *J Health Psychol* 2015;20: 765–773.
29. Gatto N, Martinez L, Spruijt-Metz D, Davis J. LA Sprouts randomized controlled nutrition, cooking and gardening programme reduces obesity and metabolic risk in Hispanic/Latino youth. *Pediatr Obes* 2017;12:28–37.
30. McAleese JD, Rankin LL. Garden-based nutrition education affects fruit and vegetable consumption in sixth-grade adolescents. *J Am Diet Assoc* 2007;107:662–665.
31. Morris JL, Zidenberg-Cherr S. Garden-enhanced nutrition curriculum improves fourth-grade school children's knowledge ol nutrition and preferences lor some vegetables. *J Am Diet Assoc* 2002;1:91.
32. Parmer SM, Salisbury-Glennon J, Shannon D, Struempler B. School gardens: An experiential learning approach for a nutrition education program to increase fruit and vegetable knowledge, preference, and consumption among second-grade students. *J Nutr Educ Behav* 2009;41:212–217.
33. Somerset S, Bossard A. Variations in prevalence and conduct of school food gardens in tropical and subtropical regions of north-eastern Australia. *Public Health Nutr* 2009;12:1485–1493.
34. Spears-Lanoix EC, McKyer ELJ, Evans A, et al. Using family-focused garden, nutrition, and physical activity programs to reduce childhood obesity: The texas! go! eat! grow! pilot study. *Child Obes* 2015;11:707–714.
35. Wang MC, Rauzon S, Studer N, et al. Exposure to a comprehensive school intervention increases vegetable consumption. *J Adolesc Health* 2010;47:74–82.
36. Hersch D, Perdue L, Ambroz T, Boucher JL. The impact of cooking classes on food-related preferences, attitudes, and behaviors of school-aged children: A systematic review of the evidence, 2003–2014. *Prev Chronic Dis* 2014;11 [Epub ahead of print; doi:10.5888/pcd11.140267].
37. Muzaffar H, Metcalfe JJ, Fiese B. Narrative review of culinary interventions with children in schools to promote healthy eatingDirections for future research and practice. *Curr Dev Nutr* 2018;2:nzy016.
38. Gibbs L, Staiger PK, Johnson B, et al. Expanding children's food experiences: The impact of a school-based kitchen garden program. *J Nutr Educ Behav* 2013;45:137–146.
39. Martinez LC, Gatto NM, Spruijt-Metz D, Davis JN. Design and methodology of the LA Sprouts nutrition, cooking and gardening program for Latino youth: A randomized controlled intervention. *Contemp Clin Trials* 2015;42:219–227.
40. Davis JN, Martinez LC, Spruijt-Metz D, Gatto NM. LA Sprouts: A 12-week gardening, nutrition, and cooking randomized control trial improves determinants of dietary behaviors. *J Nutr Educ Behav* 2016;48:2–11.e11.

41. National Center for Health Statistics. *National Health and Nutrition Examination Survey (NHANES): Anthropometry Procedures Manual 2007*. National Center for Health Statistics, Hyattsville, MD, 2007.
42. Kuczmarski RJ, Ogden CL, Guo SS, et al. 2000 CDC growth charts for the United States: Methods and development. *Vital Health Stat 11* 2002:1–190.
43. Hunsberger M, O'Malley J, Block T, Norris JC. Relative validation of Block Kids Food Screener for dietary assessment in children and adolescents. *Matern Child Nutr* 2015;11:260–270.
44. Baranowski T, Davis M, Resnicow K, et al. Gimme 5 fruit, juice, and vegetables for fun and health: Outcome evaluation. *Health Educ Behav* 2000;27:96–111.
45. Ryan RM, Connell JP. Perceived locus of causality and internalization: Examining reasons for acting in two domains. *J Pers Soc Psychol* 1989;57:749.
46. Williams GC, Grow VM, Freedman ZR, et al. Motivational predictors of weight loss and weight-loss maintenance. *J Pers Soc Psychol* 1996;70:115.
47. Davis JN, Spaniol MR, Somerset S. Sustenance and sustainability: Maximizing the impact of school gardens on health outcomes. *Public Health Nutr* 2015;18:2358–2367.
48. Beets MW, Swanger K, Wilcox DR, Cardinal BJ. Using hands-on demonstrations to promote cooking behaviors with young adolescents: The culinary camp summer cooking program. *J Nutr Educ Behav* 2007;39:288–289.
49. Shim J-S, Oh K, Kim HC. Dietary assessment methods in epidemiologic studies. *Epidemiol Health* 2014;36:e2014009.
50. Neumark-Sztainer D, Wall M, Perry C, Story M. Correlates of fruit and vegetable intake among adolescents: Findings from Project EAT. *Prev Med* 2003;37:198–208.

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