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COMMUNITY GUIDE REVIEW

Impact of Fruit and Vegetable Incentive Programs on Food Insecurity, Fruit and Vegetable Consumption, and Health Outcomes: A Community Guide Systematic Review

Renee Stein, PhD,[1] Ramona K.C. Finnie, DrPH,[1] Stacy Harmon, PhD,[2] Yinan Peng, PhD, MPH,[1] Chelsea Pritchard, MPH,[3] Heather Vecsey, MPH,[4] Karen M. Emmons, PhD,[5] Stephen Hargarten, MD, MPH,[6] Melissa A. Simon, MD, MPH,[7] Heidi M. Blanck, PhD,[8] Diane M. Harris, PhD, MPH, CHES,[8] Laura Bellows, PhD, MPH, RDN,[9] Alisha Coleman-Jensen, PhD,[10] Sheila Fleischhacker, PhD, JD, RDN,[11] Mallory M. Koenings, PhD, RDN,[12] Angela Odoms-Young, PhD,[9] Hilary K. Seligman, MD, MAS,[13] Clint Grant, MSPH,[14] Amanda Powell, PhD[15], the Community Preventive Services Task Force **

Introduction: Food and nutrition security is crucial for health, but many U.S. households experience food insecurity. This systematic review conducted in support of the Community Preventive Services Task Force examines the effectiveness of Fruit and Vegetable Incentive programs in reducing food insecurity, increasing fruit and vegetable consumption, and improving health outcomes among households with lower incomes.

Methods: Community Guide systematic review methods were applied. Studies were identified through a literature search (inception of each database to February 2023). U.S. studies were included if they evaluated programs offering participants financial incentives to purchase fruit and vegetables; were designed for or implemented among populations with lower incomes; reported health-related outcomes; and were published in English as peer-reviewed articles or government reports.

Results: This review included 30 studies. Thirteen of 14 datapoints from 12 studies indicated FVI programs reduced household food insecurity. Twenty-one of 29 datapoints from 23 studies showed increased FV consumption. Programs providing incentives to participants at risk for or with diet-related health conditions improved blood glucose levels by a median of 0.64 percentage points.

From the [1]Community Guide Program, Office of Scientific Evidence and Recommendations, Office of Science, Centers for Disease Control and Prevention, Atlanta, Georgia; [2]Cherokee Nation Operational Solutions, Arlington, Virginia; [3]Office of the Chief Information Officer, Office of the Director, CDC, Atlanta, Georgia; [4]University of Florida, College of Public Health and Health Professions, Gainesville, Florida; [5]Harvard T.H. Chan School of Public Health, Social and Behavioral Sciences Department, Boston, Massachusetts; [6]Department of Emergency Medicine, Medical College of Wisconsin, Milwaukee, Wisconsin; [7]Division of General Obstetrics and Gynecology, Department of Obstetrics and Gynecology, Northwestern University Feinberg School of Medicine, Chicago, Illinois; [8]Division of Nutrition, Physical Activity and Obesity, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia; [9]Division of Nutritional Sciences, College of Human Ecology/College of Agriculture and Life Sciences, Cornell University, Ithaca, New York; [10]Food Economics Division, Economic Research Service, United States Department of Agriculture, Washington, District of Columbia; [11]National Institute of Food and Agriculture, United States Department of Agriculture, Washington, District of Columbia; [12]Nutrition Division, Institute of Food Safety and Nutrition, National Institute of Food and Agriculture, United States Department of Agriculture, Kansas City, Missouri; [13]Division of General Internal Medicine, Department of Medicine, University of California, San Francisco, California; [14]Association of State and Territorial Health Officials, Arlington, Virginia; and [15]America's Health Insurance Plans Liaison to the Community Preventive Services Task Force, Atlanta, Georgia

Address correspondence to: Renee Stein, PhD, Community Guide Program, Office of Scientific Evidence and Recommendations, Office of Science, Centers for Disease Control and Prevention, 1600 Clifton Road, Atlanta, GA 30329. E-mail: rstein1@cdc.gov.

**Names and affiliations of Community Preventive Services Task Force members can be found at: https://www.thecommunityguide.org/task-force/community-preventive-services-task-force-members.

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Discussion: Based on the review findings, the Community Preventive Services Task Force recommends Fruit and Vegetable Incentive programs for populations with lower incomes to reduce household food insecurity, increase household fruit and vegetable consumption, and improve blood glucose levels in participants at risk for or with diet-related health conditions. Although the review did not find direct evidence of reducing health disparities, the Community Preventive Services Task Force expects that these programs will improve health equity across the U.S. by improving the affordability and accessibility of healthier foods for households with lower incomes.

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INTRODUCTION

Food and nutrition security—consistent and equitable access to healthy, safe, and affordable foods essential to optimal health and well-being—is an important social determinant of health (SDOH).[1] It reduces chronic disease risk, prevents unnecessary healthcare use, and supports overall health.[2] Food insecurity occurs when a household lacks sufficient resources to acquire adequate food,[3] which may lead to higher risks of premature mortality and shorter life expectancy.[4]

In 2023, 13.5% of U.S. households experienced food insecurity, up from 12.8% in 2022.[5] Food insecurity disproportionately affects households with lower incomes and some racial and ethnic groups. Between 2016 and 2021, 33.4% of households below 130% of the poverty threshold experienced food insecurity, as did 23% of American Indian or Alaska Native households, 21% of Black households, and 17% of Hispanic households.[6]

Research links food insecurity to lower dietary quality, particularly in fruit and vegetable (FV) consumption.[7] FV consumption accounts for 20% of the overall diet quality score in the Healthy Eating Index (HEI), a measure used to assess how well diets align with dietary guidelines.[8] FV intake is associated with health benefits, including a healthy weight, reduced risk of type 2 diabetes, stroke, cardiovascular disease, cancer, and all-cause mortality.[9–11] Yet, only 12% of U.S. adults meet fruit intake recommendations, and only 10% meet vegetable intake recommendations.[12] Among individuals with lower incomes and Black individuals, FV intake is notably low, with only 7% meeting daily intake recommendations.[12]

Structural barriers contribute to disparities in food insecurity and FV consumption, including under-resourced food environments that limit access to affordable, nutritious foods.[13] Lower-income neighborhoods often have a higher concentration of fast food restaurants offering low-cost, low-nutrient foods compared to higher-income areas.[13] Unfavorable SDOH—such as unstable employment and inadequate housing—further restrict access to nutritious food.[13]

To address these disparities, public health efforts increasingly focus on fruit and vegetable incentive (FVI) programs. These programs respond to evidence that cost is a major barrier to accessing healthy foods, particularly for Supplemental Nutrition Assistance Program (SNAP) recipients.[14] FVI programs provide financial incentives for FV purchases, improving affordability and access and encouraging healthier choices through direct price effects.[14] Some programs also include educational components, like cooking demonstrations and nutrition workshops. FVI programs can be implemented by community-based organizations, governments, and health systems at various locations, including farmers markets and grocery stores and may take forms such as point-of-sale discounts, rebates, matches, and subsidies.

Engel et al. conducted a scoping review of FVI programs for SNAP participants, summarizing factors influencing their effectiveness and impacts on FV purchases and consumption.[14] This paper presents a Guide to Community Preventive Services (Community Guide) systematic review that expands on previous research by assessing FVI programs' effects on food insecurity, FV consumption, and other health outcomes in populations with lower incomes. An analytic framework illustrating expected outcomes is available from: https://www.thecommunityguide.org/media/2024/pdf/af-sdoh-fruit-vegetable-incentive-programs-p.pdf

The Community Guide (https://www.thecommunityguide.org/) serves as a repository of recommendations on public health interventions, including modifications to SDOH to improve food and nutrition security (available at https://www.thecommunityguide.org/topics/social-determinants-health.html). These evidence-based recommendations are issued by the Community Preventive Services Task Force (CPSTF)—an independent panel of public health experts—based on systematic reviews conducted by the CDC's Community Guide Program and overseen by the CPSTF (https://www.thecommunityguide.org/pages/about-community-preventive-services-task-force.html).

METHODS

This review employed Community Guide systematic review methods.[15–17] The *Methods Manual for*

Community Guide Systematic Reviews outlines these methods and is available at https://www.thecommunityguide.org/pages/methods-manual.html. The review team included experts in food and nutrition security, SDOH, and health equity. It also included experts in systematic review methods from the CDC.

Librarians at CDC's Stephen B. Thacker Library conducted a search for relevant papers published from the inception of each database through February 2023. Databases included CINAHL, Cochrane Library, Embase, Google Scholar, Medline, PsycInfo, Scopus, Sociological Abstracts, and the U.S. Household Food Security Survey (USDA) website. The review team also recommended additional articles for inclusion as they identified them during the review process. The detailed search strategy is available at https://www.thecommunityguide.org/findings/social-determinants-health-fruit-vegetable-incentive-programs.html.

Studies were included if they evaluated FVI programs that provided financial incentives for purchasing FV, were designed for or implemented among populations with lower incomes, reported health-related outcomes, were conducted in the US, and were published as peer-reviewed articles or government reports in English. The inclusion criteria for populations with lower incomes were broad, encompassing participants eligible for federal nutrition assistance programs (e.g., SNAP), those reported to have lower incomes, and those residing in areas with limited access to nutritious food.

The review included RCTs, other designs with a concurrent comparison group, and pre-post studies. Studies were excluded if they used cross-sectional designs, directly provided FV directly to participants, or had fewer than 25 participants in the intervention group. Additionally, studies that included FV incentives as part of a larger federal nutrition assistance program, such as SNAP, were excluded, as it is difficult to attribute specific outcomes to the FVI component when integrated within broader nutrition assistance programs.

Two review team members independently screened search results using DistillerSR[18] software and abstracted data from qualifying studies into Excel. Any disagreements during screening or data abstraction were reconciled through consensus. Data abstraction included participant demographics, setting and intervention characteristics, and outcomes of interest.

Reviewers assessed study quality based on program, population, and sampling frame description; the validity and reliability of program exposure and outcome assessment; description and use of analytic methods; attrition rates (less than 20% lost to follow-up); and control for confounding and biasing factors.[16,17] These criteria were part of a quality of execution assessment framework described in detail in the *Methods Manual for Community Guide Systematic Reviews*.[16,17] Studies were rated as having good (0–1 limitations), fair (2–4 limitations), or limited (>4 limitations) quality of execution, and studies rated as limited quality of execution were excluded.[15,16,17]

The primary outcomes of interest were household food insecurity, FV consumption, and physical health outcomes. Food insecurity is commonly assessed using the USDA's U.S. Household Food Security Survey Module, which classifies food security into 4 categories: very low, low, marginal, and high.[19] Effect sizes indicating reduced food insecurity suggest favorable intervention effects. Regardless of the version of the USDA module used, these categories allow for the combination of measures. In this analysis, the low and very low categories were combined into a single measure of food insecurity.

Measures of FV consumption—servings, cups, times per day, and whether daily recommendations were met — were abstracted, along with other dietary measures like diet quality and sugar-sweetened beverage intake. Physical health outcomes of interest included blood glucose (HbA1c), blood pressure, BMI, cholesterol, and self-reported health quality.

Summary effect measures, including median absolute changes with interquartile intervals (IQIs), were calculated when 4 or more datapoints (effect sizes reported by studies or derived from pre-and post- intervention measures) were available for an outcome. For studies with multiple intervention arms, each effect size compared to the control group was included. Both statistically significant and non-statistically significant effect measures were included in the analysis. When fewer than 4 datapoints were reported for an outcome, or when outcomes could not be combined, individual study results were summarized narratively.

Absolute change was calculated using reported effect sizes or derived from pre- and post-intervention measures when available. For studies with a concurrent comparison group, the effect estimate was determined as the difference in pre-post changes between intervention (I) and comparison (C) groups: $(I_{post} - I_{pre}) - (C_{post} - C_{pre})$. For studies without a concurrent comparison group, it was calculated as the difference between pre- and postmeasurements for the intervention group: $I_{post} - I_{pre}$.

The pre-intervention measure (baseline) was the one taken nearest to the start of the intervention, while the post-intervention measure was either the last measure taken while incentives were still being provided or, if

that was not available, the nearest measure taken after the intervention ended.

In addition to evaluating the effectiveness of FVI programs, the team systematically assessed the applicability of findings across population, setting, and intervention characteristics. Key applicability factors were identified at the outset, and a priori hypotheses were developed based on theoretical frameworks and team expertise. To evaluate applicability, the team gathered and analyzed data on differences among study participants, settings, and intervention characteristics. This included examining the effectiveness of FVI programs across diverse populations and conditions, as well as considering within-study stratified analyses. Conclusions on applicability were based on the consistency of results across these factors to determine the generalizability of FVI programs to various populations and settings.

RESULTS

Figure 1 summarizes the search process and yield. The search identified 16,633 potentially relevant publications identified through the librarians' database search, along with an additional 6 publications recommended by the team. After full-text screening of 204 publications, 31 studies advanced to the quality of execution assessment (Figure 1).[20–50] Summaries of the included studies are available at https://www.thecommunityguide.org/media/2024/pdf/set-sdoh-fruit-vegetable-initiatives-508.pdf.

A variety of study designs were included to evaluate the effectiveness of FVI programs. Eligible studies included individual RCTs[22,27,33,38,50]; pre-post studies with concurrent comparison groups[20,34,42,43,49]; retrospective cohort studies[28]; single group pre-post studies[21,23–26,30–32,35–37,39–41,44–48]; and time series studies without a concurrent comparison group.[29]

The quality of execution of these studies was assessed to identify internal and external threats to validity. Eight studies were rated as having good quality of execution,[22–24,35,45–47,50] while 22 had fair quality.[20,21,25–32,33,34,37,38,39–41,42–44,48,49] One study with limited quality of execution was excluded,[36] resulting in a total of 30 included studies. Common limitations included high attrition (over 20%)[20–22,25,29–32,34,35,37,38,40,42–44,47–49] and sampling issues, such as unclear definitions of sampling frames or screening criteria and low participation rates.[21,23,24,26,27,29,31–34,37-39,41,49]

Appendix Table 1 provides study and FVI program characteristics. Most studies were published between 2016 and 2022. Studies were conducted in all 4 U.S. regions and were predominantly based in urban areas.[23–29,33,34,42–46,48,50]

Nearly half of the FVI programs offered incentives for purchasing FV through produce prescriptions from healthcare providers,[26–29,32,35,37,39,41,45–49] primarily for participants at risk for or with diet-related health conditions.[26–29,32,39,41,47,48] More than half of the programs incorporated education on nutrition or diet-related disease prevention.[20,22,25–29,31,32,35,38,41,47–50] Incentives could be redeemed at farmers' markets,[20,21,25–30,40,41,44–48,50] grocery stores,[31,35,38] or both.[22–24,32,34,37,42,43,49]

Most programs offered incentives in the form of subsidies[20,23–29,31,32,34,35,37,41–43,45–48,50] or matches.[21,22,30,33,40,44] For studies where monthly maximum incentives could be calculated, the median was $40 (IQI: $20 to $60), with dollar amounts reported

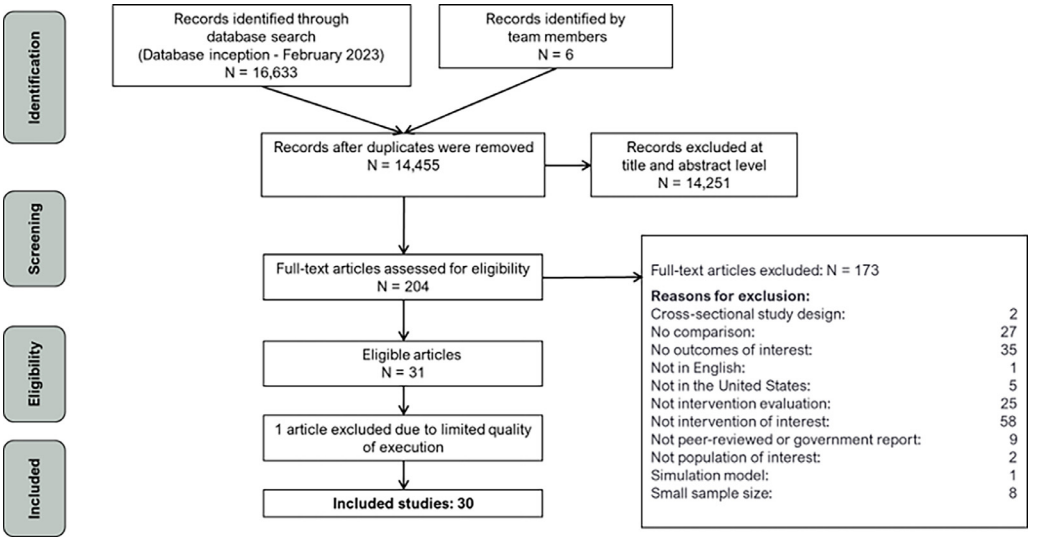

Figure 1. PRISMA flow chart search process and results for fruit and vegetable incentive program studies.

Table 1. Demographic Characteristics of Fruit and Vegetable Incentive Program Study Participants

Characteristics	Number of studies reporting	Distribution median (IQI)	Citations
Age			
Reported in years	22	42 y (29–53 y)	20–27,30,33–35,38–40,43–48,50
Reported in ranges	7	Not applicable	29,31,32,37,41,42,49
Not reported	1	Not applicable	28
Sex			
Female	25	72% (66%–82%)	21–27,29–31,33–35,37–41, 44–50
Not reported	5	Not applicable	20,28,32,42,43
Race and ethnicity			
Hispanic/Latino	24	37% (11%–55%)	20–27,29–34,37,39–44,48–50
Black or African American	26	28% (9%–51%)	20–29,31,33,34,37,39–50
White	25	27% (8%–52%)	20–22,25–34,37–44,46,48–50
Native Hawaiian or Other Pacific Islander	1	14% (Not applicable)	39
Asian American	7	9% (2%–21%)	25,31,34,39,40,42,44
2 or more races	4	3% (1%–11%)	29,33,39,43
American Indian/Alaska Native	4[a]	2% (0.40%–76%)	34,35,39,42
Education			
Less than high school	9	18% (10%–43%)	20,22–24,29,31,37,47,50
High school graduate or GED	9	35% (23%–47%)	20,22–24,29,31,37,47,50
Greater than high school	11	30% (25%–62%)	20,22–24,29,31,37,41,46,47,50
Reported in ranges or mean education (years of education)	2	Not applicable	21,34
Did not report education	15	Not applicable	25–28,30,32,38,40,42–45,48,49
Participation in Federal Nutrition Assistance Programs			
SNAP	14	55% (37%–100%)	21–23,25,29–31,35,37,38,45,47–49
WIC	11	16% (7%–100%)	20,23,25,29,31,34,35,37,42,44,45
FDPIR	1	84% (Not applicable)	35
No assistance received or not reported	12	Not applicable	24,26–28,32,33,39–41,43,46,50

[a]One study conducted on Tribal Lands (Navajo Nation).
FDPIR, The Food Distribution Program on Indian Reservations; SNAP, Supplemental Nutrition Assistance Program; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

reflecting the year the study was conducted.[22–24,26,31,34,40,42,43] Nearly a quarter of studies reported scaling the incentive amount by household size.[20,29,32,33,35,41,48] The frequency of incentive distribution varied, with most incentives being received at program site visits or redemption venues,[21,22,25,27,30,33,38,40,44,46,47] or disseminated monthly.[23,32,35,41–43,48] The median program duration was 6 months (IQI: 3.4–6 months).[20–27,29–35,38,41,42,45–48]

Table 1 presents the demographic characteristics of study participants. All studies were conducted among populations with lower incomes, with 55% of participants receiving SNAP benefits.[21–23,25,29–31,35,37,38,45,47–49] Participants had a median age of 42 years.[20-27,30,33-35,38-40,43-48,50] The median percentage of female participants across the studies was 72%.[21–27,29–31,33–35,37–41,44–50]Among studies reporting race and ethnicity, the median percentage self-identifying as Hispanic or Latino was 37%[20-27,29-34,37,39-44,48-50]; Black or African American was 28%[20–29,31,33,34,37,39–50]; White was 27%[20–22,25–34,37–44,46,48–50]; Native Hawaiian or Other Pacific Islander was 14%[39]; Asian American was 9%[25,31,34,39,40,42,44]; 2 or more races accounted for 3%[29,33,39,43]; and American Indian or Alaska Native made up 2%.[34,35,39,42] One study was conducted on tribal lands (Navajo Nation).[34,35,39,42] Most participants (65%) had a high school education or higher.[20,22-24,29,31,37,41,46,47,50]

Table 2 reports summary measures of outcome findings for which there were 4 or more datapoints. Findings with fewer than 4 datapoints or from studies reporting measures that could not be combined are described narratively in the text. Figure 2 is a scatterplot illustrating the effects of FVI programs on food insecurity, stratified by studies with the greatest suitability of design (pre-post with comparison group) at the top and those with the least suitability (single group pre-post) at the bottom.

Table 2. Summary Measures of Findings for Fruit and Vegetable Incentive Programs

Outcome	Median change (IQI)	Citations
Food insecurity		
Percentage of participants with food insecurity (8 data pts from 7 studies)	−18.00 pct pts (−25.95 to −12.30)	29,30,33,35,39,41,43
Fruits and vegetables consumed per day		
Servings/d (7 data pts from 5 studies)	+1.10 servings/d (0.30 to 1.60)	31,33–35,47
Cups/d (10 data pts from 8 studies)	+ 0.13 cups/d (0.10 to 0.30)	22–24,37,39,42,45,46
Number of times/d (5 data pts from 5 studies)	+ 0.49 times/d (−0.07 to 0.61)	21,25,30,32,48
HEI score (6 datapoints from 3 studies)	+1.50 pts (0.93 to 4.88)	23,24,33
Blood glucose (6 datapoints from 6 studies)	−0.64 pct pts in HbA1c levels (−1.33 to 0.08)	26,27,29,32,48,50
Blood pressure		
Systolic (5 datapoints from 5 studies)	−0.49 mm Hg (−2.49 to 3.45)	26,27,29,48,50
Diastolic (5 datapoints from 5 studies)	−0.40 mm Hg (−1.19 to 0.83)	26,27,29,48,50
BMI (7 datapoints from 6 studies)	−0.05 kg/m^2 (−0.57 to 0.10)	27–29,33,48,50

Note: If there were fewer than 4 datapoints, or for studies that reported measures that could not be combined with other studies, the findings are described narratively in the text.
HEI, healthy eating index; IQI, interquartile interval; kg/m^2, weight in kilograms (kg) divided by the square of the height in meters (m^2); mm HG, millimeters of mercury; pct pts, percentage points; servings/d, servings per day; times/d, times per day.

Effect sizes less than 0 indicate a decrease in food insecurity, favoring the intervention.

Twelve studies reported household food insecurity using the USDA's U.S. Household Food Security Survey Module.[24,29,30,33,35,39,41–44,46,49] The original USDA module includes 6 items measuring food insecurity over the past 12 months. Ten studies used this 6-item module; with 8 not specifying the assessment time frame,[24,29,35,39,42–44,46] and 2 assessing food insecurity over the past 30 days.[30,33] One study used the 18-item module to measure food insecurity over the past 3 months,[41] while another employed the 10-item module to assess the past 30 days.[49] Additionally, 1 study assessed food insecurity among children using the 9-question Self-Administered Food Security Survey Module for Youth.[46]

Seven of the 12 studies examined the change in the percentage of participants experiencing food insecurity.

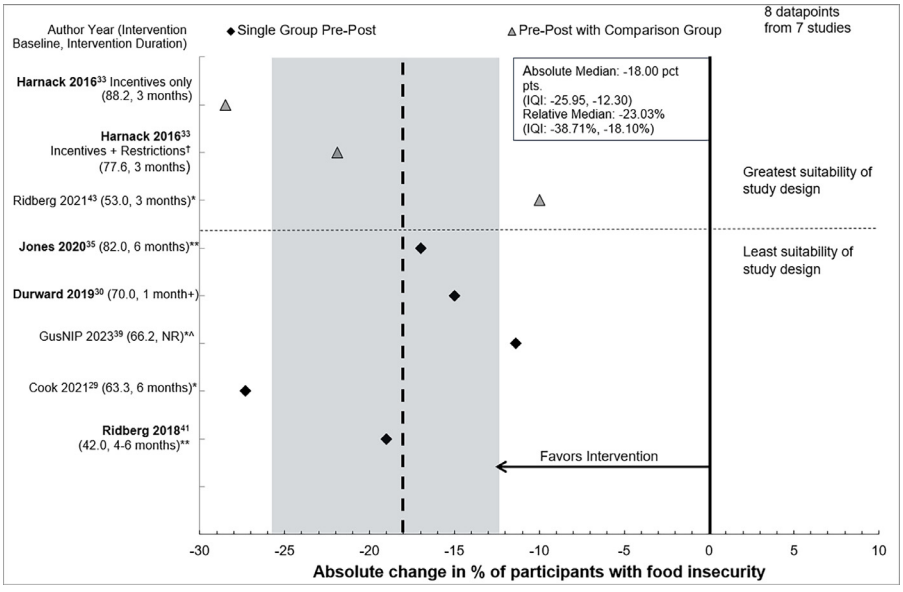

Figure 2. Effects of fruit and vegetable incentive programs on food insecurity. NR, Not reported; Author names in bold indicate statistically significant changes; *significance was not reported; **indicate child population; ^intervention was implemented during COVID-19 pandemic; +: 1 month or more; † Restriction: sugar sweetened beverages, candies, and sweet baked goods were selected for restriction in the incentive plus restriction arm.

In these studies, FVI programs reduced the percentage of participants with food insecurity by a median of 18.00 percentage points (IQI=−25.95 to −12.30, 7 studies with 8 datapoints)[29,30,33,35,39,41,43] (Figure 2). The remaining 5 studies could not be combined with the previously mentioned studies because they did not report percentages of participants experiencing food insecurity. Instead, 1 study used odds ratios to measure changes, while the others analyzed differences in module scale scores to assess variations in food security levels. Of these studies, 3 datapoints from 2 studies showed significant reductions in food insecurity[44,46]; 2 studies reported non-significant reductions (arm 1: OR=0.70, NS; arm 2: OR=0.75, NS)[24] (adjusted mean difference=0.05; 95% CI= −0.35, 0.44)[42]; and 1 study reported no change.[49] Overall, 13 of 14 datapoints from 12 studies reported that FVI programs reduced household food insecurity.

FV consumption was assessed through dietary recalls and surveys, with 23 studies reporting outcomes in servings per day, cups per day, number of times per day, or other frequency measures of consumption.[20–25,30,31,33–35,37–40,42–49] Five studies (7 datapoints) measured servings per day, showing an increase of 1.10 servings per day (IQI=0.30−1.60; 5 studies with 7 datapoints).[31,33–35,47] Additionally, 1 study that could not be combined with others reported a significant increase in FV servings per day post-FVI program implementation (OR=1.02; 95% CI=1.01, 1.03; p=0.003).[40]

Eight studies (10 datapoints) measured cups of FV consumed per day. Five programs showed an increase in FV consumption by a median of 0.13 cups (IQI=0.10 to 0.30; 8 studies with 10 datapoints).[22–24,37,39,42,45,46] One study[49] narratively described cups consumed per day and found no change. Another study[40] reported on half-cup servings per day and found an insignificant decrease in consumption for both children (absolute difference=−0.26, NS) and adults (absolute difference=−0.22, NS). Jones et al.[35] reported a statistically significant 16 percentage point increase in the number of children meeting the American Academy of Pediatrics recommendation of ≥5 servings per day.

Five studies[21,25,30,43,48] analyzed the number of times FV were consumed per day, reporting a median increase of 0.49 times (IQI=−0.07 to 0.61). Two studies[20,44] reported frequency measures that couldn't be combined, with 1 study[20] reporting no change in consumption, and the other[44] reporting a nonsignificant increase (absolute difference=0.7, p=0.10). Overall, 21 of 29 datapoints from 23 studies showed increased FV consumption, 5 showed no change, and 3 showed a decrease.

Diet quality was assessed using either the Healthy Eating Index (HEI) or a self-reported measure ranging from very healthy to very unhealthy. The HEI (0−100) score compares consumption to USDA dietary recommendations, with higher scores indicating better dietary quality.[51] FVI programs increased HEI scores by a median of 1.50 points (IQI=0.93−4.88; 6 datapoints from 3 studies).[23,24,33] One study[40] reported a significant improvement in self-reported diet quality (OR=1.10; CI=1.09, 1.11; p<0.001). Another study reported a decrease of 0.14 sodas per day (p<0.005),[25] and 2 arms of another study showed a 0.5 reduction in servings of sugar-sweetened beverages (p<0.05).[33] Overall, 3 studies reported improvements in diet quality, while 4 showed no change.

Studies measuring blood glucose, blood pressure, and cholesterol limited participation to individuals at risk for or with diet-related health conditions. Among these participants, FVI programs reduced blood glucose A1c levels by a median of 0.64 percentage points (IQI=−1.33 to 0.08; 6 studies).[26,27,29,32,48,50] Additionally, systolic blood pressure decreased by a median of 0.49 mmHg (IQI=−2.49 to 3.45; 5 studies) and diastolic blood pressure by 0.40 mmHg (IQI=−1.19 to 0.83; 5 studies).[26,27,29,48,50] One study found no significant impact on total cholesterol, low-density lipoprotein, high-density lipoprotein, or triglycerides.[50]

FVI programs showed no impact on adult BMI with a change of -0.05 kg/m^2 (IQI=−0.57 to 0.10; 7 datapoints from 6 studies).[27–29,33,48,50] However, Jones et al.[35] found a statistically significant reduction in BMI percentile among children who were overweight or had obesity at baseline. One study[39] measured participants' self-reported health and found a 3.6 percentage point increase in those describing their health as good, very good, or excellent.

Community Guide methods assess the applicability of FVI programs across different settings, populations, and intervention characteristics.[17] This review indicates that findings are applicable across various contexts, including different regions of the U.S., varying population densities, males and females, all age groups, diverse races and ethnicities, and to populations with lower incomes and differing education levels. Several studies conducted stratified analyses for different subgroups: sex[22,39,41,45,46] (n=5); age[22,32,39,41,45,46] (n=6); race/ethnicity[22,32,39,41,45,46] (n=6); educational level[22,41,45,46] (n=4); nutrition assistance program participation[22,38,41,45] (n=4); and employment status[45] (n=1). However, overall, the analyses did not reveal differences in effectiveness among the subgroups examined.

DISCUSSION

The findings from this systematic review formed the basis for the CPSTF recommendation of FVI programs

for households with lower incomes due to their strong effectiveness in reducing household food insecurity, increasing FV consumption, and improving blood glucose levels among participants at risk for or with diet-related health conditions. CPSTF also highlights these programs' potential to improve health equity across the U.S. by making healthier foods more affordable and accessible to households with lower incomes.

Twelve studies reported on food insecurity, with 7 showing a median reduction of 18 percentage points among participants. The remaining 5 studies, using non-combinable measures, showed a general trend toward reductions. Twenty-three studies assessed FV consumption, with the majority showing overall increases. Lastly, 6 studies found that FVI programs for individuals at risk for or with diet-related health conditions reduced blood glucose A1c levels by a median of 0.64 percentage points.

The substantial reduction in food insecurity underscores the effectiveness of FVI programs in improving food access for households with lower incomes. Food insecurity occurs when a household is unable to consistently obtain adequate food due to financial constraints or limited resources.[3] This situation is often exacerbated by economic or national crises, such as the COVID-19 pandemic. FVI programs provide direct financial incentives to help offset the cost of FV, which can be prohibitively expensive for these families. When integrated with broader food assistance initiatives like SNAP or the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), FVI programs strengthen food support systems and promote health equity for those facing economic hardship.[52]

The observed increases in FV consumption align with the national objectives set by Healthy People 2030, which targets incremental increases of 0.05 cups of fruits and 0.08 cups of vegetables per 1,000 calories.[53,54] This review indicates that FVI programs may help participants reach these targets, demonstrating median increases of 1.10 servings, 0.13 cups, and 0.49 times per day. By providing financial incentives that enhance the affordability and accessibility of FV, FVI programs can help individuals and families with limited resources meet dietary guidelines and advance public health nutrition goals.

The reduction in blood glucose A1c levels underscores the potential of FVI programs to benefit individuals at risk for or living with diet-related health conditions, such as diabetes. Research indicates that increasing FV consumption is important for managing blood glucose levels.[55] By enhancing the accessibility and affordability of healthier food options, FVI programs can support dietary changes that can improve blood glucose management and contribute to better health equity for underserved populations.

Three key evidence gaps exist for future research on FVI programs. First, most studies evaluated outcomes while incentives were still being provided, which limits insights into the long-term effects and sustainability of these changes after program completion. Future studies could explore the enduring impacts beyond the active program period. Second, while findings are broadly applicable to populations with lower incomes, there is limited information on specific groups, such as children in incentivized households. Since most studies focused on overall household consumption, future research could investigate how FVI programs affect children's consumption patterns and identify strategies to enhance program effectiveness for this demographic. Finally, more research is needed to understand how to tailor FVI programs for different groups to optimize incentive redemption.

Limitations

This review has several limitations. Over half of the included studies reported more than 20% attrition, and 15 studies had unclear sampling frames, screening criteria, or low participation rates. Additionally, FV consumption was assessed through self-reports, which may introduce potential recall and social desirability bias. The measurement of FV consumption and food insecurity varied across studies, limiting the ability to pool effect estimates. To address this issue, the team grouped measures by outcome type and pooled them when possible, providing narrative descriptions for results that could not be pooled. Furthermore, the review could not isolate the impacts of FVI programs that included nutritional education components, limiting the ability to determine the specific effects of the financial incentives alone. Finally, while the literature search was rigorous and comprehensive, it is important to acknowledge the potential for missed studies, which is a common limitation in systematic reviews.

CONCLUSIONS

Food and nutrition security is essential for health, as it helps to reduce chronic disease risks and prevent premature mortality. However, many households in the U.S. continue to struggle to access affordable, healthy foods, including FV, which exacerbates health disparities. This review highlights the effectiveness of FVI programs in reducing household food insecurity, increasing FV consumption, and improving blood glucose levels among households with lower incomes. The findings can inform

public health decision makers about effective strategies to enhance food and nutrition security and improve overall population health.

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CREDIT AUTHOR STATEMENT

Renee Stein: Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Software, Supervision, Validation, Writing- original draft, Writing-review and editing. Ramona K.C. Finnie: Conceptualization, Data curation, Formal analysis, Methodology, Software, Validation, Writing- original draft, Writing-review and editing. Stacy Harmon: Conceptualization, Data curation, Formal analysis, Methodology, Software, Validation, Writing- original draft, Writing-review and editing. Yinan Peng: Conceptualization, Data curation, Formal analysis, Methodology, Software, Validation, Writing-review and editing. Chelsea Pritchard: Conceptualization, Data curation, Methodology, Software, Validation, Writing-review and editing. Heather Vecsey: Conceptualization, Data curation, Methodology, Software, Validation, Writing-review and editing. Karen M. Emmons: Conceptualization, Data curation, Supervision, Writing-review and editing. Stephen Hargarten: Conceptualization, Data curation, Supervision, Writing-review and editing. Melissa Simon: Conceptualization, Data curation, Supervision, Writing-review and editing. Heidi M. Blanck: Conceptualization, Data curation, Writing-review and editing. Diane Harris: Conceptualization, Data curation, Writing-review and editing. Laura Bellows: Conceptualization, Data curation, Writing-review and editing. Alisha Coleman-Jensen: Conceptualization, Data curation, Writing-review and editing. Sheila Fleischhacker: Conceptualization, Data curation, Writing-review and editing. Mallory M. Koenings: Conceptualization, Data curation, Writing-review and editing. Angela Odoms-Young: Conceptualization, Data curation, Writing-review and editing. Hilary K. Seligman: Conceptualization, Data curation, Writing-review and editing. Clint Grant: Conceptualization, Data curation, Writing-review and editing. Amanda Powell: Conceptualization, Data curation, Writing-review and editing. Community Preventive Services Task Force: Supervision

SUPPLEMENTAL MATERIAL

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