

Multicomponent Interventions to Increase Availability of Healthier Foods and Beverages in Schools

Summary Evidence Table

Abbreviations Used in This Document:

- Intervention components
 - FFVP: fresh fruit and vegetable program
 - FRPL: free and reduced price lunch
 - FVMM: fruit and vegetables make the marks
 - SBP: school breakfast program
- Outcomes:
 - F&V: fruit and vegetables
 - SSB: sugar sweetened beverage
- Measurement terms
 - BMI: body mass index
 - CI: confidence interval
 - cm: centimeter
 - d: day
 - g: grams
 - kcal: kilocalories
 - kJ: kiloJoules
 - mmHg: millimeters of mercury
 - mmol/L: millimoles per liter
 - oz: ounces
 - pct pts: percentage points
 - serv: servings
- Study design
 - Group RCT: group randomized trial
 - RCT: randomized trial
- Other terms:
 - NA: not applicable
 - NR: not reported
 - NS: not significant
 - SES: socioeconomic status

Study	Population Characteristics	Intervention Characteristics	Results
<p>Author, Year: Anderson et al, 2005</p> <p>Study Design: Group RCT</p> <p>Suitability of Design: Greatest</p> <p>Quality of Execution: Fair</p>	<p>Study population: children aged 6-7 and 10-11</p> <p>Sample size: Intervention = 64; Control = 65</p> <p>Demographics Age: 8.4 yrs Gender: 56.3% female Race/Ethnicity: NR SES: reports number of free school lunches served by denomination of school</p>	<p>Location (urbanicity): Dundee, Scotland (urban)</p> <p>Intervention activities: school lunch policy + fruit and vegetable program + marketing + taste tests + fundraisers + foods as reward + classroom parties + nutrition education</p> <p>Increased provision of F&V in schools (tuck shops and school lunches), tasting opportunities, a range of point-of-purchase marketing (posters and quizzes), newsletters for children and parents, and teacher information sessions (delivered in school assemblies, training sessions and classroom presentations). Nutrition education: Curriculum materials focusing on practical food preparation and tasting, promoted through hands-on activities, written work, videos, self-monitoring materials and story books</p> <p>Year established: October 1999</p> <p>Comparison: not described</p> <p>Study Period: August 1999-June 2000</p>	<p>Energy Intake (kJ/day) Intervention: baseline: 7,922 f/u: 7,926 Control: baseline: 8,268 f/u: 7,920 Summary Effect: 348 kJ/d, NS</p> <p>Mean daily weight of F&V (g) Intervention: baseline: 202 f/u: 235 Control: baseline: 170 f/u: 163 Summary Effect: 40 g, NS</p> <p>Paper conclusions: A whole school approach to increasing intakes of fruits and vegetables has a modest effect on dietary outcomes.</p>

Study	Population Characteristics	Intervention Characteristics	Results
<p>Author, Year: Coleman et al, 2012</p> <p>Study Design: Group RCT</p> <p>Suitability of Design: Greatest</p> <p>Quality of Execution: Fair</p>	<p>Study population: 2nd, 3rd, and 6th grade students</p> <p>Sample size (analytic): 579</p> <p>Demographics: Age: 8.9 yrs (1.6) Gender: 57% female Race/Ethnicity: 19% White, 19% African American, 52% Hispanic, 7% Asian/Pacific Islander, 0.3% Native American, 2.7% unknown SES: Low-income school district Overweight/Obese: 18% overweight, 25% obese</p>	<p>Location (urbanicity): Lemon Grove, CA (suburban)</p> <p>Intervention activities: School lunch + fruit and vegetable program + class party + food as a reward + fundraisers + marketing + pricing + nutrition education + taste test</p> <p>The Healthy Options for Nutrition Environments in Schools (Healthy ONES) intervention goals were to 1) eliminate unhealthy foods and beverages on campus, 2) develop nutrition services as the main source on campus for healthful eating, and 3) promote school staff modeling of healthful eating. Schools were followed across a baseline year and two intervention years.</p> <p>Comparison: usual care</p> <p>Study Period: 2009-2010</p>	<p>Obesity Prevalence (%) Intervention: baseline: 28 f/u: 30 Control: baseline: 22 f/u: 25 Summary Effect: -1.0 pct pts, NS</p> <p>BMIz score: no intervention effects over time</p> <p>Paper conclusions: Intervention lead to decreases in outside foods and beverages on campus, especially for unhealthy foods and beverages. No changes in obesity rates in either group were observed, however BMIz scores increased significantly over time for both intervention and control schools.</p>
<p>Author, Year: Frerichs, 2015</p> <p>Study Design: Before-after</p> <p>Suitability of Design: Least</p> <p>Quality of Execution: Fair</p>	<p>Study population: 3rd - 5th graders</p> <p>Sample size: 101</p> <p>Demographics Age: 3rd and 4th grade students Gender: 43.1% female Race/Ethnicity: 37.9% white; 32.8% African American; 25.8% other SES: NR</p>	<p>Location (urbanicity): Virginia (rural)</p> <p>Intervention activities: Intervention activities: school lunch policy + competitive foods policy + cafeteria facility changes + placement of healthier food (marketing) + school garden</p>	<p>Sugar-sweetened beverages (times/d): Baseline: 2.0 Follow-up: 1.9 Summary Effect: -0.1 times/d, NS</p> <p>Fruits and vegetables (times/d): Baseline: 1.94 Summary Effect: 0.04 times/d, NS</p> <p>Paper conclusions: Whole school renovation had limited impact on student</p>

Study	Population Characteristics	Intervention Characteristics	Results
		healthy eating design guidelines including commercial kitchen, teaching kitchen and school garden Comparison: NA Study Period: 2012	healthy eating; some qualitative evidence to suggest certain healthy eating design guideline features such as the educational signage had direct and specific roles in shaping outcomes (qualitative data). Physical environmental interventions alone are unlikely to make an impact.
<p>Author, Year: Fung et al, 2013</p> <p>Study Design: Repeat cross sectional</p> <p>Suitability of Design: Least</p> <p>Quality of Execution: Good</p>	<p>Study population: 5th graders</p> <p>Sample size (analytic): 5,508</p> <p>Demographics Age: 5th graders Gender: 51% female Race/Ethnicity: NR SES: Household income: <\$20k:12.2% \$20K-\$40K: 22.4% >\$40K-\$60K: 25.6% >\$60K: 39.8%</p>	<p>Location (urbanicity): Nova Scotia (mixed: urban+rural)</p> <p>Intervention activities: school lunch + school breakfast + competitive foods + water access + marketing+ fundraisers + classroom party + pricing + nutrition education</p> <p>nutritional guidelines, regulation of food and beverages available and price interventions: foods a beverages served and sold in school must meet nutritional requirements; no deep fryers; sell on milk, 100% fruit juice, and water; access to clean safe drinking water; affordable pricing; and special functions with more nutritious food; food will not be offered as a reward or reinforcer; appropriate portions of foods and beverages, food safety, and nutrition education</p> <p>Year established: policy introduced in 2006; fully implemented in 2009</p> <p>Comparison: NA</p>	<p>Energy Intake (kcal/d) Baseline: 2,151 kcal/d Follow-up: 1,887 kcal/d Adjusted Summary Effect: -248 kcal/d, p<0.001</p> <p>Sugar-Sweetened Beverage Intake (serv/d) Baseline: 0.99 serv/d Follow-up: 0.62 serv/d Adjusted Summary Effect: -0.20 serv/d, 95%CI: -0.27, -0.12</p> <p>Regular soda (# of cans or glasses) Baseline: 0.44 soda/d Follow-up: 0.27 soda/d Adjusted Beta Coefficient: -0.09 soda/d, 95%C: -0.11, -0.06</p> <p>Milk or milk products (serv/d) Baseline: 3.2 serv/d Follow-up: 3.5 serv/d Adjusted Beta Coefficient: -0.24 serv/d, 95%CI: 0.18, 0.31</p> <p>Fruit and vegetable intake (serv/d) Baseline: 5.2 serv/d Follow-up: 5.2 serv/d</p>

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		<p>Study Period: 2003 - 2011</p>	<p>Adjusted Beta Coefficient: -0.08, 95%CI: -0.27, 0.19</p> <p>Diet Quality Index (range:0-100) Baseline: 62 Follow-up: 63 Adjusted Prevalence Ratio: 1.8, 95% CI: 1.33, 2.27</p> <p>Overweight and Obesity Prevalence (%) Baseline: 32.9% Follow-up: 33.5% Adjusted Prevalence Ratio: 0.6%, NS</p> <p>Paper conclusions: positive trends in diet quality and energy intake following the implementation of intervention, but no statistically significant increases in consumption of vegetables and fruit. There was no change in prevalence of overweight or obesity.</p>
<p>Author, Year: Masse, 2014</p> <p>Study Design: post only with comparison</p> <p>Suitability of Design: Least</p> <p>Quality of Execution: Fair</p>	<p>Study population 7th-12th grade students</p> <p>Sample size: 10,735 for SSB and food consumption index, 8,995 for overweight</p> <p>Demographics: Mean age: 14.9 yrs Gender: 51.9% female Race/ethnicity: NR SES: median family income \$69,006</p>	<p>Location (urbanicity): British Columbia, Canada (urban, suburban, rural)</p> <p>Intervention activities: This is an evaluation of the school nutrition environment. Policies varied from district policy institutionalization, school food guidelines, nutritional resources, program participation in the BC Milk Program or the BC School Fruit and Vegetable Nutrition Program.</p>	<p>SSB consumption Availability of SSBs at school increased students' odds of consuming SSBs and being obese and availability of less healthful foods was associated with higher consumption.</p>

Study	Population Characteristics	Intervention Characteristics	Results
		<p>Comparison: students in schools with stronger policies/guidelines were compared to students in schools with less strict policies/guidelines</p> <p>Study Period: post-test only Feb - June 2008</p>	
<p>Author, Year: Mendoza et al 2010/Cullen et al 2008</p> <p>Study Design: Repeat cross sectional</p> <p>Suitability of Design: Least</p> <p>Quality of Execution: Good</p>	<p>Study population: 3 Texas middle schools in same school district</p> <p>Sample size: 2,616</p> <p>Demographics: Age: NR</p> <p>Low SES group Gender: 34% female Race/ethnicity: 2% White; 2% African-American; Hispanic: 93%</p> <p>Moderate SES group Gender: 52% female Race/ethnicity: 9% White; 10% African-American; 77% Hispanic</p> <p>High SES group Gender: 50% female Race/ethnicity: 31% White; 3% African-American; 60% Hispanic</p> <p>SES: 47% Receive free or reduced price lunch</p>	<p>Location (urbanicity): Houston, TX (mixed)</p> <p>Intervention activities: school lunch + competitive foods</p> <p>Texas Public School Nutrition Policy (implemented fall 2004) restricts the portion sizes of high-fat and sugar snacks, SSB, and fat. It also sets limits on the frequency of serving high-fat vegetables such as french fries.</p> <p>Comparison: NA</p> <p>Study Period: baseline (2001–2002), after local district changes (2002–2003), and 1 year after implementation of the Texas Public School Nutrition Policy (2005–2006)</p>	<p>Sugar-Sweetened Beverage Intake Baseline: 0.45 serv/d Follow-up: 0.15 serv/d Summary Effect: -0.3 serv/d, p<0.05</p> <p>Regular soda consumed at lunch Baseline: 4.8 oz Follow-up: 0.11 oz Summary Effect: -4.7 oz, p<0.05</p> <p>Milk consumed at lunch Baseline: 2.4 oz Follow-up: 6.5 oz Summary Effect: -4.1 0 oz, p<0.05</p> <p>Fruit and vegetable consumption at lunch Baseline: 11.6% of lunchtime energy intake Follow-up: 16.8% of lunchtime energy intake Summary Effect: 5.2% increase in lunchtime energy intake</p>

Study	Population Characteristics	Intervention Characteristics	Results
<p>Author, Year: Mullally et al, 2010</p> <p>Study Design: Repeated cross-sectional</p> <p>Suitability of Design: Least</p> <p>Quality of Execution: Fair</p>	<p>Study population: 5th and 6th grade students</p> <p>Sample size (analytic): 1,533</p> <p>Demographics Age: 5th-6th graders Gender: Pre-intervention:45.4% female Post-intervention: 50.1% female Race/Ethnicity: NR SES: NR</p>	<p>Location (urbanicity): Prince Edward Island, Nova Scotia, Canada (NR)</p> <p>Intervention activities: school lunch + competitive foods + water access + food reward + fundraisers + marketing + pricing + nutrition education + taste test</p> <p>Intervention addresses issues such as the quality of food available in the school environment (providing healthy food and beverage choices in vending machines, canteens, and school food programs), student access to food, food used in school fundraising initiatives, food safety, and nutrition education. Parents were encouraged to ensure children eat a healthy breakfast, to pack healthy lunches, and to eat healthy meals at home.</p> <p>Study Period: 2001-2007</p>	<p>Fruit and Vegetable intake Baseline: 4.0 serv/d Follow-up: 3.6 serv/d Adjusted Beta Coefficient: 0.10 serv/d, 95%CI: -0.03, 0.23</p> <p>Milk/ milk alternatives/ dairy products Baseline: 3.0 serv/d Follow-up: 2.9 serv/d Adjusted Beta Coefficient: 0.18 serv/d, 95%CI: 0.8, 0.28</p> <p>Low nutrient dense foods Baseline: 3.0 serv/d Follow-up: 2.9 serv/d Relative Odds of Meeting Recommended Intake: 2.14, 95%CI: 1.6, 2.8</p> <p>Paper conclusions: Study shows favorable changes in student food consumption that parallel the introduction of a school nutrition policy</p>
<p>Author, Year: Rappaport et al, 2013</p> <p>Study Design: RCT</p>	<p>Study population: K through 8th grade students</p> <p>Sample size (analytic): 8,186</p> <p>Demographics</p>	<p>Location (urbanicity): Philadelphia, PA (urban)</p> <p>Intervention activities: school lunch + competitive foods + marketing + class party + food</p>	<p>Prevalence of Overweight and obese (%) Intervention: baseline: 36.2%, f/u: 39.1% Control: baseline: 36.1%, f/u: 39.2% Summary Effect: -0.20 pct pts, NS</p>

Study	Population Characteristics	Intervention Characteristics	Results
<p>Suitability of Design: Greatest</p> <p>Quality of Execution: Fair</p>	<p>Intervention: Age: K-8th grade Gender: 49% female Race/Ethnicity: 8% White; 50% African American; 26% Hispanic; 14% Asian; 2% other SES: 38% eligible for free/reduced-cost meal Overweight/Obese: 16% overweight; 20% obese</p> <p>Control: Age: K-8th grade Gender: 48% female Race/Ethnicity: 14% White; 58% African American; 10% Hispanic; 16% Asian; 2% other SES: 35% eligible for free/reduced-cost meal Overweight/Obese: 18% overweight; 20% obese</p>	<p>reward + fundraisers + marketing + nutrition education</p> <p>Intervention included the following components: school self-assessment, teacher nutrition education training, student nutrition education by the trained teachers, school nutrition policy changes, social marketing, and parent and community outreach.</p> <p>Comparison: Usual care</p> <p>Study Period: 2003-2005</p>	<p>BMI z-score Intervention: baseline: 0.58, f/u: 0.67 Control: baseline: 0.59, f/u: 0.69 Summary Effect: -0.01 pct pts, NS</p> <p>Paper conclusions: There was no significant intervention effect and there was no long-term effect among students with up to 2 years of data beyond the end of the intervention.</p>
<p>Author, Year: Sanchez-Vaznaugh et al, 2010 (CA data)</p> <p>Study Design: Repeat cross sectional</p> <p>Suitability of Design: Least</p> <p>Quality of Execution: Good</p>	<p>Study population: Targeted all school students, results for 5th and 7th grade</p> <p>Sample size: range: 475,761-616,010</p> <p>Demographics Age: 47.1% 5th grade, 53.0% 7th grade Gender: 49.8% female Race/Ethnicity: 38.2% White; 5.5% African American; 7.4% Asian; 56.7% Hispanic</p>	<p>Location (urbanicity): State of California (mixed)</p> <p>Intervention activities: School lunch + competitive foods</p> <p>The state of California implemented a beverage standard, Senate Bill 677, in July, 2004. Senate Bill 677 is aimed at students in kindergarten through eighth grade, prohibited the sale of sugary beverages; required at least 50% fruit juice with no added sweeteners; eliminated added</p>	<p>Percent Change in the Odds of Overweight and obesity</p> <p><u>5th grade</u> girls Baseline 1.8% Summary Effect: -1.4 pct pts, p<0.05</p> <p>boys Baseline 2.0% Summary Effect: -2.4 pct pts, p<0.01</p> <p><u>7th grade</u> girls</p>

Study	Population Characteristics	Intervention Characteristics	Results
	<p>SES: NR Overweight/obesity prevalence: 41.2%</p>	<p>sweeteners from water and sports beverages; and limited the fat content in milk to 2%. July 1, 2007, Senate Bill 12 set statewide nutrition and portion size standards for competitive foods for students in kindergarten through eighth grade. The state nutrition rules for snacks in elementary schools limit the percentage of total calories from fat to 35%, the percentage of calories from saturated fats to 10%, and sugar content in snacks to 35% or less by weight. Senate Bill 12 also expanded beverage standards into high schools.</p> <p>Comparison: NA</p> <p>Study Period: 2001-2008</p>	<p>Baseline 2.2% Summary Effect: -2.2 pct pts, p<0.01</p> <p>boys Baseline 2.5% Summary Effect: -4.3 pct pts, p<0.01</p> <p>Paper conclusions: There were population-level improvements in overall overweight/obesity trends among fifth and seventh graders in the state of CA.</p>
<p>Author, Year: Sanchez-Vaznaugh et al, 2010 (Los Angeles)</p> <p>Study Design: Repeat cross sectional</p> <p>Suitability of Design: Least</p> <p>Quality of Execution: Good</p>	<p>Study population: study targeted all school students, results for 5th and 7th grade</p> <p>Sample size: 94,689 (2003)</p> <p>Intervention Age: 51.6% 5th grade, 48.4% 7th grade Gender: 49.3% female Race/Ethnicity: 8.4% White; 10.0% African American; 2.7% Asian; 77.8% Hispanic SES: NR</p>	<p>Location (urbanicity): Los Angeles Unified School District (urban)</p> <p>Intervention activities: School lunch + competitive foods policy</p> <p>Two policies were evaluated.</p> <p>1. The Healthy Beverage Resolution took effect in the Los Angeles USD (Jan 1, 2004), requiring fruit juice to contain at least 50 percent fruit juice with no added sweeteners; water and sports</p>	<p>Percent Change in the Odds of Overweight and obesity</p> <p><u>5th grade</u> girls Baseline 4.0% Summary Effect: -4.0 pct pts, p<0.01</p> <p>boys Baseline 3.5% Summary Effect: -5.5 pct pts, p<0.01</p> <p><u>7th grade</u> girls</p>

Study	Population Characteristics	Intervention Characteristics	Results
	<p>Overweight/Obese: 51.3%</p>	<p>beverages contain no added sweeteners, artificial flavorings, colors and caffeine. In addition, milk must be <2% fat. Beverages cannot contain artificial sweeteners. The policy applies to all grades.</p> <p>2. The Obesity Prevention Motion, which requires that food sold at school contain no more than 35% of their total calories from fat (excluding nuts and seeds); no more than 10% of total calories from saturated fat, including trans fat; no more than 35% added sugar by weight; and no more than 600 mg of sodium per serving.</p> <p>Study Period: 2003 & 2005</p> <p>Comparison: NA</p>	<p>Baseline 3.0% Summary Effect: -1.2 pct pts, NS</p> <p>boys Baseline 3.2% Summary Effect: -2.5 pct pts, NS</p> <p>Paper conclusions: There were population-level improvements in overall overweight/obesity trends among fifth graders in the Los Angeles Unified School District.</p>
<p>Author, Year: Spence et al, 2013</p> <p>Study Design: Repeat cross-sectional</p> <p>Suitability of Design: Least</p> <p>Quality of Execution: Fair</p>	<p>Study population: Policy targeted all students aged 4-7 year-olds. Schools in the analysis represented a comprehensive range of socio-economic circumstances, determined using the free school meal index at school level</p> <p>Sample size: 385 in 2003–04; 632 in 2008–09</p>	<p>Location (urbanicity): North East, England (NR)</p> <p>Intervention activities: school lunch policy + competitive foods policy</p> <p>A policy change in England (legislative support received in 2006, schools expected to comply by September 2008) where food-based standards specified which foods</p>	<p>Energy Intake (kcal/lunch) Baseline: 450 Follow-up: 494 Summary Effect: 44 kcal/lunch, p<0.001</p> <p>Paper conclusions: There was a small increase in the energy content of a child’s average school lunch post-implementation, but this remained below the target stated in the requirements of 530 kcals/day.</p>

Study	Population Characteristics	Intervention Characteristics	Results
	<p>Demographics Age: 4-7 year olds in 2003 Gender: 51.4% female in 2003-04; 49.8% in 2008-09. Race/Ethnicity: NR SES: NR</p>	<p>could and could not be served, and how often, for school lunches. Nutrient-based standards applied to the average nutritional content of school lunches over a 3 week period, and specified minimum and maximum levels.</p> <p>Baseline conducted pre-implementation during the 2003-2004 school year. Posttest conducted during 2008-2009 school year.</p>	