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A point-of-purchase intervention featuring in-person supermarket education impacts healthy food purchases

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Abstract

Objective—This study tested the efficacy of a multicomponent supermarket point-of-purchase (POP) intervention featuring in-person nutrition education on the nutrient composition of food purchases.

Design—The design was a randomized trial comparing the intervention to usual care (no treatment).

Setting—A supermarket in a socioeconomically diverse region of Phoenix, Arizona.

Participants—One-hundred fifty-three adult shoppers were recruited on-site.

Intervention—The intervention consisted of brief shopping education by a nutrition educator and an explanation and promotion of a supermarket POP healthy shopping program that included posted shelf signs identifying healthy foods, sample shopping lists, tips, and signage.

Main Outcome Measures—Outcomes included purchases of total, saturated, and trans fat (g/1000 kcals), and fruits, vegetables, and dark green and bright yellow vegetables (servings/1000 kcals) derived through nutritional analysis of participant shopping baskets.

Analysis—Analysis of covariance compared the intervention and control groups on food purchasing patterns while adjusting for household income.

Results—The intervention resulted in greater purchasing of fruit and green and yellow vegetables. No other group differences were observed.

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Conclusions and Implications—Long-term evaluations of supermarket interventions should be conducted to improve the evidence base, and to determine the potential for impact on food choices associated with decreased chronic disease.

Keywords

health education; health behavior; health promotion; intervention studies; public health; diet

INTRODUCTION

Over two-thirds of adults and almost one-third of children in the US are currently overweight or obese and are therefore at increased risk for a number of chronic diseases.^{1–2} The ubiquity of inexpensive, palatable, energy-dense food is considered a primary contributor to the obesity epidemic, and a number of obesity-reducing modifications to the obesity-promoting environment have been proposed.^{3–7} Interventions aimed at promoting healthier food purchasing patterns represent a promising approach to reducing obesity, but have been relatively understudied. The current pilot study was aimed at determining the feasibility and efficacy of a novel point-of-purchase food shopping intervention in a socioeconomically diverse community.

Rationale for Food Shopping Interventions

Food shopping plays an important role in dietary intake and obesity. Though fast food consumption has risen sharply in recent decades, American families obtain 65–75% of their food from food stores.^{8–12} The average person makes two trips to the supermarket per week.^{13–14} Approximately 85% of individuals report purchasing most of their food during large, regular shopping trips, with 50% of individuals reporting one large shopping trip per week.¹⁵ In addition to foods purchased for the home, supermarkets now account for nearly one-fifth of all take-out foods.¹⁴ At the household level, food purchasing is strongly predictive of actual dietary intake; households with a higher aggregated body-mass index (BMI) purchase more units of daily energy and fat per member than households with lower aggregated BMIs.^{16–17} Importantly, children's dietary intake is largely determined by the shopping habits of caregivers, and the availability of fruit, vegetables, and sugared soft drinks in the home is predictive of their consumption among children and adolescents.^{18–23} Therefore, it is plausible that interventions which meaningfully influence food purchasing patterns could have a substantial positive impact on dietary intake and obesity risk for all members of a household.

A number of studies have shown that individuals with lower educational attainment or lower income are more likely to be obese and are less likely to follow the Dietary Guidelines recommended by the United States Department of Agriculture (USDA) when compared with those of higher educational attainment or a higher income.^{24–29} Lower educational attainment and lower household income are associated with unhealthy food purchasing patterns.^{30–32} Therefore, income and educational attainment should be considered when investigating the influences of food purchasing.

Previous Food Shopping Interventions

Point-of-purchase (POP) food shopping interventions are those which involve modifying the food store environment to promote healthy purchasing patterns, often in accordance with established criteria such as the Dietary Guidelines for Americans.³³ Prior POP interventions utilized several strategies, such as: 1) price discounts and coupons for healthier foods, 2) increasing the availability, variety, and convenience of fresh produce, 3) promotion and advertising of healthy foods, and 4) printed or posted nutrition education.^{34–37} In a review of

10 environmental food shopping interventions tested since the mid-1970's, Seymour et al. found wide variability in intervention effectiveness.³⁸ Half of the studies showed no change in sales of targeted food items (i.e., low-fat foods, fresh produce), and half of the studies showed an increase in some of the targeted food items.

Several more recent studies have also produced mixed results. The Healthy Foods Hawaii intervention used posters, educational displays, shelf labels, and cooking demonstrations to promote healthier food choices and food preparation methods.³⁹ The researchers found that the intervention resulted in improved food-related knowledge and better global diet quality among children who received the intervention. Interestingly, few participants reported seeing the posted POP signage included in the intervention. A recent trial by Ni Mhurcha and colleagues evaluated the effect of price discounts and computer-generated educational mailings (tailored to match participants' purchasing habits) on supermarket purchases.⁴⁰ Electronic scanner sales data were used to assess change from baseline in percentage energy from saturated fat and other nutrients purchased, as well as change in the quantity of healthier food items purchased. At the end of 6 months, the change in percentage of energy from saturated fat or other nutrients purchased did not differ between controls and participants who received price discounts, nutrition education, or both. However, participants who received price discounts on healthy foods bought significantly "healthier" foods at 6 months and 12 months. Although researchers concluded that education had no effect on food purchases, the educational intervention (a targeted mailing of nutrition-education materials) could be considered "low-intensity" because there was no face-to-face education component with participants and it is unknown to what extent participants actually received and read the materials.

A number of valuable lessons can be gleaned from prior studies of food shopping interventions. First, prior research has demonstrated that POP interventions can reach large numbers of people at a low cost, and are feasible even in low-income areas.^{35,41–43} Second, research has shown that POP strategies can influence behavior.⁴⁴ Consumer decision-making studies have shown that the average shopper arrives at the store undecided about what to buy and is influenced by aspects of the store environment such as displays and packaging.⁴⁵ These findings suggest that food shopping is a modifiable behavior that can be influenced very late in the decision-making process, including at the point-of-purchase. Third, there is some evidence of a dose-response relationship between the amount of health-education material provided at the point-of-purchase and the impact on individual diet quality.⁴⁶ Finally, most studies have measured program effectiveness in terms of purchasing of targeted items. A more fine-grained measure of program effectiveness, such as metrics reflecting the nutritional composition of all foods purchased during a shopping trip, may provide a more sensitive and meaningful outcome measure and would provide investigators with the ability to design interventions that target more general nutritional outcomes (e.g., saturated fat purchasing).

To our knowledge, no prior POP intervention has combined environmental manipulations (e.g., shelf signs, sample shopping lists) with in-person food shopping education provided by a nutrition educator. Such an approach would enable greater tailoring of nutritional recommendations, with shoppers able to ask questions about food purchases based on their current needs at the time of purchase. Several large grocery chains employ dietitians to develop and market healthy shopping campaigns, and the use of nutrition educators as a means of delivering a POP intervention deserves study to determine its feasibility and potential benefit. The current study sought to pilot test a multicomponent supermarket POP intervention featuring individualized nutrition education on the nutrient composition of food purchases. Compared to a "usual care" control group, it was hypothesized that purchases of participants in the intervention group would be lower in mean total fat, saturated fat, and

trans fat density (g/1000 kcal), and higher in fruits, total vegetables, and dark green and bright yellow vegetables (servings/1000 kcal) purchased.

METHODS

Study Overview

This pilot study used a randomized design to examine the impact of a POP healthy shopping intervention with face-to-face nutrition education on purchasing patterns relative to usual care (shelf signs only). The study was conducted in partnership with a large, Arizona-based, family-owned grocery chain with over 130 stores. Data were collected at a supermarket located in Surprise, Arizona between August and November 2009. The specific location of the store and the dates available for research were determined by supermarket management. The research was approved by both the Arizona State University and University of Arizona Institutional Review Boards.

Intervention Description

The POP intervention tested in this study included brief, face-to-face nutrition education focused on healthy food purchasing habits, and a packaged *EatSmart*® program developed by the store dietitian that consists of shelf signs and printed materials identifying healthy food choices. *EatSmart*® includes colorful nutrition shelf tags placed below items identified as a “healthier option,” “heart healthy,” “low sodium,” “calcium rich,” or an “immune booster” based on the Food and Drug Administration labeling regulations [with the exception of low sodium product selection based on more stringent guidelines (<140 mg) and the inclusion of the American Heart Association guidelines for whole grain/fiber-containing products]. Approximately 600 shelf tags (total for all five labels) are placed in each store. Bookmark-sized healthy shopping lists and a monthly *EatSmart*® newsletter featuring nutritional foods and recipes were also available in stores.

The face-to-face (one-to-one) component of the intervention was provided by a nutrition educator who followed a bulleted checklist of topics to be covered. The nutrition educator introduced the *EatSmart*® program and provided instructions on how to use the 5 *EatSmart*® nutrition shelf tags and shopping lists to identify healthy purchases. Due to our interest in evaluating the impact of the intervention on purchasing of fats and fruits and vegetables, the nutrition educator emphasized the use of the Heart Healthy (shopping for non-fat and low-fat dairy products, leaner beef and pork, vegetable oil, and other sources of healthy fats) and Immune Booster (increasing fruit and vegetable purchasing, especially dark green, orange, red, and yellow colors) tags. Finally, the nutrition educator provided an overview of nutrition label reading and answered any questions raised by the shopper. The face-to-face component of the intervention was designed to be delivered at the front of the store in less than 10 minutes.

Participants

One hundred and fifty-three adult shoppers were recruited on-site by researchers seated at a booth near the store entrance. Data collection occurred on weekdays and weekends (Saturday and Sunday), each week, for 6 consecutive hours each day, over the course of 4 months. Data collection alternated between 10:00 AM-4:00 PM and 1:00 PM and 7:00 PM. Participants were randomly assigned to a group to reduce systematic influence of the day of the week on intervention effects; and the days and times of recruitment were varied to ensure that our sample adequately reflected patterns of store traffic throughout the week. Shoppers who approached the researchers received a study description and were offered a \$15 Basha's Supermarket gift card as a participation incentive. Study eligibility criteria were as follows: age ≥ 18 y, participant was the primary household shopper, planning to purchase

at least 15 different food items, able to speak and write in English, able to shop unassisted, has transportation (due to the potential impact on the number of total and refrigerated/frozen items purchased), and owns a home refrigerator. Eligible participants were randomly assigned to either the intervention or control group using block randomization immediately after consenting to the study.

Procedure

Participants assigned to the control group received no education or printed materials of any kind, but were instructed to return to the research table after performing their usual shopping. The *EatSmart*® shelf tags posted in the store were visible to control participants, but they received no explanation of their meaning or instructions for use. Shoppers randomized to the intervention group received printed *EatSmart*® shopping lists and the 10-minute face-to-face component of the intervention described above prior to shopping. A researcher met all participants after they had selected their items for purchase. Researchers took digital photographs of all food and beverage purchases prior to the items being bagged by supermarket staff. Additionally, copies of grocery receipts were obtained from the checkout clerk, and field notes were taken to identify food items lacking packaging or a nutrition label (e.g., fresh produce, bulk candy and nuts). Participants completed two brief measures after checking out: a demographics survey (that included questions asking about intervention usefulness) and a card on which participants were to mark any of 12 signs, tags, or emblems that they observed while shopping (one of which was an *EatSmart*® shelf tag). Prior to exiting the supermarket, participants were debriefed and compensated with a \$15 gift card.

Measures

Food purchasing outcomes—Nutritional analysis of food purchases was performed using the Nutrition Data System for Research (NDSR; Nutrition Coordinating Center, Minneapolis, MN). The brand, preparation, and amount of every purchased food item was derived from digital photographs of food packaging and nutrition labels, duplicate grocery receipts, and field notes taken by researchers. The following primary outcome variables were calculated for each participant's entire shopping basket: total fat (g/1000 kcal), saturated fat (g/1000 kcal), trans fat (g/1000 kcal), fruit (servings/1000 kcal), vegetables (servings/1000 kcal), and dark green and bright yellow vegetables (servings/1000 kcal). NDSR estimates servings of fruits and vegetables according to the USDA standards.

Demographic characteristics—A survey developed by the researchers collected information such as shopper's self-reported height, weight, body mass index, age, gender, race/ethnicity, household income range, highest educational attainment, and number of children and adults in the household. Participants were also asked to indicate the number of occasions per week they made convenience store purchases, prepared their own meals, visited fast food or take-out restaurants, dined in restaurants, and consumed fruits and vegetables. Fruit, fruit juice, and vegetable intake questions in the survey were modified from Module 16 of the Behavioral Risk Factor Surveillance System Survey Questionnaire.⁴⁷ Participants randomized to the intervention group were also asked to report how useful they found the intervention and whether offering such interventions would influence their likelihood to shop at a particular store in the future.

Household income range and number of members in household were used to determine percent of the poverty guideline for each participant. The federal poverty guidelines were assigned as determined by the US Department of Health and Human Services and the Assistant Secretary for Planning and Evaluation.⁴⁸ For each participant, an income estimate was determined by taking the mid-point of the income range from the survey. The number

of people in each household was compared against the poverty guideline for 2007 and the regional income level for the specified number of household members was determined. The percent of the poverty guideline was calculated for each participant by dividing the midpoint of the income range by the regional federal poverty guideline (dependent on household number) and multiplying by 100. For example, 250% of the federal poverty guideline represents an annual income of \$55,135.00 for a family of 4.

Analytic Plan

The sample size was based on the difference between the control and treatment groups in terms of servings of fruits and vegetables as a primary endpoint. Sample size was determined through G*Power and PASS 2008 (Number Cruncher Statistical Systems, Kaysville, UT). A sample of 128 participants (64 per arm) was estimated to provide >80% power at a 5% level of significance (2-sided) to detect a medium effect ($d=.50$). The estimated sample size was inflated to account for a possible 10% attrition rate (70 per group).

Statistical analyses were performed using SPSS (version 17.0, 2008, SPSS Institute Inc, Chicago, IL). Kolmogorov-Smirnov tests and histograms were generated to determine whether the dependent variables displayed normal distribution. The Kolmogorov-Smirnov tests of normality were violated for all outcome variables; therefore, medians and interquartile ranges are displayed. Chi-square and Mann-Whitney U tests were used to determine whether the treatment and control groups were comparable on key demographic variables such as age and BMI. A between-groups analysis of covariance was conducted to compare the effectiveness of the intervention on the nutrient profile of food purchases. The independent variable was the treatment (control or intervention), and the dependent variables included total fat (g/1000 kcal), saturated fat (g/1000 kcal), trans fat (g/1000 kcal), fruits (servings/1000 kcal), total vegetables (servings/1000 kcal), and dark green/bright yellow vegetables (servings/1000 kcal). The percent federal poverty line calculated for each participant was used as the covariate in this analysis. There is no non-parametric test equivalent to a one-way between-groups analysis of covariance. According to Conover (1999), when a non-parametric test that is equivalent to a parametric test is not available, the parametric test may be used as long as the parametric test results on the raw data are the same as the parametric tests on the ranked data.

RESULTS

Sample characteristics are shown in Table 1. Of approximately 500 individuals who inquired about the study, 164 met initial inclusion criteria and were randomly assigned to either the treatment ($n=80$) or the control ($n=84$) group. The final analysis included 153 participants (treatment $n=70$; control $n=83$). Sample size differences stem from a combination of the randomization table, which was based on a random number sequence generated with a computer program, and a few additional participants not purchasing 15 different food items. With the exception of household income level, descriptive characteristics were not significantly different between groups (Table 1). Eighty-one percent of the entire study population were female (mean age 41 y), 78% were of white race/ethnicity, each shopping for an average of three people. Sixty-one percent had less than a college degree, and 39% had an annual household income of less than \$60,000. The control group [median (Md)=355%] reported a greater percent of the federal poverty guideline when compared to those in the intervention group ($Md=295\%$) ($p=0.044$). Sixty-nine percent of the participants randomized to receive the intervention reported the program very or extremely useful, and 26% reported it somewhat useful. Sixty-five percent of participants in the intervention group reported they would be more likely to shop in a supermarket that offered a healthy shopping program, and 32% reported that it would make no difference in their likelihood to shop.

Approximately 65% of the intervention group and 29% of the control group reported seeing the *EatSmart*[®] shelf tags.

Nutrient Profile of Food Purchases

A one-way between-groups analysis of covariance was conducted to compare the effectiveness of the intervention on the nutrient profile of food purchases, using percent federal poverty line as a covariate (Table 2). After adjusting for percent federal poverty line, there were no significant differences between the two groups on purchased total fat, saturated, or trans fat, and servings of total vegetables (Table 2). However, the intervention group purchased significantly more servings (per 1000 kcal) of whole fruit [$F(1,138)=9.50$, $p=0.002$, partial eta squared of 0.064] and dark green/bright yellow vegetables [$F(1,138)=4.80$, $p=0.034$, partial eta squared of 0.034] when compared to the control group.

DISCUSSION

Prior POP supermarket interventions have had modest effects on food purchasing patterns. Therefore, we sought to test the impact of a POP intervention with in-person counseling from a nutrition educator on food purchasing patterns, while adjusting for percent federal poverty line. The POP intervention with in-person counseling did not have a significant effect on fat density (total, saturated, and trans), or total vegetable servings of food purchases when compared to that of the control group. However, the intervention group did purchase more servings of fruit and more servings of bright green/yellow vegetables when compared to the control group. Food purchasing patterns are predictive of actual dietary intake¹⁷, and even these modest effects could translate into meaningful health benefits if sustained long-term in this population (an increase of 0.8 servings of fruits and bright green/yellow vegetables per day for someone with a 2,000 kcal/d diet). Future research is clearly warranted on the long-term effects of POP interventions involving in-person nutrition education.

Mhurchu et al. reported that neither price discounts nor nutrition education had a significant impact on energy density, total fat, saturated fat, or vegetable purchases.⁴⁰ However, the results of our study indicated significantly more servings of fruits were purchased by those randomized to the intervention group when compared to the control group, whereas Mhurchu et al. did not report similar observations.⁴⁰ Kristal et al. evaluated a supermarket intervention to increase the consumption of fruits and vegetables.³⁵ Advertisements, coupons, recipe flyers, store signage, and food demonstrations were utilized in their supermarket intervention but failed to increase fruit and vegetable consumption as measured by a food frequency questionnaire at baseline and one year post randomization.

Gittelsohn et al. did not observe a significant impact on Healthy Eating Index component scores (including fat, saturated fat, fruits, and vegetables) among adult caregivers in Hawaii following the Healthy Foods Hawaii intervention.³⁹ Similar to our study, this intervention utilized POP strategies, such as posters, educational displays, and shelf labels to improve healthy food purchases. Dietary intake variables included diet quality components (Healthy Eating Index scores), and were determined via participant dietary recalls. In contrast to our findings, Gittelsohn et al. did not observe an increase in fruit intake.³⁹ Differences in outcome measures could account for the difference in findings (density or servings in shopping basket vs Healthy Eating Index score).

The strengths of this pilot study include the use of a control group, a free-living study population, and the objective measure of the nutrient profile of shopping baskets. Although the majority of participants were female, the population was moderately diverse according to income and educational attainment. Reflecting intervention feasibility and high participant

satisfaction, exit survey data suggested that the majority of the participants in the intervention group found the program very or extremely useful, and would be more likely to shop at a supermarket that offered similar services to their customers.

Study limitations include the absence of baseline measures, the implementation of the intervention at a single site, and the short-term duration of the follow-up period (one episode of shopping). This last limitation is perhaps the most significant considering that the health benefits of POPs are based on their ability to yield long-term dietary changes, and stronger effects may be seen if participants are repeatedly exposed to intervention components. Also, we did not have the opportunity to pilot test the EatSmart intervention tools or our survey instrument prior to the study. According to the exit survey, only 29% of the participants in the control group reported seeing the EatSmart shelf tags. However, it would be expected that any contamination of the control group would reduce our ability to detect an intervention effect. Therefore, exposure to the shelf tags among the control group does not bear upon the interpretation of our findings of an intervention effect. Similarly, as both the intervention and control groups received the gift card as compensation (after they had already paid for their food items), we can conclude that the effects of the intervention are not confounded by the presentation of the gift card.

As dietitians and nutrition educators are more commonly employed by food retailers, the value of in-person counseling as a component of POP interventions should be studied. Many prior POP intervention studies have found modest effects. More intensive interventions may be required, as well as need for long-term follow-up using supermarket till receipts or electronic sales data.

IMPLICATIONS FOR RESEARCH AND PRACTICE

This pilot study demonstrated the feasibility of conducting a supermarket intervention to promote purchasing of low-fat foods, fruits, and vegetables at the point-of-purchase (POP). The success of supermarket interventions that use POP strategies depends on many factors, including cooperation of supermarket management and employees, research design and implementation, and consumer interest in POP programs. Encouraging the feasibility of supermarket interventions, in our study and in others, shoppers have expressed the importance of supermarkets offering healthy shopping programs to assist in food shopping and promoting healthy nutrition.⁴⁹

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References

1. Flegal KM, Carroll MD, Ogden CL, Curtin LR. Prevalence and trends in obesity among US adults, 1999–2008. *JAMA*. 2010; 303(3):235–241. [PubMed: 20071471]
2. Ogden CL, Carroll MD, McDowell MA, Flegal KM. Obesity among adults in the United States--no statistically significant change since 2003–2004. *NCHS Data Brief*. 2007; 1(1):1–8. [PubMed: 19389313]

3. Swinburn B, Sacks G, Ravussin E. Increased food energy supply is more than sufficient to explain the US epidemic of obesity. *Am J Clin Nutr.* 2009; 90(6):1453–1456. [PubMed: 19828708]
4. Drewnowski A. The real contribution of added sugars and fats to obesity. *Epidemiol Rev.* 2007; 29:160–171. [PubMed: 17591599]
5. French SA, Story M, Jeffery RW. Environmental influences on eating and physical activity. *Annu Rev Public Health.* 2001; 22:309–335. [PubMed: 11274524]
6. Hill JO. Can a small-changes approach help address the obesity epidemic? A report of the joint task force of the American society for nutrition, institute of food technologists, and international food information council. *Am J Clin Nutr.* 2009; 89(2):477–484. [PubMed: 19088151]
7. Pomeranz JL, Teret SP, Sugarman SD, Rutkow L, Brownell KD. Innovative legal approaches to address obesity. *The Milbank Quarterly.* 2009; 87(1):185–213. [PubMed: 19298420]
8. Bauer KW, Larson NI, Nelson MC, Story M, Neumark-Sztainer D. Fast food intake among adolescents: Secular and longitudinal trends from 1999 to 2004. *Prev Med.* 2009; 48(3):284–287. [PubMed: 19166872]
9. Guthrie JF, Lin BH, Frazao E. Role of food prepared away from home in the American diet, 1977–78 versus 1994–96: Changes and consequences. *J Nutr Educ Behav.* 2002; 34(3):140–150. [PubMed: 12047838]
10. Nielsen SJ, Popkin BM. Patterns and trends in food portion sizes, 1977–1998. *JAMA.* 2003; 289(4):450–453. [PubMed: 12533124]
11. Nielsen SJ, Siega-Riz AM, Popkin BM. Trends in energy intake in U.S. between 1977 and 1996: Similar shifts seen across age groups. *Obes Res.* 2002; 10(5):370–378. [PubMed: 12006636]
12. Nielsen SJ, Siega-Riz AM, Popkin BM. Trends in food locations and sources among adolescents and young adults. *Prev Med.* 2002; 35(2):107–113. [PubMed: 12200094]
13. Food Marketing Institute. Trends: Consumer attitudes and the supermarket. Washington, DC: Food Marketing Institute; 2004. Retrieved November 20, 2010, from the Food Marketing Institute Official Website: http://www.fmi.org/for_members/index.cfm?fuseaction=archive
14. Food Marketing Institute. Industry Overview 2008: Supermarket facts. Retrieved November 20, 2010, from the Food Marketing Institute Official Website: http://www.fmi.org/facts_figs/?fuseaction=superfact
15. Yoo S, Baranowski T, Missaghian M, et al. Food-purchasing patterns for home: A grocery store-intercept survey. *Public Health Nutr.* 2006; 9(3):384–393. [PubMed: 16684391]
16. Ransley JK, Donnelly JK, Khara TN, et al. The use of supermarket till receipts to determine the fat and energy intake in a UK population. *Public Health Nutr.* 2001; 4(6):1279–1286. [PubMed: 11796091]
17. Ransley JK, Donnelly JK, Botham H, Khara TN, Greenwood DC, Cade JE. Use of supermarket receipts to estimate energy and fat content of food purchased by lean and overweight families. *Appetite.* 2003; 41(2):141–148. [PubMed: 14550311]
18. Busick DB, Brooks J, Pernecky S, Dawson R, Petzoldt J. Parent food purchases as a measure of exposure and preschool-aged children's willingness to identify and taste fruit and vegetables. *Appetite.* 2008; 51(3):468–473. [PubMed: 18573567]
19. Savage JS, Fisher JO, Birch LL. Parental influence on eating behavior: Conception to adolescence. *J Law Med Ethics.* 2007; 35(1):22–34. [PubMed: 17341215]
20. Cullen KW, Baranowski T, Owens E, Marsh T, Rittenberry L, de Moor C. Availability, accessibility, and preferences for fruit, 100% fruit juice, and vegetables influence children's dietary behavior. *Health Educ Behav.* 2003; 30(5):615–626. [PubMed: 14582601]
21. Grimm GC, Harnack L, Story M. Factors associated with soft drink consumption in school-aged children. *J Am Diet Assoc.* 2004; 104(8):1244–1249. [PubMed: 15281041]
22. Jago R, Baranowski T, Baranowski JC, Cullen KW, Thompson D. Distance to food stores & adolescent male fruit and vegetable consumption: Mediation effects. *Int J Behav Nutr Phys Act.* 2007; 4:35. [PubMed: 17850673]
23. 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(3):198–208. [PubMed: 12914825]
24. McLaren L. Socioeconomic status and obesity. *Epidemiol Rev.* 2007; 29:29–48. [PubMed: 17478442]

25. Wang Y, Beydoun MA. The obesity epidemic in the United States--gender, age, socioeconomic, racial/ethnic, and geographic characteristics: A systematic review and meta-regression analysis. *Epidemiol Rev.* 2007; 29:6–28. [PubMed: 17510091]
26. Galobardes B, Morabia A, Bernstein MS. Diet and socioeconomic position: Does the use of different indicators matter? *Int J Epidemiol.* 2001; 30(2):334–340. [PubMed: 11369739]
27. Giskes K, Turrell G, van Lenthe FJ, Brug J, Mackenbach JP. A multilevel study of socioeconomic inequalities in food choice behaviour and dietary intake among the Dutch population: The GLOBE study. *Public Health Nutr.* 2006; 9(1):75–83. [PubMed: 16480537]
28. Mullie P, Clarys P, Hulens M, Vansant G. Dietary patterns and socioeconomic position. *Eur J Clin Nutr.* 2010; 64(3):231–238. [PubMed: 20087378]
29. Roos E, Prattala R, Lahelma E, Kleemola P, Pietinen P. Modern and healthy? Socioeconomic differences in the quality of diet. *Eur J Clin Nutr.* 1996; 50(11):753–760. [PubMed: 8933123]
30. Ball K, Crawford D, Mishra G. Socio-economic inequalities in women's fruit and vegetable intakes: A multilevel study of individual, social and environmental mediators. *Public Health Nutr.* 2006; 9(5):623–630. [PubMed: 16923294]
31. Ricciuto L, Tarasuk V, Yatchew A. Socio-demographic influences on food purchasing among Canadian households. *Eur J Clin Nutr.* 2006; 60(6):778–790. [PubMed: 16418741]
32. Turrell G, Kavanagh AM. Socio-economic pathways to diet: Modeling the association between socio-economic position and food purchasing behaviour. *Public Health Nutr.* 2006; 9(3):375–383. [PubMed: 16684390]
33. Glanz K, Yaroch AL. Strategies for increasing fruit and vegetable intake in grocery stores and communities: policy, pricing, and environmental change. *Prev Med.* 2004; 39(Suppl 2):S75–80. [PubMed: 15313075]
34. Ernst ND, Wu M, Frommer P, et al. Nutrition education at the point of purchase: The foods for health project evaluated. *Prev Med.* 1986; 15(1):60–73. [PubMed: 3714660]
35. Kristal AR, Goldenhar L, Muldoon J, Morton RF. Evaluation of a supermarket intervention to increase consumption of fruits and vegetables. *Am J Health Promo.* 1997; 11(6):422–425.
36. Paine-Andrews A, Francisco VT, Fawcett SB, Johnston J, Coen S. Health marketing in the supermarket: Using prompting, product sampling, and price reduction to increase customer purchases of lower-fat items. *Health Marketing Quart.* 1996; 14(2):85–99.
37. Rodgers AB, Kessler LG, Portnoy B, et al. "Eat for health": A supermarket intervention for nutrition and cancer risk reduction. *Am J Public Health.* 1994; 84(1):72–76. [PubMed: 8279615]
38. Seymour JD, Yaroch AL, Serdula M, Blanck HM, Khan LK. Impact of nutrition environmental interventions on point-of-purchase behavior in adults: A review. *Prev Med.* 2004; 39(Suppl 2):S108–36. [PubMed: 15313080]
39. Gittelsohn J, Vijayadeva V, Davison N, et al. A food store intervention trial improves caregiver psychosocial factors and children's dietary intake in Hawaii. *Obes.* 2010; 18(Suppl 1):S84–90.
40. Ni Mhurchu C, Blakely T, Jiang Y, Eyles HC, Rodgers A. Effects of price discounts and tailored nutrition education on supermarket purchases: A randomized controlled trial. *Am J Clin Nutr.* 2010; 91(3):736–747. [PubMed: 20042528]
41. Sutherland LA, Kaley LA, Fischer L. Guiding stars: The effect of a nutrition navigation program on consumer purchases at the supermarket. *Am J Clin Nutr.* 2010; 91(4):1090S–1094S. [PubMed: 20147468]
42. Lang JE, Mercer N, Tran D, Mosca L. Use of a supermarket shelf-labeling program to educate a predominately minority community about foods that promote heart health. *J Am Diet Assoc.* 2000; 100(7):804–809. [PubMed: 10916519]
43. O'Loughlin J, Ledoux J, Barnett T, Paradis G. La commande du coeur ("shop for your heart"): A point-of-choice nutrition education campaign in a low-income urban neighborhood. *Am J Health Promo.* 1996; 10(3):175–178.
44. Matson-Koffman DM, Brownstein JN, Neiner JA, Greaney ML. A site-specific literature review of policy and environmental interventions that promote physical activity and nutrition for cardiovascular health: What works? *Am J Health Promo.* 2005; 19(3):167–193.

45. Inman, JJ.; Winer, RS. Where the rubber meets the road: a model of in-store consumer decision-making; Working paper. 1998. p. 98-122. Retrieved November 1, 2010, from the Marketing Science Institute Official Website: <http://www.msi.org>
46. Cheadle A, Psaty BM, Curry S, et al. Community-level comparisons between the grocery store environment and individual dietary practices. *Prev Med.* 1991; 20(2):250–261. [PubMed: 2057471]
47. Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Questionnaire. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2007.
48. US Department of Health and Human Services (USDHHS), & Assistant Secretary for Planning and Evaluation (ASPE). Poverty guidelines, research, and measurement. 2010. Retrieved May 1, 2010, from the ASPE Official Website: <http://aspe.hhs.gov/poverty>
49. Vermeer WM, Steenhuis IH, Seidell JC. From the point-of-purchase perspective: A qualitative study of the feasibility of interventions aimed at portion-size. *Health Policy.* 2009; 90(1):73–80. [PubMed: 18762350]

Table 1Descriptive characteristics by shopping intervention group^{*}

Characteristics	Intervention group (n=70)	Control group (n=83)	All participants (n=153)
Age (y) ^a	43 (24)	41 (18)	41 (21)
Sex [n (%)]			
Female	59 (84)	64 (77)	123 (81)
Male	11 (16)	19 (23)	30 (19)
Height (cm) ^a	165 (12)	165 (15)	165 (13)
Weight (kg) ^a	75 (27)	77 (25)	77 (27)
Body mass index (kg/m ²) ^a	27.7 (9.2)	27.4 (7.4)	27.6 (8.9)
Race [n (%)]			
White	52 (74)	68 (82)	120 (78)
Black or African-American	3 (4)	1 (1)	4 (3)
Hispanic/Latino ethnicity [n (%)]	11 (16)	10 (12)	21 (14)
Highest educational attainment [n (%)]			
<College	49 (70)	45 (54)	94 (61)
College	10 (14)	20 (24)	30 (20)
Graduate degree	11 (16)	18 (22)	29 (19)
Percent Federal Poverty ^{a,*}	295 (197)	355 (219)	322 (238)
No. of people in household ^a	4 (3)	3 (2)	3 (2)
Children (< 18 y)	1 (2)	1 (2)	1 (2)
Adults	2 (0)	2 (0)	2 (0)
Shopping occasions/month ^a	8 (6)	8 (6)	8 (7)
Fast food visits/month ^a	2 (4)	3 (3)	3 (3)
Restaurant visits/month ^a (sit-down/carry-out)	2 (3)	2 (3)	2 (3)
Fruit intake (times/wk) ^{a,b}	5 (4)	6 (3)	6 (3)
Fruit juice intake (times/wk) ^{a,b}	3 (5)	2 (5)	3 (4)
Vegetable intake (times/wk) ^{a,b}	7 (6)	7 (5)	7 (5)

^aValues are medians; interquartile range in parentheses.^bFruit, fruit juice, and vegetable intake questions were modified from Module 16 of the Centers for Disease Control and Prevention (CDC). *Behavioral Risk Factor Surveillance System Survey Questionnaire*. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2007.

* Non-parametric Mann-Whitney U tests were used to determine differences in descriptive characteristics by group. The control group reported a greater percent of the federal poverty guideline ($p=0.044$) when compared to the intervention group. No other group differences were found.

Table 2Nutrient composition of food purchases in the intervention and control groups^{a,b}

Nutrient profile ^c	Intervention (n=70)	Control (n=83)	p	Partial eta squared
Total fat g/1000 kcal	39 (19)	39 (19)	0.494	0.003
Saturated fat g/1000 kcal	14 (9)	14 (9)	0.460	0.004
Trans fat g/1000 kcal	1.5 (1.2)	1.5 (1.2)	0.993	0.000
Fruit Servings/1000 kcal	0.7 (0.9)	0.4 (0.7)	0.002 [*]	0.064
Vegetables Servings/1000 kcal	1.3 (2.2)	1.0 (1.7)	0.063	0.025
Dark green/yellow vegetables Servings/1000 kcal	0.2 (0.5)	0.1 (0.5)	0.034 [*]	0.034

^aValues are medians; interquartile range in parentheses.^bAnalysis of Covariance model controlling for percent federal poverty line.^cNutrient and food calculations of shopping cart were performed using the Nutrient Data System for Research (NDSR) software version, developed by the Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN, Food and Nutrient Database.^{*}Statistically significant at the p<0.05 level.