



# Health Promotion and Healthier Products Increase Vending Purchases: A Randomized Factorial Trial



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## ABSTRACT

**Background** The current food environment has a high prevalence of nutrient-sparse foods and beverages, most starkly seen in vending machine offerings. There are currently few studies that explore different interventions that might lead to healthier vending machine purchases.

**Objective** To examine how healthier product availability, price reductions, and/or promotional signs affect sales and revenue of snack and beverage vending machines.

**Design** A 2×2×2 factorial randomized controlled trial was conducted.

**Participants/setting** Students, staff, and employees on a university campus.

**Intervention** All co-located snack and beverage vending machines (n=56, 28 snack and 28 beverage) were randomized into one of eight conditions: availability of healthier products and/or 25% price reduction for healthier items and/or promotional signs on machines. Aggregate sales and revenue data for the 5-month study period (February to June 2015) were compared with data from the same months 1 year prior. Analyses were conducted July 2015.

**Main outcome measures** The change in units sold and revenue between February through June 2014 and 2015.

**Statistical analyses performed** Linear regression models (main effects and interaction effects) and *t* test analyses were performed.

**Results** The interaction between healthier product guidelines and promotional signs in snack vending machines documented increased revenue ( $P<0.05$ ). Beverage machines randomized to meet healthier product guidelines documented increased units sold ( $P<0.05$ ) with no revenue change. Price reductions alone had no effect, nor were there any effects for the three-way interaction of the factors. Examining top-selling products for all vending machines combined, pre- to postintervention, we found an overall shift to healthier purchasing.

**Conclusions** When healthier vending snacks are available, promotional signs are also important to ensure consumers purchase those items in greater amounts. Mitigating potential loss in profits is essential for sustainability of a healthier food environment. *J Acad Nutr Diet.* 2017;117:1057-1065.

**T**WENTY-OUNCE SODAS, CANDY, COOKIES, AND chips—these are the typical items offered in vending machines.<sup>1</sup> Such items tend to have a long shelf life to benefit the vendor, but lack nutrition for the consumer.<sup>1,2</sup> Vending machines contribute to the “toxic food environment,” which is an environment with constant exposure and access to unhealthy foods.<sup>3</sup> Intervention studies in both schools and worksites have examined the effects of creating a healthier vending environment by providing access to healthier snacks and beverages,<sup>4-7</sup> price changes,<sup>8</sup> calorie labels,<sup>9</sup> and education.<sup>10</sup>

A systematic review of healthier vending machine studies<sup>11</sup> indicated that of the 10 interventions or case studies conducted during the past 20 years, 7 had an influence on consumer purchasing,<sup>8,10,12-16</sup> 2 did not document a positive

change,<sup>4,17</sup> and 1 had equivocal or mixed outcomes.<sup>7</sup> Overall, increasing availability of healthier products may be enough to influence some consumer purchasing; however, price reductions and promotional signage could increase the odds of success. To date, only one study<sup>15</sup> has examined the simultaneous effects of changes in healthy product availability, price, and promotional signage. French and colleagues<sup>15</sup> manipulated availability of healthier (ie, low-fat) products, pricing, and promotional signage about the health benefits of low-fat snacks. As prices were reduced, consumer purchasing increased. Promotional signs were only weakly associated with increased sales.

The goal of this factorial experimental study was to determine whether healthier products, pricing, and/or promotion would influence sales and revenue for both snack and

beverage vending machines on a university campus. We hypothesized that each manipulation would independently promote healthier choices among consumers, and that the combination of all three changes would result in the most favorable outcomes. Specifically, the combined effects of healthier products, price reductions, and promotional signs should have the greatest influence on consumer purchasing of healthier snacks and beverages. This study extends prior research by expanding the number of vending machines randomized; including items that are healthier but not necessarily low in fat such as nuts; and targeting healthier vending options across a university campus for students, faculty, and staff.

**METHODS**

This study was deemed exempt by the Yale University Institutional Review Board because no individual information was observed or collected. A message disclosing this project and its design appeared on several university websites, including those of the three partner organizations (ie, the hospitality service, the health plan, and the School of Public Health). The university's Wellness Leadership Group unanimously endorsed the project.

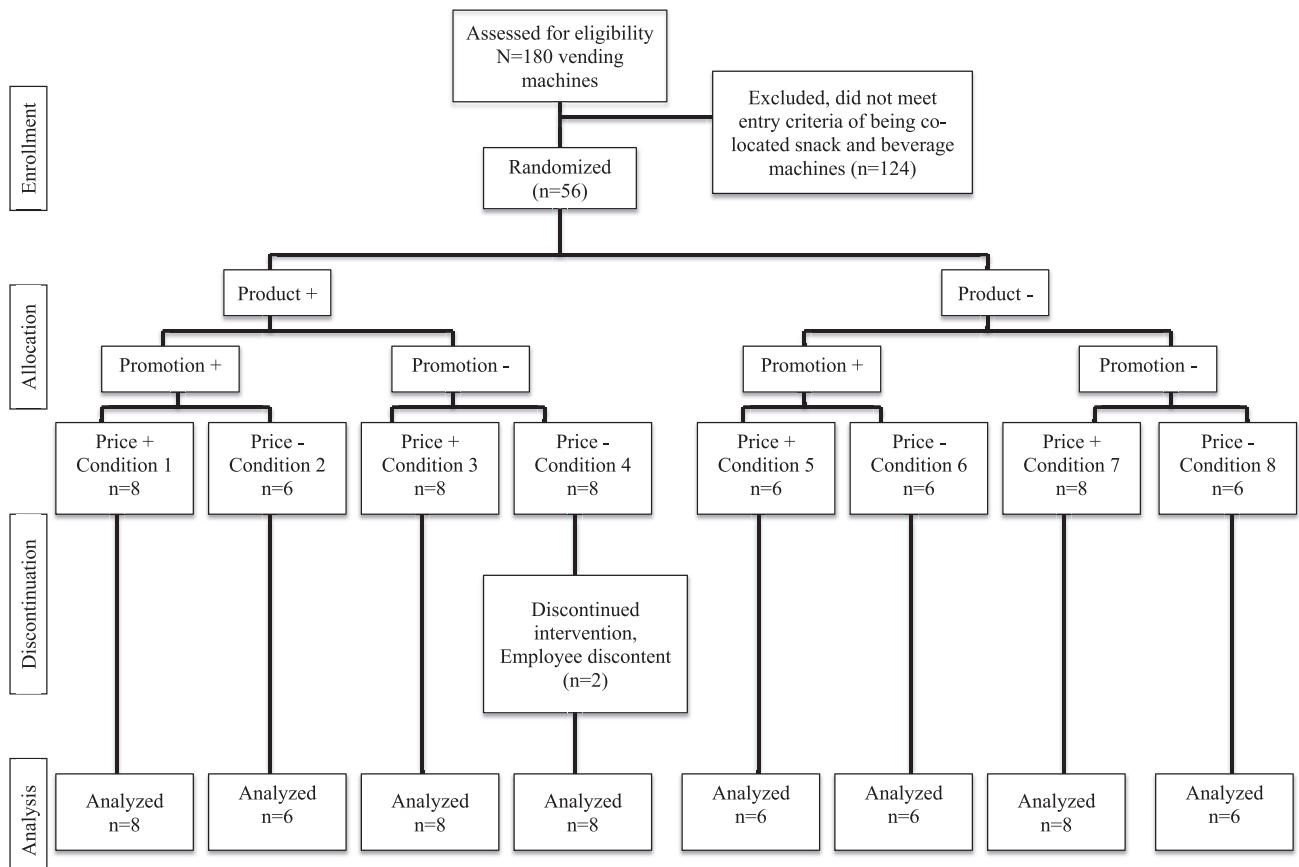
**Study Overview**

This was a 2x2x2 balanced factorial experimental study of all co-located snack and beverage machines on a university

campus (n=56). Snack and beverage machines that were co-located in a single location were included. One hundred twenty-four vending machines did not meet this inclusion criterion. Locations included dormitories, libraries, administrative buildings, and department buildings with classrooms. The researchers used a random number generator to randomly assign vending machines into one of eight different conditions in a 2x2x2 factorial design that manipulated availability of healthier products, pricing, and/or promotional signage (Figure 1). Aggregate sales and revenue data for the 5-month study period (February to June 2015) were compared with sales and revenue data from the prior year. Statistical power exceeds 80% to detect differences in main effects as well as interaction effects.<sup>18,19</sup>

**Intervention Manipulations**

**Product Guidelines.** Snack machines randomized to the healthier product guidelines stocked only items that met *a priori* healthier guidelines as set by the National Automatic Merchandising Association FitPick nutrition standards<sup>20</sup>: ≤250 kcal, ≤20 g sugar, ≤230 mg sodium, ≤10 g fat, ≤3 g saturated fat, and no *trans* fats. Examples of such items include Kar's Nuts Cashews (1.0 oz) (Kar's Nuts), Nature Valley Granola Bars (≤1.5 oz) (General Mills), Baked! Lays Potato Crisps (0.88 oz) (Frito-Lay), and Pirate's Booty (1.0 oz) (B&G Foods, Inc) (puffed rice and corn snack). For snack vending machines randomized into conditions that did not



**Figure 1.** Consolidated Standards of Reporting Trials (CONSORT) flow diagram of vending machines throughout the study: enrollment through analysis.

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