

Does providing nutrition information at vending machines reduce calories per item sold?

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Abstract:

In 2010, the United States (US) enacted a restaurant menu labeling law. The law also applied to vending machine companies selling food. Research suggested that providing nutrition information on menus in restaurants might reduce the number of calories purchased. We tested the effect of providing nutrition information and 'healthy' designations to consumers where vending machines were located in college residence halls. We conducted our study at one university in Southeast US (October-November 2012). We randomly assigned 18 vending machines locations (residence halls) to an intervention or control group. For the intervention we posted nutrition information, interpretive signage, and sent a promotional email to residents of the hall. For the control group we did nothing. We tracked sales over 4 weeks before and 4 weeks after we introduced the intervention. Our intervention did not change what the residents bought. We recommend additional research about providing nutrition information where vending machines are located, including testing formats used to present information.

Keywords: calories | vending machine | Affordable Care Act | nutrition information | menu law

Article:

INTRODUCTION

An increase in the number of meals and snacks purchased away from home (in restaurants, vending machines) often high in calories, saturated fat, and sugar, has been temporally associated with increased obesity in the United States (US) and elsewhere.¹ Wikipedia describes *vending machine* as ‘a machine that dispenses items such as snacks, beverages, alcohol, cigarettes, lottery tickets, cologne, consumer products ... to customers automatically, after the customer inserts

currency or credit into the machine' (see en.wikipedia.org/wiki/Vending_machine). Traditional vending machine snacks – chips, candy, and pastry – are associated with 20 per cent of the excess calories Americans consume,² and vending machines account for 5 per cent of away from home food and beverage sales.² Federal nutrition information in US legislation included in the 2010 Patient Protection and Affordable Care Act requires restaurants and large vending machine companies to make nutrition information available at the point of purchase, before purchase.³ Nutrition information policies, such as this law, intend to limit or prevent diseases related to food consumption by reducing the calories Americans consume away from home.¹

Evidence on nutrition information provided where vending machines are located is limited and contradictory.⁴⁻⁶ Wilbur et al⁵ found that sales of snacks with 140 or fewer calories increased when their proportion in a vending machine space increased, but labels calling attention to low calorie items had no effect. By contrast, Hoerr and Louden⁴ found that when they increased the proportion of snacks that met certain nutrition criteria, overall vending machine sales declined. When they added special labels indicating the products nutrition content, total sales moved upward, but not to the original baseline. The increase in sales was for items they considered less nutritious. When Larson-Brown⁷ added nutrition labels to snacks, the sales of snacks that had more protein, calcium, thiamine, vitamin C, and iron (nutrients believed, at the time, to be lacking in the American diet) increased, but so did sales of snacks that had lower amounts of these micronutrients. It is possible that the different years these studies were conducted could explain some of the apparently contradictory findings.

In two more recent studies,^{6,8} French and colleagues found that labels by themselves had minimal or no impact on vending machine purchases, while price had a substantial impact when it was used to promote purchase of low fat snacks. They also found that a label plus promotion of low fat snacking increased sales of low fat snacks by about 8 per cent, whereas the nutrition label alone had no effect.

Although studies of vending machine sales suggest that a change in availability or price will lead buyers to choose lower fat or lower calorie snacks, the US federal legislation requires only that owners of vending machines provide nutrition information. It encourages rather than requires education and promotion. The legislation is intended to reduce the calories purchased but research has not yet assessed the impact on calories purchased.

A separate body of research on nutrition information labels might guide choice of label type.⁹⁻¹² The US Institute of Medicine (IOM) recommended a standardized assessment of calories, saturated fat, added sugar, and sodium content be used to develop simple, interpretive labels.¹² An interpretive label guides the customer by showing whether or not the noted item (sugar or sodium) is considered to be high or low for a usual diet. The IOM notes that interpretive labels help consumers make choices that align with dietary guidance (a diet low in calories, saturated fat, sugar, and sodium).¹²

As the law requires that vending machine operators provide nutrition information but the evidence about its efficacy is unclear, we undertook an intervention study. We investigated whether a multicomponent nutrition intervention – nutrition information, interpretive label, and promotional health communication – would lead consumers to choose lower calorie snacks that

contained less salt, sugar, and saturated fat. We tested how this multicomponent intervention would impact the behavior of college students. Research suggests that college students are at risk for weight gain due to snacking and access to vending machines.^{13,14} One study¹⁴ showed that 76 per cent of college students reported snacking from vending machines at least once a day, and many college campuses have vending machines in academic buildings and residence halls.

We tested the effect of an intervention package that included nutritional information, item labels, and promotion/education. We focused on two separate outcomes measures: the average calories sold per snack, and the proportion of snacks that contained fewer calories and less saturated fat, sugar, and sodium than the usual snacks. (We refer to these as *Better Choice* snacks.)

We hypothesized that our intervention would decrease the average calories per snack item sold and increase in the proportion of *Better Choice* snacks sold.

METHODS

Study Sample

We studied vending machine sales from 21 machines located in 22 residence halls that housed 4128 students at a southeastern university in the US. Each residence hall had only one snack vending machine, but one set of residence halls with a connecting hallway shared a vending machine. At the end of our study, we had gathered usable sales data from 18 machines. Sixty-seven per cent of students living in these 18 residence halls were female, average age 19. Fifty-seven per cent were in their first year, and 91 per cent were residents of North Carolina. All of the residence halls housed both men and women. (The university institutional review board reviewed and approved our study materials and procedures.)

Intervention

We affixed a poster board adjacent to each vending machine. It listed the *Nutrition Facts Panel* (as required on packaged food in the US) for each product in that vending machine. We also highlighted five products in the machine that met certain per package nutrition criteria (less than 200 calories, 2 g or less of saturated fat, 0 g of trans fat, 7 g or less of sugar, and less than 300 mg of sodium per package). We used these criteria (similar to those recommended by the IOM¹²) to define the snack as a *Better Choice* compared with other snacks within the machine. We placed a sticker with the letters BC inside the machine next to these snacks.

We placed the Nutrition Facts Panel labels, a BC symbol, and the criteria on the posters. In an email from the first author to all residents of the 'intervention' halls, we explained the *Better Choice* criteria. University and nutritionists in the community reviewed the *Better Choice* criteria and the email message for accuracy. We did not provide information or send the promotional email to residents in the control residence halls. We believe that sales reflect residents' behavior, as entry to the residence halls required a key or code.

Procedure

Before the collection of any sales data, the vendor stocked the machines and agreed to keep the items consistent and in the same slots throughout the 8-week study. For each machine, the vendor provided a sheet that listed each snack name and its location inside that machine. We assessed the nutrient content from the Nutrition Facts Panel for each item. Seventeen of the machines contained 35 snack items and 1 machine contained 40.

At the start of Week 5, we placed the nutrition posters in frames adjacent to the intervention machines. A note on the machine directed the customers' attention to the poster. On the same day that we placed the poster and note, we sent the students in those residence halls an email communication about the *Better Choice* criteria. It also announced the availability of nutrition information near the machines. We collected data from 2 October to 27 November 2012. During this time, the campus closed for a few days to observe the Thanksgiving Holiday and sales were lower across all of the machines.

The vendor provided us with sales data on the number of each snack item sold per machine for the 8 continuous weeks. During routine service visits, the vendor representative using a handheld computerized device counted the number of each item sold. If the electronic device failed, the representative conducted and entered a manual count. This occurred three times during this study, once in a control machine and once each in two intervention machines.

During the 8-week experiment, we conducted one intervention fidelity check of a randomly selected group of 11 machines. We did this to confirm that the snack items continued to match the posters. Our fidelity check found that one snack item had changed and we revised that particular poster. Otherwise, the posters accurately reflected the machine content and nutrient disclosures throughout the first 6 weeks of the study. Changes in snack items occurred in all but one machine during the last 2 weeks of data collection (3–12 snacks changed within a given machine when the vendor chose to replace some of the snack items. However, we confirmed that the replacement items were of similar caloric content and the number of *Better Choice* items did not change.) The director of *Residence Life* (an adult staff person responsible for the buildings) confirmed that the posters remained intact and in place during the intervention phase.

At the end of the data collection period, we emailed a link inviting students to participate in a supplemental survey. We sent it to all students living in the original 22 residence halls. We used the survey to complete a second fidelity check: Did those sent the original email communication receive it? Did they see the information at the vending machine?

Research Design

We used a 2 (time)×2 (condition) experimental design to test the effect of our intervention. We collected data throughout a 4-week baseline period (pre-intervention). There was no nutrition information given. We also collected data throughout a 4-week post-intervention period during which we posted information and placed labels for the intervention machines. We used simple random sampling to assign the vending machines to intervention or control.

Analysis

From the sales data, we calculated the average calories per snack sold and the proportion of *Better Choice* snacks sold. For analysis, we chose summary measures (pre-intervention average for each machine and post-intervention average for each machine). Frison and Pocock consider them the best way to capture differences between groups before and after an intervention.¹⁵ Summary measures were necessary because the vending machine data were not all collected weekly (see below). We analyzed the dependent variables separately, using Repeated Measures ANOVA; one within-subject factor (for example, pre- versus post-intervention) and one between-subject factor (intervention versus control). Our data met the assumptions of normality. We used Ver. 20 IBM/ SPSS software for our analysis.¹⁶

When we met with the vendor to retrieve the sales data, we learned that not all machines were serviced weekly. We reviewed the available sales data and learned which machines had data for both the 4-week pre-intervention period and the 4-week post-intervention period. We excluded 3 machines that had only post-intervention data, leaving us with our sample of 18. The 18 machines had at least one set of sales data in the pre-intervention weeks, but 7 had missing data for Week 4. The next available data point – Week 5 – would include sales from one pre-intervention week. Where there were missing data for Week 4, the end of the pre-intervention period, but data for Week 5, sales in Week 5 for that machine would include products sold during both a pre-intervention and a post-intervention week. To prevent confounding in these particular cases, we used the next available data point in the post-intervention period and all those that followed (for example, Weeks 6–8).

Results

The residence halls with the final 18 machines (9 intervention, 9 control) housed 3850 students. More males (34.8 versus 30.4 per cent) and more first year students (63.1 versus 47.1 per cent) lived in the intervention halls, but the differences were not statistically significant. We included sex and year of school as covariates in our models. We present the adjusted numbers.

The average calories (standard deviation (SD)) per snack sold across the 9 intervention machines for the 4 weeks of pre-intervention sales was 252 (24) and for the 4 weeks of post-intervention sales, the average was 251 (21). The average calories (SD) per snack sold across the 9 control machines at the pre-intervention time point was 217(55) and at post-intervention the average was 225(56) (Figure 1). Available snacks ranged in calories from 100 to 470 per package.

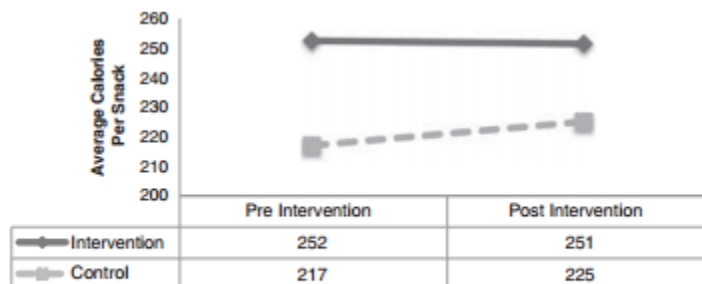


Figure 1: Average calories per snack sold at pre- and post-intervention.
 $P > 0.05$.

The per cent (and SD) of *Better Choice* snacks sold across the intervention machines at pre-intervention was 6.17 per cent (2.72 per cent) and at post-intervention, it was 6.92 per cent (1.14 per cent). The per cent of *Better Choice* snacks sold across the control machines at pre-intervention was 8.24 per cent (3.56) and at post-intervention, the per cent was 6.60 per cent (2.66) (Figure 2). The changes from pre-intervention to post-intervention were not statistically significant ($P>0.05$).

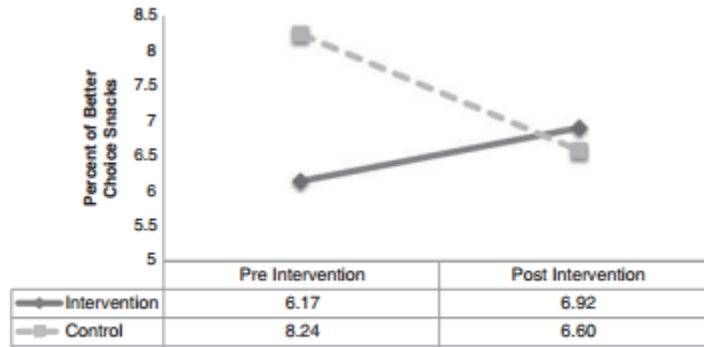


Figure 2: Percent of *Better Choice* snacks sold at pre- and post-intervention. $P>0.05$.

We did not find a significant interaction between intervention period and intervention versus control for the average number of calories sold per snack ($F_{(1,14)}=0.51$, $P=0.49$, $\eta p^2=0.04$). Nor did we find a significant interaction between intervention period and intervention and control for the proportion of *Better Choice* snacks sold ($F_{(1,14)}=1.64$, $P=0.22$, $\eta p^2=0.11$). See Table 1 for tests of effects.

Table 1: F-tests for main effects and interactions

	$F_{(1,14)}$	P	ηp^{2a}
<i>Average calories per snack</i>			
Time	0.211	0.65	0.02
Condition	1.93	0.19	0.12
Time \times condition	0.505	0.49	0.04
<i>Proportion of Better Choice</i>			
Time	2.12	0.17	0.13
Condition	0.568	0.46	0.04
Time \times condition	1.64	0.22	0.11

^aPartial η^2 is a measure of effect size.

Fifty-six per cent of students living in the intervention halls ($n=364$) said that they noticed the on-site nutrition information, but 60 per cent ($n=192$) of them said it did not influence their purchasing decisions. (The n for each question varied slightly due to missing responses.)

DISCUSSION

We did not find support for our hypothesis that a multicomponent intervention including nutrition information, an interpretive label, and a health communication/promotional message would reduce average calories per snack item purchased and an increase in the purchase of snacks with a *Better Choice* label.

Our intervention combined three strategies that had shown promise in previous research (that is, information, label, promotion).⁴⁻⁸ We tailored our promotional component and delivered it directly, following the suggestion of French et al to use promotion outside of the vending setting with media (for example, through email).⁸ We also used an interpretive label, as suggested by the IOM.¹² We were not, however, allowed to place the label directly on the product package.

There are several possible explanations for our findings. Our implementation of the intervention may have been compromised, as the three components we used, might be effective strategies for changing behavior if delivered at full dose and with fidelity. Survey responses from students in the intervention halls suggest that our promotional message did not work as intended. Very few students recalled receiving the message and an even smaller percentage reported reading it. In future studies, it might help to use recurring promotions, delivered multimodally (for example, email, university Web pages, on site posters, social media, text messages).

We attached the BC (*Better Choice*) symbol to the machine, where it may have been overlooked. Ideally, this interpretive label would be on the snack pack itself, where it is more likely to be seen and taken into consideration. Lastly, it is possible that there was a cross over effect. If students in the control halls were exposed to the intervention, they might have changed their purchasing behavior.

Personal characteristics of the residents may have influenced purchasing behavior. We randomly assigned machines with the intent of creating two groups that would differ only in exposure to the intervention. We controlled for potential differences in year of school and sex, but the groups may have differed in a characteristic that we did not measure, such as including more public health or nutrition students.

Changes in the snacks in machines during the last 2 weeks of the study period could also have influenced our results. Ideally, the machines would have been the same in every respect for the entire 8 weeks except information introduced at Week 5. Possibly the new snacks introduced at Week 7 were more or less popular than those they replaced, influencing sales. Our follow-up analysis using the average of Weeks 5 and 6 as the post-measure did not produce different results.

Lastly, the three components used in this study may change behavior and a longer study with a larger sample might have detected the effect.

College students are more likely to consider taste than health (for example, calorie content) when choosing snacks¹³ and females are more likely to choose lower calorie items than males¹⁷. The effects of providing nutrition labels at the vending machine site would be small and moderated by sex. The intervention might work in a different population and setting, such as employees at a worksite. Of five previous studies⁴⁻⁸ that attempted to change behavior at vending machines, only two^{4,7} were conducted at universities and none assessed behavior in residence halls.

POLICY QUESTIONS

Is there (i) a more effective way to display information than is currently proposed by law or, (ii) would a non-information strategy work better to change behavior for this population? Most college-aged students are age 18–29, the group recently found to be the least likely to use nutrition information as it is currently available.¹⁸

First, could a different format for providing the nutrition information be more effective? Traditional vending machine snacks come in packages similar to those in grocery stores. Comprehensive studies on packaged foods conducted in the US,¹² the United Kingdom¹⁹ and Australia²⁰ found that consumers respond better to simple, interpretive labels.²¹ The Multiple Traffic Light (MTL) label placed on the front of the package is well known and effective.²² Each selected nutrient (for example, sugar, salt) is highlighted in a circle that is red, green, or amber; similar to the order of a traffic light. Front of Pack systems (that include a total calories declaration) might allow a vending machine customer to scan all product nutrition information rapidly, something our study was not able to accomplish. The MTL label has a second attribute. It can trigger a health appraisal, as the color red is often associated with danger.²³ As we do not know of any studies that have examined the traffic light approach with college students and snacks from vending machines, we believe it is a fruitful area for future research. This type of nutrition label is not popular with the food industry. If the food industry changes its behavior, as suggested by Robbins and Nestle,²⁴ and reformulates its snacks to be lower in calories, saturated fats, and sugar, the application of traffic light labels may highlight their efforts. In reformulating snacks and using interpretive labels, the food industry becomes part of the solution.

Second, we acknowledge that non-information strategies might work better to change behavior at vending machines, especially in combination with interpretive labels. Studies, including university field studies, that manipulated the availability of lower calorie snacks or the price of more nutritious snacks or both, in addition to placing a nutrition label on them, led to an increase as intended in the sale of targeted snacks.^{5,6} To us this seems too controlling as national policy, but this type of restriction may be feasible at the state, local, or organizational level, if not preempted by the national law. In fact, in worksites, schools, and recreation centers, these strategies are recommended and used more often than information disclosures (see, for example, the County of San Diego Parks and Recreation Healthy Vending Policy, King County Healthy Vending Guidelines). Here again, the food industry can benefit from reformulating their snacks. When organizations adopt ‘healthier’ policies, they promote reformulation because criteria exist for sales in machines; organizational policy incentivizes manufacturers to change so they may sell their products in the organizations’ vending machines.

In conclusion, our small, exploratory study did not find that providing and promoting nutrition information led to a significant decrease in calories per snack purchased or a significant increase in the purchase of snacks with a *Better Choice* label. It is possible that replication using careful fidelity checks, revision of the label and promotion components, and separate analysis for males and females would have confirmed our hypothesis. It is also possible that an alternative label would be a more effective information approach or that the information approach in general is inferior to less popular, but more effective pricing and availability strategies. As the law currently requires the disclosure of nutrition information, we suggest that future research also

assess the use of MLT labels. In addition, we encourage food manufacturers to reformulate their products so vending machine snacks will have a better nutrient profile.

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