The Effectiveness of Point-of-Purchase Nutrition Education on Improving Beverage Choices and Nutrition Knowledge in a College Foodservice Setting

THE EFFECTIVENESS OF POINT-OF-PURCHASE NUTRITION EDUCATION ON IMPROVING BEVERAGE CHOICES AND NUTRITION KNOWLEDGE IN A COLLEGE FOODSERVICE SETTING

A Thesis Presented

by

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ABSTRACT

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MAY 2012

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Excessive consumption of sweetened beverages and low intake of milk is associated with increased risk for obesity, compromised oral health and bone disease. College students are among the highest consumers of sweetened beverages. Point-of-purchase (POP) marketing and nutrition education can be effective in changing food selection behaviors. No known studies, however, have used POP nutrition education to target beverage behaviors in college students.

This study examined the effectiveness of a POP nutrition education intervention on changing beverage selection behaviors and knowledge of college students in a university dining hall setting in March 2011. We aimed to increase consumption of calcium and vitamin D rich beverages, decrease consumption of sweetened beverages, and increase knowledge about health and beverages using POP with nutrition education in three of the four campus dining facilities at the University of Massachusetts Amherst (UMass Amherst).

To determine effectiveness of the campaign, college students enrolled at UMass Amherst with a meal plan of $\geq$ six meals/week were recruited via email for survey participation prior to (n=1547) and 14 days after (n=1387) the intervention. We compared self-reported beverage consumption and nutrition knowledge for pre- versus post-intervention and exposed versus unexposed (post-intervention) survey respondents with Chi-square tests. Using both approaches to assess campaign effectiveness, we found that exposed participants were less likely to drink regular soda at least once per week ($p = 0.001$, $p = 0.044$), more likely to identify fruit juice is not a source of calcium/vitamin D ($p<0.001$, $p = 0.011$) and more likely to identify that there is a link between artificial sweeteners and hunger ($p<0.001$, $p<0.001$).

We found that POP marketing was effective in decreasing soda consumption and increasing nutrition knowledge about calcium/vitamin D and artificial sweeteners in our study. These results suggest that similar POP marketing campaigns may be useful in college settings to improve beverage choices and knowledge. Successful campaigns that impact long-term behavior may also improve long-term health outcomes for college students by decreasing sweetened beverage intake.

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CHAPTER 1

BACKGROUND

Beverage Consumption and Health Outcomes

Beverage consumption habits are linked to health outcomes. Excessive consumption of sweetened beverages is associated with increased risk for obesity[1, 2] and compromised oral health with an increased risk for dental caries and enamel erosion.[3] Regular intake of milk is negatively associated with obesity[4] and osteoporosis.[5] In the United States, beverage consumption trends have shifted towards more sweetened and fewer milk beverages since the 1970s.[6, 7]

These changes in beverage consumption may lead to poor health outcomes because the nutrient profiles of sweetened beverages and milk are different.[8] Sweetened drinks, including sodas, sports drinks, ades (lemonade, limeade, etc.) and sweet teas are typically nutrient-poor, while milk and milk equivalents, such as fortified soy or rice milks, are nutrient-rich.[8]

Finding and implementing effective strategies for reversing the beverage consumption trends of the last 35 years is an important step in improving the health of the population. This is especially true for young adults to prevent future disease onset and progression. Students entering college are often making totally autonomous food choices for the first time compared to earlier in life when parents may have influenced their eating.[9] College students, whose intake of sweetened beverages tends to be high,[7, 10] are an important group to target for improving beverage selection behaviors to prevent obesity and poor dental health and to promote bone health.

Obesity

Beverage choices can impact body weight. Carbohydrate consumed in liquid form is considered less satiating as carbohydrate from isocaloric solid foods.[11] This means that liquid calories from carbohydrates, like those found in sweetened beverages are not perceived to be as filling as carbohydrate from solid foods, which can lead to consuming additional calories. An excess of calories consumed from beverages can lead to weight gain.[12, 13]

Trend analysis show a 135% increase in the number of calories consumed from sweetened beverages and a 38% decrease in calories consumed from milk between 1977 and 2001 in the United States.[6] This shift over two decades appears to have contributed to an average increase of 278 calories/day consumed by Americans.[6] This increase in calories from sweetened beverages may be linked to increasing rates of obesity in the United States.

Additional data indicate that the biggest shifts in beverage intake among children aged 2-18 years are an increase in sweetened beverage consumption from 87 to 154 calories/day and an average decrease of 91 calories/day from milk between 1977 and 2006.[7] The same data also show that among adults aged 19 years and older, sweetened drink consumption has more than doubled in this time period.

Sweetened beverage consumption appears especially high among college and university students.[7, 10] One survey of college students found that 65% of participants report drinking sweetened beverages daily.[10] The average number of calories consumed from sweetened beverages, including sodas, fruit drinks, sports drinks, sweet teas and

energy drinks, was 543 calories/day per student,[10] which is approximately 27% of total calorie needs for the average college student based on a 2,000 calorie diet.[14]

Conversely, some evidence supports that consuming dairy products, such as milk, is associated with reduced risk for obesity.[4, 15, 16] Using NHANES III data, Zemel et al.[15] found that body fat was lower in people with the highest calcium intake, when controlling for energy intake and physical activity. In addition, there was a reduced risk for obesity with each increasing quartile of calcium intake. When the RDA for calcium was met there was an 85% decreased risk of being in the highest BMI range. Brooks et al.[16] found an inverse association between low fat dairy consumption and waist-to-hip ratio, a measurement of abdominal adiposity, among young men in the Bogalusa Heart Study.

Oral Health

In addition to effects on obesity risk, beverage choices also impact oral health. Sugar consumption increases the risk of developing dental caries because oral bacteria are able to utilize the excess sugar left on the teeth as food. This action produces an acid which erodes protective tooth enamel and promotes decay.[17] Additionally, the low pH of soft drinks may soften tooth enamel and leave it vulnerable to being brushed away during regular oral care, weakening teeth.[18- 20] Population evidence demonstrates that soft drink consumption contributes to dental caries and weakened tooth enamel.[3]

Bone Health

The high sweetened beverage intake and low milk consumption patterns among children and young adults may also play a role in bone health later on in life. Osteoporosis is a disease in which bones are weakened from demineralization. Although the disease generally affects older adults, it has roots in childhood and young adulthood

at times when bone is still forming.[21] Adequate intake of calcium and vitamin D from childhood to the age of peak bone mass is important in preventing bone disease.[22] A diet in which sweetened beverages are substituted for milk, a major contributor of calcium in the American diet[5], could therefore increase the risk for bone disease later in life.[21, 22]

Strategies for Influencing Food Selection Behavior

Targeted interventions can be used to influence food and beverage selection behaviors, and thus impact health outcomes. Point-of-purchase (POP) marketing and increasing nutrition knowledge are two ways of implementing such interventions. These strategies have been used separately and in combination with one another in nutrition interventions targeting food selection behaviors. POP campaigns (explained below) may supplement marketing with explanatory nutrition information to strengthen the intervention by increasing the knowledge of those interacting with the campaign. Given this, a Venn diagram is an appropriate representation of such strategies to demonstrate the overlapping of POP marketing and nutrition education (Figure 1). POP marketing, nutrition education and the combination of the two interventions will be described in more detail through this paper.

POP is a marketing strategy that highlights one or more positive features of a product, as a way of influencing dietary purchases and consumption. POP nutrition marketing is an alternate to lengthy and more expensive nutrition education programs as a means of influencing purchasing and consumption habits.[23] POP marketing techniques can be thought of as an extension of the Social Marketing Theory (SMT), which posits that behavior change can be sold to consumers through marketing in the same way as commercial products. SMT has been used in public health and nutrition since the

1980's.[24-26] POP marketing targeting food selection behaviors aims to change behavior through advertising targeted food items that promote a healthy diet.

Nutrition knowledge is associated with positive food selection behavior[27-29] and may influence to what extent participants interact with POP marketing.[30] Increasing nutrition knowledge through nutrition education leads to more healthful food choices according to some studies.[27,28] Additionally, researchers have found that participants with higher baseline nutrition knowledge tend to be more influenced by POP marketing and utilize it when making food selections.[30]

Intentions to change behaviors are also correlated with actual behavior change. In a 2006 meta-analysis of 47 studies about intent to change behavior and actual behavior change, Webb and Sheeran found that having moderate or high intentions to change behavior was related to actual behavior changes. [31] Despite this, no known studies have compared both actual behavior change and intentions to change behavior in investigations of POP marketing. The Transtheoretical Model of health behavior change is one way of capturing information about thoughts and intentions of changing health behaviors.[32] In the model, individuals are thought to progress through a series of stages from not intending to change their behavior (purposefully or not) at one end to maintaining their behavior change at the other. According to Prochaska,[33] the six stages of change (SOC) are termed: precontemplation, contemplation, preparation, action, maintenance, and termination. Precontemplation, contemplation and preparation are all stages in which no observable behavior change is taking place, while action and maintenance describe behavior changes. Termination is the stage in which a new habit has been established to the point of no longer ever reverting to an unhealthy habit. The

stages are not linear; a person may progress or regress through varying stages, or even remain in one stage. Despite research using the model to describe the associations between the stage of an individual and behaviors such as physical activity[34] and fruit and vegetable intake,[35] no known studies to date have investigated the association between non-alcoholic beverage intake and the stage of the college student.

Introduction to Study and Research Questions

POP investigations have largely proved successful in influencing food selection behaviors.[23, 36-39] However, no known studies have specifically targeted beverage purchasing or consumption behaviors with POP nutrition information in the college student population. In addition, existing literature documenting POP and nutrition education interventions have not measured intentions to change food selection behavior in terms of actual food selections.

This research study was conducted in a university population to expand upon existing research about the effectiveness of POP nutrition marketing and nutrition education on food selection behavior by focusing on beverage selection behaviors and combining POP nutrition information with nutrition education. To determine the effectiveness of this POP intervention self-reported behavior change, planned beverage selection behavior change, and nutrition knowledge were measured.

Specifically, this thesis investigated the following research question and related research hypotheses:

1. What is the association between exposure to POP icons and nutrition education materials and:

a. measured behavior change?

Hypothesis 1a. Exposure to POP icons and nutrition education materials will be associated with measured behavior change towards fewer sweetened and more calcium and vitamin D-rich beverages.

b. self-reported behavior change?

Hypothesis 1b. Exposure to POP icons and nutrition education materials will be associated with self-reported behavior changes towards fewer sweetened and more calcium and vitamin D-rich beverages.

c. self-reported planned behavior change?

Hypothesis 1c. Exposure to POP icons and nutrition education materials will be associated with self-reported planned behavior change from not intending to change behaviors to intending to change behaviors or behavior change actions.

d. measured nutrition knowledge?

Hypothesis 1d. Exposure to POP icons and nutrition education materials will be associated with higher nutrition knowledge of beverage sources of calcium and vitamin D and added sweeteners and of health outcomes associated with beverage intake.

CHAPTER II

LITERATURE REVIEW

Food selection behavior can be influenced by different types of interventions. Two interventions of interest in the college population are POP marketing and nutrition education. While both POP marketing and nutrition education are effective in changing food selection behaviors, the change may be mediated by factors outside of the interventions.

Point-of-Purchase Nutrition Marketing and Food Selection Behavior Change

Results of POP marketing studies suggest that POP advertising can be an effective means of influencing food selection behaviors. College and university settings, as well as worksites, have been used to study the effectiveness of POP marketing in promoting healthful foods, with promising results.

POP advertising has been used to promote changes in entrée purchases among university students. In 2009, Chu et al.[37] tracked consumer purchases following the implementation of a POP marketing campaign in a university foodservice setting. The researchers created POP nutrition information about entrée choices that included calories, which they posted on entrée choices. They tracked cafeteria sales and calories purchased at baseline, during the implementation of the POP nutrition information, and for 13 days after removal of the POP marketing. Entrée calories purchased decreased by 12.4 kcals from the last day of the pretreatment period to the first day of the first day of the intervention (P=0.007). Although the effect of decreasing calories purchased existed during the time in which signage was present, it dissipated quickly upon removal of the

nutrition labeling, with an average increase of 1.52 kcals purchased per day from the initial decrease of 12.4 kcals, bringing calories purchased back to pre-treatment levels. The results raise the question of whether a 14-day intervention period is long enough to sustain an effect on food selection behavior post-intervention or whether it was a feature of study design other than the length of the intervention.

POP marketing is also useful in targeted food selection interventions. In 2010, Peterson et al. implemented POP marketing using SMT constructs in a college dining hall targeting ten healthful food items.[39] The researchers placed healthy choice indicators (POP) near targeted food items, as well as large posters and table tent displays promoting the target foods in the dining hall. Pre- and post- intervention data were collected via survey, with the baseline collected at the intervention location and the post-intervention sent via student e-mail. Post-intervention, the researchers found significant increases in self-reported intake of two of the targeted foods, cottage cheese and low-fat salad dressings, as well as an increase in awareness of healthy food choices in the dining halls compared with pre-intervention. Although the results suggest that POP marketing utilizing the SMT can be effective for improving food selection behavior, this study did not use a control group. Given this, it is possible that influences other than the intervention or the repeated testing may have impacted the participants' abilities to identify healthful choices.

In 2001 Buscher et al.[36] utilized POP advertisements to promote healthy snacks including fruits, vegetables, yogurt, and pretzels in a four-week intervention in university cafeterias. POP messages were framed in terms of budget, energizing capability, sensory pleasure and convenience of time. Sales data were compared from a two-week baseline,

during the four-week intervention period, and in a two-week post-intervention period. Compared with baseline sales, there was an increase in the sales of yogurt from 2.62% of total revenue to 3.43% of total revenue ($P<0.05$). Pretzel sales also increased from 0.14% of total revenue to 0.40% of total revenue ($P<0.05$). In a follow-up study promoting yogurt only, sales of yogurt increased during both intervention (3.56% of total revenue) and post-intervention (3.76% of revenue) compared with baseline (2.62% of revenue $P<0.001$). Together, these promotions suggest that targeted marketing and longer exposure to POP may increase success of POP campaigns among university students.

POP marketing interventions with college students has not been limited to dining hall facilities. In another instance of POP targeting specific items, in 2010 Freedman and Connors[23] found that POP labeling in a university convenience store increased sales of promoted items. The researchers promoted healthy food choices from soups, crackers, cereals and breads sold in a campus convenience store for POP labeling over a five-week intervention period. They posted educational materials on storefront windows and at the cash register. POP labeling was attached on the shelf containing each promoted product. Compared with baseline sales six weeks prior to the intervention of all soups, crackers, cereals and breads sold, sales in the intervention period increased marginally on promoted products, from 24.2% of total sales within the cereal, soup, cracker and bread categories to 27.8% of total sales in those categories ($P=0.082$). No post-intervention data were collected following the removal of POP marketing, so post-intervention changes were not assessed or reported by the researchers. Other factors may have impacted the success of the campaign. For example, the researchers did not assess

nutrition knowledge or health motivations, which other investigations have demonstrated may influence food selection behavior.

POP marketing has also improved employee food selection in worksite settings. In 2010 Lowe et al.[38] studied the effects of POP marketing combined with nutrition education and price incentives in a 12-week intervention in a worksite cafeteria. They compared worksite cafeteria sales from two groups of employees. One group saw POP marketing in their worksite cafeteria, while the second group saw the same POP materials and additionally attended four one-hour nutrition education classes and received price incentives on healthy entrées in their worksite cafeteria. Compared to the POP marketing only group, the workers who received nutrition education and price incentives decreased their percentage of total calorie intake from fat by 6.4% (P=0.001). The results of this investigation may support the use of nutrition education as a supplement to POP advertising given that employees in the group receiving nutrition education improved the nutritional quality of their meals more than the POP only group. However, given that price incentives for purchasing healthier entrées were also implemented, it is difficult to elucidate which part of the intervention led to behavior change. The researchers were unable to determine whether the price alone would influence purchasing habits or increasing nutrition knowledge was sufficient to produce a desired behavior change.

POP and Predisposing Factors

Some attributes of participants can influence their interaction with POP marketing. For example, people with a higher level of existing nutrition knowledge appear to be more susceptible to POP advertisements and thus more likely to change their

food selection behavior when POP is present. These characteristics can be considered predisposing factors to the influence of POP marketing.

POP marketing appears to be most effective in college students with some level of existing nutrition knowledge. In 2011 Hoefkens et al.[30] studied the effect of a POP marketing campaign on dietary practices of students frequenting a university canteen. The one month POP intervention included a POP ranking system identifying entrees from most to least healthy, displayed near entrees and supplemental written nutrition education materials explaining the ranking system. The researchers collected baseline and post-intervention (six months after the intervention) data, including canteen sales, nutrition knowledge and motivation to change eating behavior, and dietary practices (using three 24-hour dietary recalls) from participants who regularly ate at two university canteens. Compared with baseline practices, there was no change in the nutritional profile of entrée choice six months post-intervention (P=0.82). However, there was a difference between students with higher and lower nutrition knowledge and motivation to change behavior at baseline. Subjects with higher knowledge and motivation reported making healthier entrée selections post-intervention compared to those with low knowledge and motivation to change did. This suggests that knowledge and motivation may make a difference in the effectiveness of POP marketing campaigns. The researchers did not capture data on the use of the explanatory materials, which may have given insight into how participants interact with all study materials, or whether participants increased nutrition knowledge through use of the supplemental postings.

In summary, evidence suggests that POP marketing can be an effective strategy for influencing the food selection behaviors of college students. The extent to which

students utilize POP messages to inform food selections may be associated with their level of existing nutrition knowledge or motivation to change their behaviors. Figure 2 illustrates the complexity of the relationship between motivation, education, knowledge, POP, and beverage selection (and ultimately health outcomes).

Nutrition Knowledge and Food Selection Behavior

Increasing nutrition knowledge is associated with positive eating behaviors,[27,29] though the relationship is not necessarily direct. Some evidence suggests that knowledge alone is not sufficient to influence behavior, and that mediating factors, such as access to the target food and outcome expectations, must also be present for behavior change to be successful.[28, 30, 40, 41] Nevertheless, the association between knowledge and behavior change supports the use of a nutrition education component in interventions seeking to impact food and beverage selection behavior.

Nutrition education in the form of a college nutrition course improved beverage consumption among college students. In 2009 Ha et al.[27] studied the effect of a basic nutrition course on soft drink and fat-free milk consumption of university students. They measured beverage consumption at the beginning and end of a 15-week intervention with self-reported three-day food records. Following the course, which included traditional lectures and interactive activities, self-reported soft drink consumption decreased in all participants (P=0.033) and average daily fat-free milk consumption more than doubled (P=0.026) among female participants, compared with self-reported consumption in the beginning of the semester. Given that all of the students in this intervention had elected to enroll in a nutrition education course, the results of this research are difficult to

interpret. Although the results of this study are promising for the use of nutrition education as a behavior modifier, the researchers could not tell whether the improvements in dietary choices were due to the underlying motivation of the students combined with the intervention or to the intervention alone.

The influence of nutrition knowledge on food selection behavior is present outside of the classroom setting as well. In 2000 Wardle, Parmenter and Waller[29] found nutrition knowledge to be significantly associated with healthy eating habits. The researchers used mail surveys from general practitioner's patient listings to collect data on dietary intake and nutrition knowledge among adults. Nutrition knowledge was assessed with a validated questionnaire. Data returned from mail surveys of 455 male and 584 female patients from the offices of three general practitioners showed that nutrition knowledge was significantly correlated with intake of vegetables ($P<0.001$), fruit ($P<0.001$), and fat ($P<0.001$). The results also demonstrated that the positive associations between knowledge and the intake of fruits, vegetables and fat were independent of sociodemographic characteristics of the study participants.

Nutrition Knowledge and Predisposing Factors

Although there is evidence that nutrition knowledge influences behavior change, some studies demonstrate that it is likely not the sole factor in changing food selection behavior. Results of several investigations provide evidence that knowledge may act in concert with other factors, such as motivation to change, access to the target foods and belief that behavior change will have a positive effect on future health which together ultimately lead an individual to change their habits.

Nutrition education courses may be more effective on students who are overweight prior to enrollment. In 2001 Matvienko et al.[28] found exposure to a nutrition science course effective in maintaining body weight and decreasing total calorie intake among female college freshmen with BMI>24 kg/m^2. The study investigated the effectiveness of a nutrition science course without a focus on weight loss on helping first year female students maintain their weight. Participants included 40 female first year college students, either enrolled in a four month long nutrition course intervention (n=21) or not (n=19). The researchers measured body weight, nutrient intakes and nutrition knowledge at baseline, at completion of the course (four months) and one year post-completion of the course (16 months). For comparison purposes, the researchers also broke down participants into two BMI categories: those with BMI$\leq$24 kg/m^2 and those with BMI>24 kg/m^2. Compared with control subjects with BMI>24 kg/m^2, intervention subjects with similar BMI reported 15% lower fat (P=0.04) intake four months post-intervention. The intervention participants with BMI>24 kg/m^2 maintained their weight at one year, while the control subjects with BMI> 24 kg/m^2 gained 9.2$\pm$6.8kg (P=0.012) over the same time period. This may have been due to decreased calorie intake in the intervention group. The researchers found no significant effects of knowledge on calorie intake or weight maintenance among women with BMI<24 kg/m^2 and no difference between intervention and control post-intervention. The researchers suggested that motivation to change eating habits in women with higher BMI may have influenced results observed in this group. Because few males were interested in the study, they were not included as participants in the intervention. Consequently, results cannot be generalized to males. Finally, similar to other similar college classroom-based

interventions, the generalizability of this investigation may also have be impacted by a selection bias, as students already possessing an interest in improving food selection and/or nutrition knowledge may be more likely to participate than those without such an interest.

Nutrition knowledge may change food selection behaviors through a change in behavioral intentions. In 2000 Kristal et al.[41] found that a worksite intervention program targeting nutrition for cancer prevention led to a significant increase in knowledge of a healthful diet as well as progress or maintenance in the TTM model to the action and maintenance stages. The researchers randomized 28 self-contained worksites into intervention or control groups. The work was a three year study. A baseline survey of nutrition knowledge, SOC assessment and dietary intake was distributed to all participants. In the first year, participants in the intervention groups were offered a series of five nutrition classes at their worksite and had supplemental nutrition education material mailed to their homes. Following that, participants were sent a mail survey assessing knowledge, SOC and dietary habits. A third survey was administered at the end of year two, including only those participants who had responded to the initial surveys. Compared to the control group, participants in the intervention group had an increase in knowledge about diet and cancer prevention. They were also more likely to maintain their SOC or progress into action or maintenance from pre-action or action stages respectively. These changes were also associated with an improved dietary intake based on responses to a Food Frequency Questionnaire (FFQ). This study demonstrates that knowledge of nutrition, SOC and food selection behaviors are related, and that an intervention targeting an increase in knowledge can change behavioral intentions and

actions. Despite the positive findings, the researchers did acknowledge that participation in the offered nutrition classes was voluntary. Given that participants in the intervention group could select whether or not to attend the course, it is difficult to know whether these participants had different existing motivations for changing their food selection behaviors than those participants who chose not to attend.

Nutrition knowledge may have an indirect effect on food selection behavior, as Sharma et al.[40] found in 2010 in an analysis of calcium intake and nutrition knowledge in adolescent girls. The researchers used data from the IMPACT study, an investigation conducted to promote bone mineral density among middle school girls. The investigators performed a path analysis to determine pathways by which variables that influence calcium intake and bone quality interact with one another. The analysis showed that knowledge of calcium-rich food sources alone did not directly influence calcium intake. The research team instead found that those participants who both knew that calcium helps prevent osteoporosis and believed that that consuming milk would decrease osteoporosis risk were more likely to consume milk than those girls who did not have a positive outcome expectation of milk drinking behavior. Interestingly, milk availability at home directly influenced calcium intake in a positive direction ($P<0.05$). These results suggest that knowledge is necessary, but not sufficient to produce behavior change.

Increasing nutrition knowledge is associated with positive changes in food and beverage selection behavior. This association, however, may be mediated by factors such as belief in the positive effects of diet change and motivation to change food selection behavior towards more healthful choices (see Figure 2). Because current results of research may be influenced by selection bias from participants who enroll in studies with

an existing interest in changing their behaviors, additional research should also include participants not enrolled in elected nutrition courses.

Conclusions

Existing studies point to a role in both POP marketing and nutrition knowledge in influencing food selection behavior among college students. Given that nutrition knowledge is mediated by motivation to change, a measure of motivation should be included in research evaluating the effectiveness of nutrition education interventions.

Epidemiological data suggest that beverage trends are linked with health outcomes.[1-5] Despite this, no known studies have specifically examined the effect of POP marketing and nutrition education on beverage choice among college students. The possibility that POP marketing and nutrition education exposure could influence beverage choice behavior in college students is plausible, but has not received targeted attention in existing research on food selection behavior in this population. Given this, studies that specifically examine beverage selection behavior would provide important new knowledge in exploring effective methods for influencing behavior and therefore improving health outcomes with respect to obesity, osteoporosis and other diseases.

CHAPTER III

STUDY OBJECTIVES

The primary objective of this thesis was to evaluate the effectiveness of a POP nutrition education campaign on changing beverage selection, behavioral intentions, and nutrition knowledge among college students in a university dining hall setting. The study had three aims:

1. Improve self-reported and observed behavior towards more calcium-rich and fewer sweetened beverages (Hypotheses 1a and 1b, see page 7).

2. Improve behavioral intentions to change beverage selection behaviors toward more calcium-rich and fewer sweetened beverages (Hypothesis 1c, see page 7).

3. Improve nutrition knowledge with respect to identifying beverage sources of calcium, vitamin D and added sweeteners and the health outcomes associated with the consumption of nutrients (Hypothesis 1d, see page 7).

CHAPTER IV

METHODS

Overview

A study was conducted at the UMass Amherst in the University's Dining Common facilities with funding from UMass Dining Services. POP marketing and nutrition education materials were developed and displayed in experimental Dining Commons as part of a social marketing campaign. The purpose of this research was to investigate the success of this campaign with respect to changing behaviors and intentions surrounding beverage choice among university students.

Changes in beverage consumption, nutrition knowledge, and planned behavior from baseline to post-intervention and between those who were exposed/not exposed post-intervention were measured through the use of:

1. a random survey of students, administered as a repeated cross-sectional questionnaire pre- and post-intervention.

2. beverage consumption use in the Dining Commons, measured weekly through the course of the study.

Setting

The intervention took place in three of the four Dining Commons locations of the University of Massachusetts Amherst campus. The fourth Dining Common served as a control for the evaluation of the campaign.

Subjects and Recruitment

All undergraduate students enrolled in the University, residing on campus and on a Dining Services meal plan with minimum of a six meals per week were recruited to participate in a survey that addressed the effectiveness of the nutrition intervention (described below). Through the Student Assessment, Research, and Evaluation Office (SAREO) at the UMass Amherst, 10,988 eligible students were sent an email invitation to participate in an electronic survey about their beverage choices in the Dining Commons, planned behavior and nutrition knowledge. Surveys for pre-intervention were sent to 5494 of the eligible students. The post-intervention survey were sent to the remaining 5494 of eligible participants at a later time. Emails utilizing an existing data set with numbers of students living in each of the residential areas on the University of Massachusetts Amherst campus were used in order to prevent bias from oversampling of one residential area. Participation was incentivized with a random drawing for one iPad device per survey time (two in total).

Sample Size

Sample size was based on an estimated response rate that would yield an adequate number of respondents to assess outcomes of interest. Previous work by Buscher et al.[36] were used to estimate sample size. Buscher et al.[36] reported that purchases of targeted food choices increased by 35% to 285% depending on the targeted food and the timing of the suvey. Using the Cohen tables[42] and these data, in order to be able to detect a difference of 20% at 0.8 power with α=0.05, if we were to have similar effect and variance within our population, we would need a minimum of 393participants per group (assuming three intervention subjects for every one control subject given the three

experimental dining commons and one control). Our final samples of 1547 and 1387 far exceeded this minimum sample size, so we are confident that our analysis did detect existing differences.

Privacy

Participants' personal information was de-identified and did not include the first or last name in order to ensure privacy of all participants. Any print copies of data collected were de-identified and kept in a locked file cabinet at UMass Dining Services administrative offices.

Institutional Review Board

Approval from the UMass Institutional Review Board was obtained (Appendix A). All research assistants and study personnel were certified in human subjects research through the Institutional Review Board at the UMass Amherst.

Intervention

The intervention consisted of two components: 1.) a POP labeling campaign, and 2.) accompanying nutrition education information on table tents and posters in the dining commons. Specifically, calcium and vitamin D and absence of added sweeteners were indicated on the POP labeling because this intervention was intended to increase consumption of beverages with calcium and vitamin D and decrease consumption of beverages with added sweeteners.

UMass Dining operates four Dining Commons, which are cafeteria-style foodservice facilities, each named for counties in Massachusetts: 1.) Berkshire, located

in the Southwest area of campus, does not serve breakfast; 2.) Hampshire, located next to Berkshire in the Southwest area of campus; 3.) Franklin, located in the Central area of campus; and 4.) Worcester, located in the Northeast area of campus. The Berkshire, Hampshire, and Franklin Dining Commons all had POP labeling and nutrition education materials. The Worcester Dining Commons served as the external control location with no POP marketing or education materials because fewer students from other areas would be likely to visit Worcester. Given the locations of Berkshire and Hampshire, and that Berkshire does not serve breakfast, it is likely that students living in the Southwest residential area frequent both facilities. Franklin is the least frequented dining facility, with a large vegetarian population and Kosher kitchen, making the location undesirable as a control as the facility would not likely be representative of the total population.

POP Marketing

POP icons (Appendix B1) were placed on all beverage dispensing stations in intervention dining commons (Berkshire, Hampshire and Franklin). The presence of calcium and vitamin D and/or absence of added sweeteners were denoted by a coloring in of the POP icon for easy reading. The absence of calcium and vitamin D and/or presence of added sweeteners were denoted by a "grayed out" effect of the POP icon. There were no POP icons in control DC (Worcester).

POP icons were created by a graphic artist and pre-tested with a focus group, similar to the study population in age and education level, by a member of the research team and with IRB human subjects pre-approval. Ten students enrolled in a marketing course at the UMass Amherst participated in a focus group interview where the students

were shown several POP icon designs and asked to discuss their opinions on the effectiveness of conveying the nutrition message for each of the icons.

Nutrition Education Materials

Nutrition education materials on calcium and vitamin D and added sweeteners in beverages accompanied POP icons in intervention facilities. Education materials were presented in a poster format that could not be easily removed from the dining area (Appendix B2), as well as in a table tent advertisement which may have increased the number of potential participants exposed to the materials (Appendix B3). The locations of the education materials in each facility were identical in order to ensure that exposure is as similar as possible in all intervention facilities. No nutrition education materials were posted in the control dining facility. The POP icons and nutrition education materials remained posted for 14 days prior to initiation of post-intervention surveys.

Nutrition education materials were created by a graphic artist and based on current dietary recommendations for calcium, vitamin D and added sweetener intake for this population, as well as information about bone and tooth health and weight maintenance from existing literature on each respective topic.

Evaluation

Effectiveness of the intervention was assessed by comparing self-reported beverage selection, intentions to change behavior and nutrition knowledge across pre- and post surveys and between exposed and non-exposed participants (post-intervention). Additionally, an analysis of whether self-reported use of POP icons was associated with beverage selection behaviors and nutrition knowledge was conducted.

Pre-Intervention Survey

Surveys for this study were conducted at two times, one pre-intervention and one post-intervention. The survey in Appendix C reflects the questions asked in the post-intervention survey. The pre-intervention survey was identical to the post-intervention survey, with the exception of the exclusion of the questions that pertain to seeing, reading or using campaign materials which were not available at pre-intervention.

Participants answered a series of questions via computer pertaining to demographics, frequency of dining in specified campus dining facilities, nutrition knowledge, self-reported beverage consumption and a self-reported SOC assessment. A copy of the full survey is attached to this document (Appendix C).

In both the pre-intervention and post-intervention surveys, a typographical error that altered the meaning of one of the listed SOC options went unnoticed until after data collection had ceased. Because of this, no assessment of SOC was possible in our analysis.

Post-Intervention Survey

A survey nearly identical to baseline was sent out to a second group of students from the same meal plan database. The post-intervention survey contained all of the questions from the pre-intervention survey as well as additional questions that assessed whether or not the participant was aware of, had read and had utilized the nutrition education materials and POP icons in the dining common they most often visit and whether each participant utilized the marketing to inform their own beverage selections (Appendix C).

Objective Measurements of Beverage Consumption

To compare actual beverage consumption with self-reported consumption data, weekly beverage usage in each dining facility was collected from existing water-meters attached to beverage dispensers. Syrup usage on soda machines was also recorded in a similar manner. Purchasing tracked through the meal management system compared to inventory provided the remaining objective data.

Unfortunately, due to discrepancies in reporting usage and differences in dates when usage data was collected at each dining commons location, the objective data were unusable for analysis. Given this, the data collected were not used for comparison with self-reported beverage habits.

Measurement of Exposure

Exposure to the POP campaign was assessed in the post-intervention survey (Appendix C) with the following questions:

- Do you remember seeing the beverage-related nutrition education materials (e.g. posters, table tents and icons) that were featured recently in the Dining Commons?
- Did you read the poster pertaining to beverage nutrition?
- Did you read the table tent pertaining to beverage nutrition?

A positive response on any of these questions was considered to be exposure to the POP campaign for purposes of our analysis.

Measurement of Self-Reported Use of POP Icons

Use of POP icons to inform beverage choices was assessed in the post-intervention survey (Appendix C) with the following question:

- Did you use the icons located on the beverage dispensers to guide your beverage selections?

A response of "yes" to this question was considered to be self-reported use of POP icons for the purpose of our analysis.

Measurement of Dependent Variables

Research hypotheses were tested by comparing pre with post and exposed with non-exposed self-reported beverage practices and measured nutrition knowledge. Although not directly linked to a research hypothesis, practices were also compared between those who reported using POP icons and those who did not report using them.

Self-reported beverage practices were measured in two ways: 1.) how many times per week a beverage was consumed and 2.) how many dining commons cups per meal each beverage was consumed. All beverages served at the dining commons were included in the survey. Similar beverages (e.g. cola, root beer, and other sweetened sodas) were combined into one category to decrease the total number of survey questions. However, the questions explicitly listed all beverages in each category to aid respondents in their ability to most accurately answer the question (See Appendix C).

Frequency in times per week was assessed with a comprehensive list of beverages available in the Dining Commons and corresponding radio buttons for zero days through

seven days. Participants were instructed to click on how many days in the past week they consumed each of the beverages in the Dining Commons.

Responses to frequency were converted into a binary variable for response of 0 days per week and responses of 1-7 days per week. This construction was chosen to represent those who did not drink a certain beverage category versus those who did drink it.

Cups per meal were assessed with the following question format:

Please think of what you typically drink at meal name in the dining common. How much of each type of beverage do you drink at a TYPICAL MEAL NAME in the DC? This question was accompanied by the same comprehensive beverage list from the frequency questions. Respondents were given a choice of 0, ½, 1, 1 ½ , 2 or more than 2 cups.

A standard Dining Commons cups holds 12 ounces of fluid. Cups per meal was converted into ounces per meal and then each meal's total in a given beverage category were added together to represent a daily total ounces for each category. The total ounces per day were also converted to binary variables, with cutoffs that depended on the specific beverage category:

Sweetened sodas, sweet teas, fruit drinks, and hot chocolate were converted into ≤12 ounces per day or >12 ounces per day. Twelve ounces was chosen because a typical 12 ounce serving of sodas and similar sweetened beverages contains about 150-200 kcals. This amount is consistent with the amount of discretionary calories typically allowed in a 1,800-2,000 kcal diet.[43]

Milks and milk equivalents were converted into ≤16 ounces per day or >16 ounces per day. Sixteen ounces was chosen based on the USDA recommendations that Americans should consume about three servings of dairy or calcium rich foods daily.[44] Sixteen ounces represents about two dairy servings and we assumed that additional calcium would come from foods to meet daily needs.

Fruit juice was converted into ≤6 ounces per day or > 6 ounces per day. Although not a direct goal of the project, in an effort to limit calories from juice consumption, our educational materials encouraged students to limit juice to half of a cup. Six ounces represents half of a standard Dining Commons cup size.

Measured nutrition knowledge was assessed in two main areas: 1.) identification of specific beverages as nutrient sources and 2.) awareness of health implications of the consumption of certain nutrients.

Identification of specific beverages as nutrient sources was addressed with the following question format:

Please indicate, to the best of your knowledge, whether or not each of the beverage types listed below contains nutrient of interest. Check all that apply. Followed by a list of beverage categories and accompanying list of beverages within each category.

Responses to these questions were dichotomized as correct or incorrect.

Identification of health outcomes associated with specific nutrients was addressed with the following question format:

Which of the following can [outcome of interest]? Check all that apply. [Followed by a list of nutrients that were specifically mentioned on the educational materials of the campaign.] (See Appendix C).

Responses to these questions were dichotomized as correct or incorrect.

Statistical Analysis

All statistical analyses were conducted using SPSS version 19.[45] When comparing the effect of intervention on outcomes (between pre and post, and exposed and non-exposed) Chi-square tests were performed to compare categorical data. Regression models to control for potential confounders were constructed. However, no effects of confounding were seen for gender, race or enrollment in a health-related college course.

Analyses were conducted in two ways: 1).a pre- and post-intervention group comparison of all participants at pre-intervention with only those exposed post-intervention and 2.) an exposed versus unexposed comparison all from the post-intervention survey. Additionally, although not directly related to a specific research hypothesis, an analysis comparing self-reported use/nonuse of POP icons with outcome variables was conducted as an another measure of program effectiveness.

CHAPTER V

RESULTS

Response

Response rate to the survey was 28% at pre-intervention and 25% at post-intervention. These rates were consistent with the expected 30% rate that is typical of UMass Amherst surveys (Personal communication, Elizabeth Williams, Associate Director, Research Educational Policy, Research, & Administration, October 1, 2010). Due to the nature of the survey, which was voluntary and electronically administered, students who chose not to participate did so without giving any demographic or personal information. Because of this, reasons for non-response could not be determined.

Characteristics of Study Participants

All study subjects were students at the UMass Amherst during the Spring 2011 semester. The majority of participants were white at both survey times (64.8% at pre-intervention and 65.2% at post-intervention). More females than males responded to both survey times (54.8% female vs. 44.7% male at pre-intervention and 54.6% female versus 45.0% male at post-intervention). There was no difference in the proportions of males and females who responded at either survey time (Table 1).

POP Nutrition Education and Self-Reported Beverage Selection Behaviors

Hypothesis 1b results. Exposure to POP icons and nutrition education materials will be associated with self-reported behavior changes towards fewer sweetened and more calcium and vitamin D-rich beverages.

Pre- and Post-Intervention

Exposure to our campaign appeared to impact some beverage selection behaviors towards the selection of more healthful beverages. Compared to pre-intervention participants, the participants who were exposed post-intervention to our POP campaign were more likely to drink milk/milk equivalents on at least one occasion per week (76.7% vs. 72.4%, $p = 0.045$). At pre-intervention participants were more likely to drink at least 12oz of diet beverages per day (25% pre- vs. 17% of exposed post-intervention participants, $p = 0.001$). Pre-intervention participants were also more likely to drink regular sodas at least once per week (44% pre vs. 36% post, $p = 0.001$), and more than 12oz of regular soda per day (30% pre vs. 22% post, $p = 0.002$). A similar pattern was seen with hot chocolate consumption, with 19% of pre-intervention participants reporting drinking hot chocolate on one occasion or more per week compared to only 9% of exposed participants ($p<0.001$). Pre-intervention participants also more frequently reported drinking at least 12oz of hot chocolate per day than participants exposed to the POP campaign (8% vs. 5% respectively, $p<0.001$). A trend towards significance was observed for reporting diet drink consumption at least one day per week (33.3% pre vs. 29.1% post-intervention, $p = 0.06$) (Table 2).

Exposed vs. Not Exposed, Post-Intervention

Differences in self-reported beverage consumption habits were also found in the comparison of exposed versus unexposed participants post-intervention. Compared to unexposed participants post-intervention, the exposed participants were more likely to report drinking sweetened milks/milk equivalents (41% vs. 34.9%, $p =0.045$). Exposure was also associated with less frequent reporting of regular soda consumption on one or

more days per week (36.5% vs. 42.1% of unexposed participants, p =0.044). There were also trends toward significance observed for drinking any milk/milk equivalent at least once per week (76.7% vs. 71.8% unexposed, p = 0.052) and drinking hot chocolate at least once per week (12.2% vs. 8.9% unexposed, p = 0.059) (Table 3).

Icon Use and Self-Reported Beverage Selection

Differences in self-reported beverage selection were observed between participants who reported using icons to inform beverage selection versus participants who did not report using the icons. Participants who reported using the icons were more likely to drink unsweetened milks at least once per week than those who did not use the POP icons (60% non-users versus 68.5% users of icons, p=0.008). Use of the icons to inform beverage choices was also associated with greater likelihood to report 100% fruit juice consumption at least once per week (58.7% non-users versus 68.9% users of icons, p=0.001) (Table 4).

POP Nutrition Education and Nutrition Knowledge

Hypothesis 1d results. Exposure to POP icons and nutrition education materials will be associated with higher nutrition knowledge of beverage sources of calcium and vitamin D and added sweeteners and of health outcomes associated with beverage intake.

Pre- and Post-Intervention

As seen with beverage selection behaviors, nutrition knowledge differed between pre- and post-intervention participants. Compared to pre-intervention participants, post-intervention participants who were exposed were more likely to correctly identify that calcium and vitamin D play a role in bone health (88.1% post vs. 84.2% pre-intervention participants, p = 0.027) and that added natural sweeteners may increase risk for dental

caries (84.3% post vs. 80.7% pre, p = 0.04). Seventy eight percent of exposed post-intervention participants correctly identified that some evidence indicates artificial sweeteners can increase the sense of hunger, compared to 65.9% of pre-intervention respondents (p< 0.001). Post-intervention respondents also correctly identified that fruit juice naturally contains no calcium or vitamin D (41%) versus pre-intervention participants (26.4%, p< 0.001). Post-intervention participants who had been exposed were more likely to identify unsweetened milks as a source of calcium and vitamin D, although the results were not significant (p=0.066) (Table 5).

Exposed vs. Not Exposed, Post-Intervention

Differences in nutrition knowledge were also seen when comparing exposed and unexposed participants at post-intervention. Exposure was associated with greater likelihood to identify unsweetened milks as sources of calcium and vitamin D (99% vs. 97.3%, p =0.036) and that fruit juice is not a source of calcium or vitamin D (41.0% vs. 33.8%, p = 0.011). Exposed participants were also more likely than unexposed respondents to correctly identify that artificial sweeteners may increase the sense of hunger (78.6% vs. 68.9% of unexposed participants, p<0.001) (Table 6).

Icon Use and Nutrition Knowledge

Participants who reported using the icons also differed from non-users of icons in identifying sources of natural sweeteners in beverages. This was observed in identifying natural sweeteners in sweetened milks (38.7% non-users versus 46.1% users of icons, p=0.039) and in fruit drinks (74.4% non-users versus 82.1% users of icons, p=0.009) (Table 7).

CHAPTER VI

DISCUSSION

Our study results suggest that POP nutrition education is effective in influencing beverage selection behaviors and increasing nutrition knowledge of college students. These findings are important because no known previous studies of POP marketing have targeted only beverages, and none have targeted beverages in a college-age population.

Comparison with Previous Research

Previous research has linked POP marketing with improved food selection behaviors in college students[36,37,39] and the workplace.[38,41] Similarly, our study demonstrated that exposure to POP marketing was associated with improved beverage choices in some categories.

A study conducted by Peterson et al[39] found that students increased consumption of cottage cheese and low fat salad dressings and were more able to identify healthy food choices in their college dining halls after implementation of a POP campaign that promoted healthy foods. Our research found that students who were exposed to our campaign were more likely to engage in positive beverage behaviors and know more about nutrition and beverages. Unlike Peterson et al., our study used a control group to assess differences in behaviors and knowledge, which strengthens our findings and makes a secular change less likely to be the cause of the differences observed.

Ha et al.[27] found that when students were exposed to nutrition education about beverages, self-reported beverage consumption changed over time to include fewer sugar sweetened drinks and more milk beverages. This is consistent with our findings that exposed participants reported more healthful beverage selections than unexposed

students, which further supports a link between knowledge and health behavior. However, Ha et al.[27] used a 15-week nutrition course with students who chose to enroll. The motivation to enroll in a nutrition course may make the subjects in that study different than the general student population. Our research addressed this issue by surveying the maximum number of students possible from different academic backgrounds and by providing education through posters and table tents in the Dining Commons of our campus. The Dining Commons are spaces used by students from all academic disciplines, meaning that students not actively seeking nutrition education could still be exposed to our campaign, unlike a nutrition class in which students enroll out of academic requirement or personal interest.

Lowe et al.[38] found that employees eating at worksite cafeterias changed their food selection behaviors at lunch when exposed to a combination of POP marketing, nutrition education and price incentives more than those who were exposed to POP alone. Although these findings may indicate that POP and nutrition education are effective at changing behaviors when combined, the use of price incentives adds a variable to the research. Price incentives may have been the factor that ultimately led to the behavior change observed in the worksite population in this study. Without a price incentive only comparison group, it is not possible to tell to what extent price was a determining factor in food selection. Our intervention used a combination of POP and nutrition education and was effective at changing both food selection behaviors and knowledge compared to when participants were not exposed. Our findings may indicate that price incentives are not necessary to facilitate behavior change; however our study was conducted with

college students on pre-paid meal plans. Our subjects did not have to weigh price as a factor in their decision making, which sets them apart from the Lowe et al. participants.

As with the Ha et al. study[27], Lowe et al.[38] participants attended nutrition classes. This differs from our study, in which participants were exposed to nutrition education via posters and table tents in the Dining Commons. Given that a larger time investment is required for attending nutrition classes when compared to reading a poster or table tent, it is possible that the participants in the Ha et al. and Lowe et al. studies who enrolled in the courses had a higher level of motivation to learn about nutrition than people who chose not to attend nutrition classes.

Chu et al. [37] observed differences in the number of calories purchased in a university cafeteria when nutrition information was posted on a menu board for patrons to see prior to ordering. Interestingly, Chu et al. found that the behavior of participants immediately began to revert back to higher calorie purchases upon removal of the POP nutrition information, suggesting that signage must remain posted in order for behavior change to be maintained. Although it is possible that POP campaigns must remain posted in order for an effect to be sustained, given that Chu et al. did not supplement the posted information with any nutrition education it is also possible that the effectiveness of POP campaigns is strengthened with nutrition education. A combination of POP marketing and nutrition education may be a stronger intervention than either one alone as interventions that combine the two have been successful.[38,39, 41] POP marketing in our study remained posted during the post-intervention survey period, so it is impossible to know whether the observed effects of our campaign would be sustained after the signage was removed.

Hoefkens et al. [30] did not observe differences in food selection behaviors when participants were exposed to POP marketing. This was not the case with our study, which yielded positive behavior differences in the selection of certain targeted beverages such as sodas between exposed and non-exposed participants as well as pre- and post-intervention. This was somewhat surprising, as the campaign conducted by Hoefkens et al.[30] was designed in a similar manner to our own, with POP marketing on food items and accompanying nutrition education materials that explained the campaign. One difference in the Hoefkens et al.[30] study is the use of a ranking system for foods. The ranking system may have been more complicated in terms of instant recognition of meaning than our POP icons, making only those participants who were motivated to use the ranking system read the accompanying materials and likely to change their behaviors.

One feature of our analysis that strengthened our results is the comparison of both pre- and post-intervention groups with exposed vs. non-exposed groups. Using this analysis, we can interpret whether observed changes may have been due to secular changes or whether it is likely that our intervention impacted behaviors and /or knowledge. When comparing pre- and post-intervention to exposed and unexposed participants we found different results with the exception of a greater likelihood for both pre-intervention participants and the unexposed participants post-intervention to drink regular soda at least once per week. This may indicate that there is a difference in people who read or utilized the campaign because the behaviors observed for exposed versus unexposed participants were different than those of the pre- and post-intervention groups. This also may indicate that a secular change, such as weather patterns may have influenced beverage choices in our population.

When comparing nutrition knowledge among pre- and post-intervention and exposed versus unexposed groups, we found that both analyses yielded significant differences in correctly identifying that 100% fruit juice is not a source of calcium or vitamin D and that artificial sweeteners may increase the sensation of hunger. These overlaps indicate these findings are likely related to the campaign and not a secular change. Findings that were not seen in both comparisons, such as the difference in awareness of the role of calcium and vitamin D in bone health may indicate influences other than the campaign are the cause of the results.

It was initially planned that our research would explore the relationship between motivation to change and behavior, in order to expand on work by Kristal[41] and Hoefkens[30] which suggest that motivation may influence how people interact with POP and therefore may lead to behavior change. This was not possible due to error in our study; however this may be addressed in future studies. Another avenue for future research would be examining the link between SOC, behavioral intentions and beverage selections, which was unable to be completed in this study. Although we found changes in self-reported beverage selection behaviors, we could not assess to what extent the behavior change intentions of participants changed following intervention. Examining whether POP is effective in moving people from stages on planning to stages of action may be helpful in better understanding how behavioral changes are made with respect to beverage selections.

Strengths

The use of a web-based questionnaire with an invitation through the student e-mail system ensured two important things. The first is that the maximum number of

potential participants could be reached by using an official an up-to-date contact for each student. The second is that the web-based format allowed participants to take the survey at their leisure and in their own home or dormitory. This is in contrast to surveys that may take place in a dining facility, when students may not have time to complete it. The large sample size attained in this study (1547 participants in pre-intervention and 1387 in post-intervention) is an additional strength of our research as we can be confident that they study is well-powered to detect differences between groups.

Another strength of this study is the environment in which it took place. The UMass system is primed for this type of nutrition intervention. UMass Dining Services offers students access to nutrition information online and provides menu identifiers on entrees and sides detailing whether the items are healthy, vegetarian, vegan, made with sustainable or local seafood/produce and/or gluten or nut free in all Dining Commons. Students eating at the Dining Commons may already seek nutrition information through the above mentioned channels, making a POP campaign such as ours a complement to existing nutrition information.

Our study included both baseline data collection as well as a control group for post-intervention data collection. This adds to existing research which typically lacks either or both of these features. Using both a baseline data collection and a control group strengthen analysis when considering whether changes in behaviors or knowledge are based on secular changes, existing differences in those who respond to or do not respond to POP/nutrition education, or to exposure to our intervention.

Limitations

The survey itself was relatively lengthy which may have led to response burden in some participants, and resulted in fewer completed surveys than desired. Indeed, participants were more likely to answer questions at the beginning of the survey than towards the end, with 968 participants of 1387 (69.7%) completing the post-intervention questionnaire.

The analysis was limited due to 1.) human error in reporting objective beverage consumption data and 2.) typographical oversight in the SOC assessment question. These errors led us to be unable to perform the analysis as initially planned, which included comparing self-reported data and measured beverage consumption as well as comparing SOC assessment with likelihood of behavior change.

This study did not address financial barriers to accessing healthy beverages. All participants in our study were students with a pre-paid meal plan of at least six meals per week. The Dining Commons are all-you-care-to-eat facilities in which items are not purchased a la carte. Because all beverages in the Dining Commons are of equal price and availability, it is not possible to know whether participants would have made the same choices in beverages outside the Dining Commons facilities. This limits the generalizability of our study to only people with a pre-paid meal plan system.

Finally, although some evidence suggests that participants with higher initial nutrition knowledge may respond better to an intervention, this was not addressed in our analysis. This may be addressed in the future with additional analysis controlling for

nutrition knowledge pre-intervention using regression models to compare pre-and post-intervention and when considering potentially confounding characteristics.

Summary of Findings

In this study of self-reported beverage consumption habits and nutrition knowledge, we found that following the POP intervention, exposed participants differed from those who were not exposed. This was true for self-reported consumption habits of calcium and vitamin D rich beverages and sweetened beverages, as well as nutrition knowledge. We also found that knowledge and behaviors were different among respondents prior to the intervention compared to after the intervention.

Implications for Research and Practice

As stated above, the UMass system made for an environment that was ready for and likely to accept the POP campaign we implemented. Our participants came from a sample of students who were already used to utilizing POP nutrition information in the form of menu identifiers provided by UMass Dining Services. In future practice, other colleges or universities seeking to implement a similar campaign should consider the campus environment when planning interventions. Success of a campaign may depend on the existing campus environment, both in food service settings and elsewhere in the college or university.

Based on our results, future research could involve expanding our POP marketing campaign into on-campus convenience stores where students pay a la carte per item for beverages and are not linked with the campus meal plans. This would help to elucidate

the effectiveness of POP interventions targeting beverage behaviors in environments that involve a price factor.

Another factor that could be examined in future studies would be how motivation to change behaviors is impacted by nutrition education courses in collegiate settings. Although Kristal et al.[39] did measure SOC assessment in their study of nutrition education in worksite settings, no known studies have specifically examined SOC and classroom education in college nutrition courses aimed at changing beverage behaviors. Given the link between nutrition knowledge, motivation and behaviors, it would be beneficial to better understand how motivation may change with education and whether that change ultimately impacts beverage selection behaviors.

Conclusion

Our study found that POP marketing and nutrition education impacted self-reported consumption of some targeted beverages. We also found that POP nutrition education was effective in increasing nutrition knowledge with respect to fruit juice and calcium and vitamin D as well as a link between artificial sweeteners and hunger.

Some of our questions remain unanswered. Future research could include examining a link between SOC, behavioral intentions and beverage selections, as well as the links between motivation, knowledge and POP.

Our study produced a successful POP marketing campaign aimed at changing beverage behaviors and nutrition knowledge. The results of our study add to existing literature on POP marketing in the college population and open possibilities for future research to test generalizability.

TABLE 1. Demographic Characteristics of Study Participants

Variable	Pre-Intervention % (n)	Post-Intervention % (n)
Gender		
Male	44.7(539)	45.0(488)
Female	54.8(661)	54.6(592)
Transgender	0.3(4)	0.3(3)
Other	0.2(2)	0.2(2)
Race		
White	64.8(1003)	65.2(905)
Black	2.8(44)	2.2(31)
Latino	3.6(56)	3.8(53)
Asian	8.0(123)	8.1(113)
Native American	1(16)	0.9(12)
Cape Verdean	0.7(11)	0.4(6)
Pacific Islander	0.4(6)	0.5(7)
Unmarked/Other	18.7(271)	18.9(260)

TABLE 2. Self-Reported Beverage Practices for Pre- and Post-Intervention

Self-Reported Practice[c]	Overall	Time		
		Pre-Intervention[a]	Post-Intervention[b]	P Value
		%(n)		
Unsweetened ca/vitD				
Drank≥1 day per week				
No	35.1(719)	35.2(496)	34.7(223)	0.829
Yes	64.9(1331)	64.8(912)	65.3(419)	
Drank ≥16oz/day				
No	65.2(822)	65.4(561)	64.8(261)	0.829
Yes	34.8(439)	34.6(297)	35.2(142)	
Sweetened Ca/vitD				
Drank≥1day per week				
No	60.9(1236)	61.9(863)	58.8(373)	0.195
Yes	39.1(793)	38.1(532)	41.2(261)	
Drank ≥16oz/day				
No	82.1(1027)	82.3(701)	81.7(326)	0.805
Yes	17.9(224)	17.7(151)	18.3(73)	
All Ca/vitD				
Drank≥1day per week				
No	26.3(525)	27.6(379)	23.3(146)	0.045
Yes	73.8(1475)	72.4(995)	76.7(480)	
Drank 8oz/day				
No	39.6(487)	40.6(340)	37.4(147)	0.289
Yes	60.4(744)	59.4(498)	62.6(246)	
Drank ≥16oz/day				
No	54.0(665)	54.4(456)	53.2(209)	0.685
Yes	46.0(566)	45.6(382)	46.8(184)	
Drank 24oz/day				
No	60.4(744)	60.9(510)	59.6(234)	0.659
Yes	39.6(487)	39.1(328)	40.4(159)	
Sweet Teas				
Drank ≥ 1 day/wk				
No	65.6(1330)	64.5(901)	67.9(429)	0.143
Yes	34.4(698)	35.5(495)	32.1(203)	
Drank ≥ 12oz/day				
No	76.8(962)	76.3(650)	77.8(312)	0.554
Yes	23.2(291)	23.7(202)	22.2(89)	

Fruit Juice				
Drank ≥ 1 day per week				
No	37.5(767)	38.2(536)	36.0(231)	0.330
Yes	62.5(1277)	61.8(866)	64.0(411)	
Drank ≥ 6oz/day				
No	34.6(433)	34.0(290)	36.1(143)	0.484
Yes	65.4(817)	66.0(563)	63.9(254)	
Fruit Drinks				
Drank ≥ 1 day per week				
No	47.1(956)	41.0(640)	49.8(316)	0.110
Yes	52.9(1072)	59.0(753)	50.2(319)	
Drank ≥ 12oz/day				
No	62.2(778)	61.1(522)	64.5(256)	0.254
Yes	37.8(473)	38.9(332)	35.5(141)	
Diet Drinks				
Drank ≥ 1 day per week				
No	68.0(1373)	66.7(927)	70.9(446)	0.060
Yes	32.0(646)	33.3(463)	29.1(183)	
Drank ≥ 12oz/day				
No	76.8(960)	74.1(630)	82.7(330)	0.001
Yes	23.2(290)	25.9(221)	17.3(69)	
Regular Sodas				
Drank≥1 day per week				
No	58.1(1182)	55.7(780)	63.5(402)	0.001
Yes	41.9(851)	44.3(620)	36.5(231)	
Drank≥12oz/day				
No	72.0(906)	69.4(594)	77.6(312)	0.002
Yes	28.0(352)	30.6(262)	22.4(90)	
Hot Chocolate				
Drank ≥ 1 day per week				
No	84.3(1694)	81.2(1123)	91.1(571)	<0.001
Yes	15.7(316)	18.8(260)	8.9(56)	
Drank ≥ 12oz/day				
No	92.6(1158)	91.7(781)	95.0(377)	0.032
Yes	7.4(92)	8.3(71)	5.0(20)	

[a]All respondents from pre-intervention survey.
[b]Respondents from post-intervention survey who were classified as exposed (saw and/or read POP and/or nutrition education materials.

[c]Beverages defined:
Unsweetened ca/vit D includes skim milk, 2% milk and rice milk
Sweetened ca/vitD includes 1% chocolate milk and soy milk
All ca/vitD includes all unsweetened and sweetened milks listed above
Sweet Teas include black, green and other flavored sweetened iced teas
Fruit Juices include 100% apple or orange juice
Fruit Drinks include grape drink, orange-guava drink, Powerade™ and Hi-C Lemonade™
Diet Drinks include Minute Maid™ light lemonade, Diet Coke™, Coke Zero™ and Sprite Zero™
Regular Sodas include Coca Cola Classic™, Sprite™, orange soda, rootbeer and gingerale
Hot Chocolate includes hot chocolate mix

TABLE 3. Self-Reported Beverage Practices and Exposure to POP at Post-Intervention

Self-reported practice[b]	Overall	Exposure[a]		
		No	Yes	P value
		%(n)		
Unsweetened Ca/vitD				
Drank≥1 day per week				
No	35.2(444)	35.7(221)	34.8(223)	0.719
Yes	64.8(817)	64.3(398)	65.2(419)	
Drank ≥16oz/day				
No	66.8(490)	69.2(229)	53.3(261)	0.206
Yes	33.2(244)	30.8(102)	35.2(142)	
Sweetened Ca/vitD				
Drank≥1day per week				
No	61.9(767)	65.1(394)	59.0(373)	0.025
Yes	38.1(473)	34.9(212)	41.0(261)	
Drank ≥16oz/day				
No	83.1(604)	84.8(278)	86.7(326)	0.275
Yes	16.9(123)	15.2(50)	18.3(73)	
All Ca/vitD				
Drank≥1day per week				
No	25.7(314)	28.2(168)	23.3(146)	0.052
Yes	74.3(908)	71.8(428)	76.7(480)	
Drank 8oz/day				
No	40.1(287)	43.5(140)	37.4(147)	0.099
Yes	59.9(428)	56.5(182)	62.6(246)	
Drank ≥16oz/day				
No	55.5(397)	58.4(188)	53.2(209)	0.164
Yes	44.5(318)	41.6(134)	46.8(184)	
Drank 24oz/day				
No	61.3(438)	63.4(204)	59.6(234)	0.298
Yes	38.7(277)	36.6(118)	40.4(159)	
Sweet Teas				
Drank ≥ 1 day per week				
No	66.7(828)	65.4(399)	67.9(429)	0.356
Yes	33.3(414)	34.6(211)	32.1(203)	
Drank ≥ 12oz/day				
No	78.6(572)	79.5(260)	77.8(312)	0.577

Yes	21.4(156)	20.5(67)	22.2(89)	
Fruit Juice				
Drank ≥ 1 day per week				
No	37.8(475)	39.7(244)	36.0(231)	0.177
Yes	62.2(782)	60.3(371)	64.0(411)	
Drank ≥ 6oz/day				
No	38.8(281)	42.2(138)	36.1(143)	0.089
Yes	61.2(443)	57.8(189)	63.9(254)	
Fruit Drinks				
Drank ≥ 1 day per week				
No	48.2(600)	46.5(284)	49.8(316)	0.246
Yes	51.8(646)	53.5(327)	50.2(319)	
Drank ≥ 12oz/day				
No	62.1(453)	59.2(197)	64.5(256)	0.140
Yes	37.9(277)	40.8(136)	35.5(141)	
Diet Drinks				
Drank ≥ 1 day per week				
No	71.7(886)	72.5(440)	70.9(446)	0.537
Yes	28.3(350)	27.5(167)	29.1(183)	
Drank ≥ 12oz/day				
No	81.9(593)	80.9(263)	82.7(330)	0.535
Yes	18.1(131)	19.1(62)	17.3(69)	
Regular Sodas				
Drank ≥ 1 day per week				
No	60.8(756)	57.9(354)	63.5(402)	0.044
Yes	39.2(488)	42.1(257)	36.5(231)	
Drank ≥ 12oz/day				
No	75.2(549)	72.3(237)	77.6(312)	0.096
Yes	24.8(181)	27.7(91)	22.4(90)	
Hot Chocolate				
Drank≥1 day per week				
No	89.4(1102)	87.8(531)	91.1(571)	0.059
Yes	10.6(130)	12.2(74)	8.9(56)	
Drank≥12oz/day				
No	94.7(685)	94.5(308)	95.0(377)	0.772
Yes	5.3(38)	5.5(18)	5.0(20)	

[a] Exposure defined as positive response to having seen or read posters, table tents and/or icons in POP campaign

[b]Beverages defined:

Unsweetened ca/vit D includes skim milk, 2% milk and rice milk
Sweetened ca/vitD includes 1% chocolate milk and soy milk
All ca/vitD includes all unsweetened and sweetened milks listed above
Sweet Teas include black, green and other flavored sweetened iced teas
Fruit Juices include 100% apple or orange juice
Fruit Drinks include grape drink, orange-guava drink, Powerade™ and Hi-C Lemonade™
Diet Drinks include Minute Maid™ light lemonade, Diet Coke™, Coke Zero™ and Sprite Zero™
Regular Sodas include Coca Cola Classic™, Sprite™, orange soda, rootbeer and gingerale
Hot Chocolate includes hot chocolate mix

TABLE 4. Self-Reported Beverage Practices and Self-Reported Use of POP Icons

Self-reported practice[b]	Overall	Use of Icons[a]		
		No	Yes	P-Value
		%(n)		
Unsweetened Ca/vitD				
Drank≥1 day per week				
No	35.9(322)	40.0(183)	31.5(139)	0.008
Yes	64.1(576)	60.0(274)	68.5(302)	
Drank ≥16oz/day				
No	66.4(364)	67.9(186)	65(178)	0.469
Yes	33.6(184)	32.1(88)	35(96)	
Sweetened Ca/vitD				
Drank≥1day per week				
No	59.8(530)	60.4(274)	59.1(256)	0.709
Yes	40.2(357)	39.6(180)	40.9(177)	
Drank ≥16oz/day				
No	82.9(450)	80.9(220)	84.9(230)	0.217
Yes	17.1(93)	19.1(52)	15.1(41)	
All Ca/vitD				
Drank≥1day per week				
No	25.4(221)	28.0(125)	22.6(96)	0.065
Yes	74.6(650)	72.0(321)	77.4(329)	
Drank 8oz/day				
No	38.8(208)	38.5(104)	39.1(104)	0.891
Yes	61.2(328)	61.5(166)	60.9(162)	
Drank ≥16oz/day				
No	54.5(292)	53.3(144)	55.6(148)	0.592
Yes	45.5(244)	46.7(126)	44.4(118)	
Drank 24oz/day				
No	61.2(328)	60.0(162)	62.4(166)	0.568
Yes	38.8(208)	40.0(108)	37.6(100)	
Sweet Teas				
Drank ≥ 1 day per week				
No	67.1(595)	67.1(304)	67.1(291)	0.985
Yes	32.9(292)	32.9(149)	32.9(143)	
Drank ≥ 12oz/day				
No	77.8(423)	76.3(203)	79.2(217)	0.416
Yes	22.2(121)	23.7(64)	20.8(57)	

Fruit Juice				
Drank ≥ 1 day per week				
No	36.3(326)	41.3(189)	31.1(137)	0.001
Yes	63.7(573)	58.7(269)	68.9(304)	
Drank ≥ 6oz/day				
No	36.9(200)	39.0(106)	34.8(94)	0.316
Yes	63.1(342)	61.0(166)	65.2(176)	
Fruit Drinks				
Drank ≥ 1 day per week				
No	47.7(424)	48.1(218)	47.2(206)	0.794
Yes	52.3(465)	51.9(235)	52.8(230)	
Drank ≥ 12oz/day				
No	62.3(339)	63.5(174)	61.1(165)	0.565
Yes	37.7(205)	36.5(100)	38.9(105)	
Diet Drinks				
Drank ≥ 1 day per week				
No	70.0(619)	72.2(324)	67.8(295)	0.159
Yes	30.0(265)	27.8(125)	32.2(140)	
Drank ≥ 12oz/day				
No	82.1(446)	83.1(226)	81.2(220)	0.562
Yes	17.9(97)	16.9(46)	18.8(51)	
Regular Sodas				
Drank ≥ 1 day per week				
No	61.8(551)	58.9(268)	64.8(283)	0.072
Yes	38.2(341)	41.1(187)	35.2(154)	
Drank ≥ 12oz/day				
No	76.1(416)	74.7(204)	77.4(212)	0.468
Yes	23.9(131)	25.3(69)	22.6(62)	
Hot Chocolate				
Drank≥1 day per week				
No	90.7(797)	92.2(416)	89.0(381)	0.101
Yes	9.3(82)	7.8(35)	11.0(47)	
Drank≥12oz/day				
No	94.8(513)	96.3(260)	93.4(253)	0.123
Yes	5.2(28)	3.7(10)	6.6(18)	

[a]Use of icons defined as positive response to the question "Did you use the icons located on the beverage dispensers to guide your beverage selection?"

[b]Beverages defined:

Unsweetened ca/vit D includes skim milk, 2% milk and rice milk

Sweetened ca/vitD includes 1% chocolate milk and soy milk

All ca/vitD includes all unsweetened and sweetened milks listed above
Sweet Teas include black, green and other flavored sweetened iced teas
Fruit Juices include 100% apple or orange juice
Fruit Drinks include grape drink, orange-guava drink, Powerade™ and Hi-C Lemonade™
Diet Drinks include Minute Maid™ light lemonade, Diet Coke™, Coke Zero™ and Sprite Zero™
Regular Sodas include Coca Cola Classic™, Sprite™, orange soda, rootbeer and gingerale
Hot Chocolate includes hot chocolate mix

TABLE 5. Nutrition Knowledge Pre- and Post-Invention

	Overall	Time		
Nutrient Source[c]		Pre-Intervention[a]	Post-Intervention[b]	P Value
		%(n)		
calcium and vitamin D				
ca/vitD Unsweetened Milks				
Incorrect	1.9(35)	2.3(29)	1.0(6)	0.066
Correct	98.1(1844)	97.7(1259)	99.0(585)	
ca/vitD Sweetened Milks				
Incorrect	4.3(81)	4.9(62)	3.3(19)	0.107
Correct	95.7(1792)	95.1(1219)	96.7(573)	
No ca/vitD Fruit Juice				
Incorrect	68.9(1285)	73.6(939)	59.0(346)	<0.001
Correct	31.1(579)	26.4(338)	41.0(241)	
Added Natural Sweeteners				
Natural Sweetener in Sweet Milks				
Incorrect	57.5(1009)	58.2(699)	56.0(310)	0.366
Correct	42.5(745)	41.8(501)	44.0(244)	
Natural Sweetener in Sweet Teas				
Incorrect	23.1(407)	23.2(280)	22.9(127)	0.891
Correct	76.9(1356)	76.8(928)	77.1(428)	
Natural Sweetener in Fruit Drinks				
Incorrect	20.3(358)	20.2(243)	20.7(115)	0.822
Correct	79.7(1403)	79.8(961)	79.3(442)	
Natural Sweetener in Regular Sodas				
Incorrect	25.7(453)	25.1(302)	27.1(151)	0.372
Correct	74.3(1310)	74.9(903)	72.9(407)	
Natural Sweetener in Hot Chocolate				
Incorrect	42.2(742)	42.6(511)	41.6(231)	0.693
Correct	57.8(1015)	57.4(690)	58.4(325)	
Health Outcomes[d]				
ca/vitD Bone Health				
Incorrect	14.6(328)	15.8(243)	11.9(85)	0.027
Correct	85.4(1919)	84.2(1304)	88.1(615)	

ca/vitD Teeth				
Incorrect	13.8(310)	14.7(227)	12.1(83)	0.073
Correct	86.2(1937)	85.3(1320)	87.9(617)	
Added Sweeteners and Cavities				
Incorrect	18.2(409)	19.3(299)	15.7(110)	0.04
Correct	81.8(1838)	80.7(1248)	84.3(590)	
Artificial Sweetener and Hunger				
Incorrect	30.2(678)	34.1(528)	21.4(150)	<0.001
Correct	69.8(1569)	65.9(1019)	78.6(550)	

[a]All respondents from pre-intervention survey.

[b]Respondents from post-intervention survey who were classified as exposed (saw and/or read POP and/or nutrition education materials.

[c]Nutrient sources defined:

calcium and vitamin D

Knowledge that unsweetened milks (skim milk, 2% milk and rice milk) and sweetened milks (1% chocolate milk and soy milk) contain calcium and vitamin D, while fruit juices (100% apple or orange juice) do not.

Added natural sweeteners

Knowledge that sweetened milks (1% chocolate milk and soy milk) sweet teas (black, green, and other flavored sweetened iced teas), fruit drinks (grape drink, orange-guava drink, Powerade™ and Hi-C Lemonade™), regular sodas (Coca Cola Classic™, Sprite™, orange soda, rootbeer and gingerale), and hot chocolate (hot chocolate mix) contain added natural sweeteners.

[d]Health outcomes defined:

ca/vitD Bone Health Knowledge of the link between bone health and calcium and vitamin D, knowledge of a protective effect of calcium and vitamin D on teeth, knowledge of link between added sweeteners and dental caries, knowledge of link between artificial sweeteners and hunger

TABLE 6. Nutrition Knowledge and Exposure to POP at Post-Intervention

	Overall	Exposure[a]		
		No	Yes	P value
Nutrient Source[b]				
		%(n)		
calcium and vitamin D				
Ca/vitD Unsweetened Milks	1.8(21)	2.7(15)	1.0(6)	0.036
Incorrect	98.2(1132)	97.3(547)	99.0(585)	
Correct				
Ca/vitD Sweetened Milks	3.8(44)	4.5(25)	3.3(19)	0.267
Incorrect	96.2(1108)	95.5(535)	96.7(573)	
Correct				
No Ca/vitD Fruit Juice	62.5(714)	66.2(368)	59.0(346)	0.011
Incorrect	37.5(429)	33.8(188)	41.0(241)	
Correct				
Added Sweeteners				
Natural Sweetener in Sweet Milks	56.7(606)	57.6(296)	56.0(310)	0.591
Incorrect	43.3(462)	42.4(218)	44.0(244)	
Correct				
Natural Sweetener in Sweet Teas	24.4(262)	26.1(135)	22.9(127)	0.226
Incorrect	75.6(811)	73.9(383)	77.1(428)	
Correct				
Natural Sweetener in Fruit Drinks	20.3(218)	19.9(103)	20.7(115)	0.756
Incorrect	79.7(857)	80.1(415)	79.3(442)	
Correct				
Natural Sweetener in Regular Sodas	26.5(284)	42.6(382)	27.1(151)	0.647
Incorrect	73.5(789)	57.415)	72.9(407)	
Correct				
Natural Sweetener in Hot Chocolate	42.9(461)	44.4(230)	41.6(231)	0.345
Incorrect	57.1(613)	55.688)	58.4(325)	
Correct				
Health Outcomes[c]				
Ca/vitD Bone Health	12.8(176)	13.8(93)	11.9(85)	0.296
Incorrect	87.2(1201)	86.2(584)	88.1(615)	
Correct				

Ca/vitD Teeth	13.4(185)	14.8(100)	12.1(83)	0.153
Incorrect	86.6(1192)	85.2(577)	87.9(617)	
Correct				
Added Sweeteners and Cavities	16.7(230)	20.1(120)	15.7(110)	0.317
Incorrect	83.3(1147)	79.9(557)	84.3(590)	
Correct				
Artificial Sweetener and Hunger	26.1(360)	31.1(210)	21.4(150)	<0.001
Incorrect	73.9(1017)	68.9(467)	78.6(550)	

[a] Exposure defined as positive response to having seen or read posters, table tents and/or icons in POP campaign

[b]Nutrient sources defined:

calcium and vitamin D

Knowledge that unsweetened milks (skim milk, 2% milk and rice milk) and sweetened milks (1% chocolate milk and soy milk) contain calcium and vitamin D, while fruit juices (100% apple or orange juice) do not.

Added natural sweeteners

Knowledge that sweetened milks (1% chocolate milk and soy milk) sweet teas (black, green, and other flavored sweetened iced teas), fruit drinks (grape drink, orange-guava drink, Powerade™ and Hi-C Lemonade™), regular sodas (Coca Cola Classic™, Sprite™, orange soda, rootbeer and gingerale), and hot chocolate (hot chocolate mix) contain added natural sweeteners.

[c]Health outcomes defined:

ca/vitD Bone Health Knowledge of the link between bone health and calcium and vitamin D, knowledge of a protective effect of calcium and vitamin D on teeth, knowledge of link between added sweeteners and dental caries, knowledge of link between artificial sweeteners and hunger

TABLE 7. Nutrition Knowledge and Self-Reported Use of POP Icons

	Overall	Use of Icons[a]		
Nutrient Source[b]	Row%(n)	No	Yes	P value
		%(n)		
calcium and vitamin D				
Ca/vitD Unsweetened Milks				
Incorrect	1.8(15)	2.2(9)	1.5(6)	0.448
Correct	98.2(810)	97.8(406)	98.5(404)	
Ca/vitD Sweetened Milks				
Incorrect	3.8(31)	3.9(16)	3.6(15)	0.876
Correct	96.2(795)	96.1(399)	96.4(396)	
No Ca/vitD Fruit Juice				
Incorrect	61.3(503)	61.2(254)	61.3(249)	0.971
Correct	38.7(318)	38.8(161)	38.7(157)	
Added Sweeteners				
Natural Sweetener in Sweet Milks				
Incorrect	57.7(444)	61.3(239)	53.9(205)	0.039
Correct	42.3(326)	38.7(151)	46.1(175)	
Natural Sweetener in Sweet Teas				
Incorrect	24.3(188)	25.7(101)	22.9(87)	0.363
Correct	75.7(585)	74.3(292)	77.1(293)	
Natural Sweetener in Fruit Drinks				
Incorrect	21.8(169)	25.6(101)	17.9(68)	0.009
Correct	78.2(605)	74.4(293)	82.1(312)	
Natural Sweetener in Regular Sodas				
Incorrect	28.2(218)	28.2(111)	28.1(107)	0.960
Correct	71.8(556)	71.8(282)	71.9(274)	
Natural Sweetener in Hot Chocolate				
Incorrect	43.4(335)	45.4(178)	41.3(157)	0.251
Correct	56.6(437)	54.6(214)	58.7(223)	
Health Outcomes[c]				
Ca/vitD Bone Health				
Incorrect	12.4(122)	12.4(62)	12.3(60)	0.960
Correct	87.6(864)	87.6(437)	87.7(427)	
Ca/vitD Teeth				

Incorrect	12.7(125)	12.2(61)	13.1(64)	0.665
Correct	87.3(861)	87.8(438)	86.9(423)	
Added Sweeteners and Cavities				
Incorrect	16.1(159)	15.8(79)	16.4(80)	0.799
Correct	83.9(827)	84.2(420)	83.6(407)	
Artificial Sweetener and Hunger				
Incorrect	23.9(236)	23.4(117)	24.4(119)	0.716
Correct	76.1(750)	76.6(382)	75.6(368)	

[a]Use of icons defined as positive response to the question "Did you use the icons located on the beverage dispensers to guide your beverage selection?"

[b]Nutrient sources defined:

calcium and vitamin D

Knowledge that unsweetened milks (skim milk, 2% milk and rice milk) and sweetened milks (1% chocolate milk and soy milk) contain calcium and vitamin D, while fruit juices (100% apple or orange juice) do not.

Added natural sweeteners

Knowledge that sweetened milks (1% chocolate milk and soy milk) sweet teas (black, green, and other flavored sweetened iced teas), fruit drinks (grape drink, orange-guava drink, Powerade™ and Hi-C Lemonade™), regular sodas (Coca Cola Classic™, Sprite™, orange soda, rootbeer and gingerale), and hot chocolate (hot chocolate mix) contain added natural sweeteners.

[c]Health outcomes defined:

ca/vitD Bone Health Knowledge of the link between bone health and calcium and vitamin D, knowledge of a protective effect of calcium and vitamin D on teeth, knowledge of link between added sweeteners and dental caries, knowledge of link between artificial sweeteners and hunger

FIGURE 1:

VENN DIAGRAM OF STRATEGIES USED IN INTERVENTIONS TARGETING FOOD SELECTION BEHAVIOR

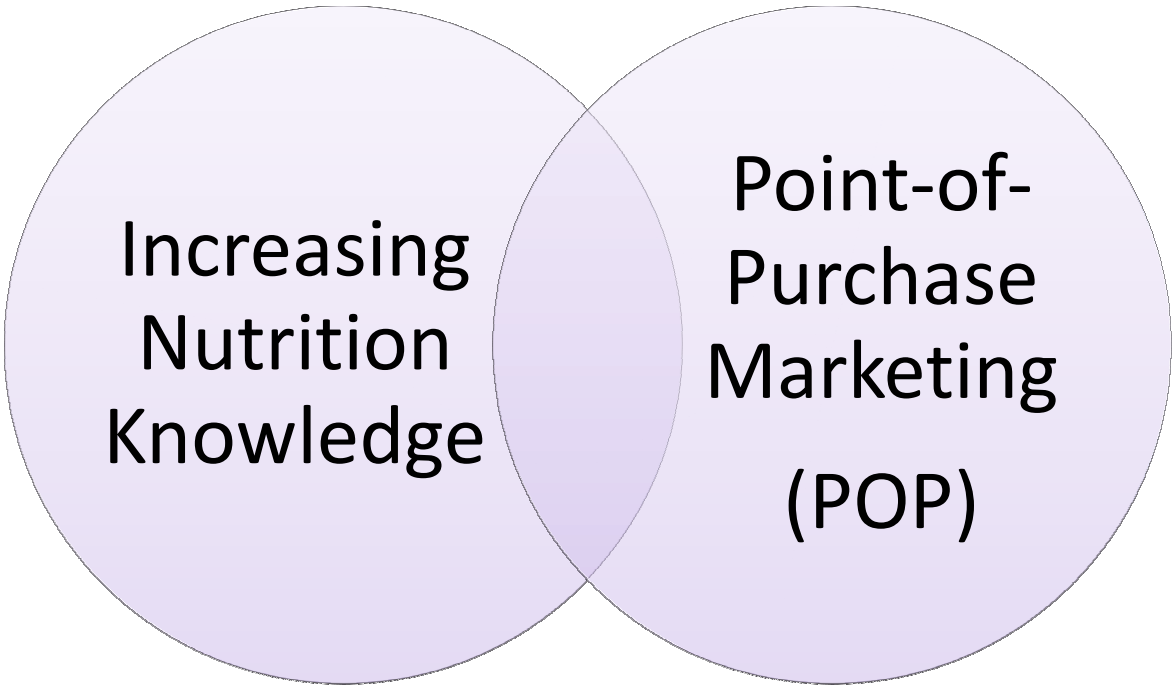
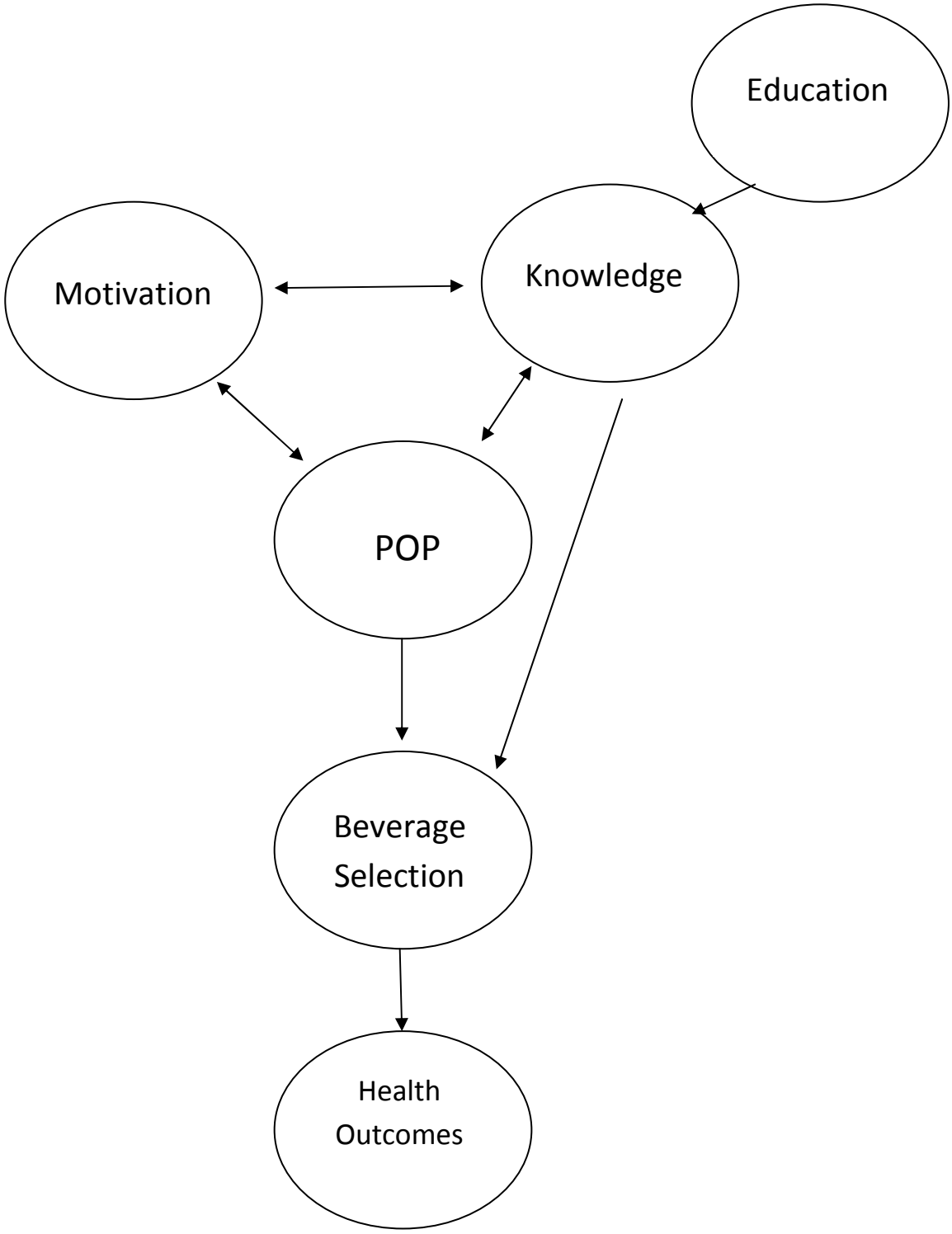


FIGURE 2:

PROPOSED CONCEPTUAL MODEL OF HOW POP MARKETING, EDUCATION, KNOWLEDGE, AND MOTIVATION INFLUENCE BEVERAGE SELECTION AND HEALTH OUTCOMES



APPENDIX A

APPROVAL FROM INSTITIUTIONAL REVIEW BOARD

University of Massachusetts Amherst
108 Research Administration Bldg.
70 Butterfield Terrace
Amherst, MA 01003-9242

Research Compliance
Human Research Protection Office (HRPO)
Telephone: (413) 545-3428
FAX: (413) 577-1728

Certification of Human Subjects Approval

Date: February 14, 2011

To: Heather Morin, Nutrition

Other Investigator: Dianne Sutherland, Worcester Dining Commons, Jerusha Peterman, Nutrition

From: Priscilla Clarkson, Chair, UMASS IRB

Protocol Title:The Impact of Point-of-Purchase Icons and Nutrition Education on Beverage Choice Among Undergraduate College Students in a University Dining Commons Setting
Protocol ID: 2010-0811
Review Type:EXPEDITED - NEW
Paragraph ID: 7
Approval Date: 02/14/2011
Expiration Date:02/13/2012
OGCA #:

This study has been reviewed and approved by the University of Massachusetts Amherst IRB, Federal Wide Assurance # 00003909. Approval is granted with the understanding that investigator(s) are responsible for:

Modifications - All changes to the study (e.g. protocol, recruitment materials, consent form, additional key personnel), must be submitted for approval in e-protocol before instituting the changes. New personnel must have completed CITI training.

Consent forms - A copy of the approved, validated, consent form (with the IRB stamp) must be used to consent each subject. Investigators must retain copies of signed consent documents for six (6) years after close of the grant, or three (3) years if unfunded.

Adverse Event Reporting - Adverse events occurring in the course of the protocol must be reported in e-protocol as soon as possible, but no later than five (5) working days.

Continuing Review - Studies that received Full Board or Expedited approval must be reviewed three weeks prior to expiration, or six weeks for Full Board. Renewal Reports are submitted through e-protocol.

Completion Reports - Notify the IRB when your study is complete by submitting a Final Report Form in e-protocol.

Consent form (when applicable) will be stamped and sent in a separate e-mail. Use only IRB approved copies of the consent forms, questionnaires, letters, advertisements etc. in your research.

Please contact the Human Research Protection Office if you have any further questions. Best wishes for a successful project.

APPENDIX B1

POINT-OF-PURCHASE ICON EXAMPLES

APPENDIX B2

NUTRITION EDUCATION POSTER

APPENDIX B3

TABLE TENT

Side 1

Side 2

APPENDIX C

STUDY SURVEY

Question INTRO

This semester, Dining Services is conducting research about beverage consumption in the Dining Commons (DC) here at the University. Through this study, we hope to learn more about students' beverage preferences, the amounts of different types of beverages they consume at meals, and the information they have about beverages' nutritional aspects. The findings of this study will be used to inform beverage offerings in the DC.

You have been randomly selected by computer from the population of all residential students on a meal plan to participate in this important survey. The questionnaire asks about your own beverage consumption in the DC, including what specific beverages you consume and how many glasses you consume at typical meals. The survey is confidential and your responses will be analyzed only after being grouped together with those of other students. Your participation is voluntary; at any time, you may exit or skip questions that you do not wish to answer. The survey should take you approximately 5-7 minutes to complete. You should not fill out the survey unless you are 18 or older.

All students who complete the survey will be entered into a drawing to win an Apple iPad.

If you have any questions about this study, please contact Dianne Sutherland at dsutherland@mail.aux.umass.edu or 413-545-2472.

By checking the "I consent" statement below, you understand that:

* **Your participation is voluntary.**
* **The survey is intended for students 18 years of age or older.**
* **At any time you may exit the survey or skip questions that you do not wish to answer.**
* **The survey is confidential and your responses will be analyzed only after being merged with those of other students.**

*** If you have any questions concerning your rights as a research subject, you may contact the University's Human Research Protection Office at 413.545.3428 or humansubjects@ora.umass.edu.**

If you are ready to begin, click the consent statement below.

- [ ] **I CONSENT TO PARTICIPATE IN THIS SURVEY**

NOTE: If you are interrupted while filling out the survey, and need to terminate your browser session, you can click on the link again and resume where you left off.

Question DEMO1

The first few questions ask for some background information.

You are:

- [ ] **Vegetarian**
- [ ] **Vegan**
- [ ] **Neither**

Are you on a Kosher meal plan?

- [ ] **Yes**
- [ ] **No**

Which meal plan are you on?

- [ ] **Residential Unlimited**
- [ ] **Residential Value**

- ☐ **YCMP Platinum**
- ☐ **YMCP Gold**
- ☐ **YCMP Commuter**

Question EDUCMATSA

Do you remember seeing the beverage-related nutrition education materials (e.g. posters, table tents and icons) that were featured recently in the Dining Commons?

- ☐ **Yes**
- ☐ **No**

Question EDUCAMATSB

Did you read the poster pertaining to beverage nutrition?

- ☐ **Yes**
- ☐ **No**

Did you read the table tent pertaining to beverage nutrition?

- ☐ **Yes**

☐ **No**

Did you use the icons located on the beverage dispensers to guide your beverage selection?

☐ **Yes**
☐ **No**

Question PortionDC

Which of the following best describes what proportion of your meals you eat in the Dining Commons?

☐ **Nearly all of your meals**
☐ **Most of your meals**
☐ **Some of your meals**
☐ **None of your meals**

At which Dining Commons (DC) do you eat most often?

☐ **Franklin/Kosher**
☐ **Worcester**
☐ **Hampshire**
☐ **Berkshire**

Question MEALSA

Next, please think about the meals you ate in the Dining Commons over the past seven days.

How many BREAKFASTS did you eat in each of these different DCs in the past seven days?

	Zero Breakfasts	One	Two	Three	Four	Five	Six	Seven Breakfasts
Franklin	☐	☐	☐	☐	☐	☐	☐	☐
Worcester	☐	☐	☐	☐	☐	☐	☐	☐
Hampshire	☐	☐	☐	☐	☐	☐	☐	☐
Berkshire	☐	☐	☐	☐	☐	☐	☐	☐

How many LUNCHES did you eat in each of these different DCs in the past seven days?

	Zero Lunches	One	Two	Three	Four	Five	Six	Seven Lunches
Franklin	☐	☐	☐	☐	☐	☐	☐	☐
Worcester	☐	☐	☐	☐	☐	☐	☐	☐
Hampshire	☐	☐	☐	☐	☐	☐	☐	☐
Berkshire	☐	☐	☐	☐	☐	☐	☐	☐

Question MEALSB

How many DINNERS did you eat in each of these different DCs in the past seven days?

	Zero Dinners	One	Two	Three	Four	Five	Six	Seven Dinners
Franklin	☐	☐	☐	☐	☐	☐	☐	☐
Worcester	☐	☐	☐	☐	☐	☐	☐	☐
Hampshire	☐	☐	☐	☐	☐	☐	☐	☐
Berkshire	☐	☐	☐	☐	☐	☐	☐	☐

Question DAYS

In a TYPICAL WEEK, on how many days do you eat each meal in the Dining Commons?

	ZERO Days	One Day	Two Days	Three Days	Four Days	Five Days	Six Days	Seven Days
Breakfast	☐	☐	☐	☐	☐	☐	☐	☐
Lunch	☐	☐	☐	☐	☐	☐	☐	☐
Dinner	☐	☐	☐	☐	☐	☐	☐	☐

Question BEVERAGES

Below is a comprehensive list of beverages that are available in the Dining Commons here at UMass.
IN THE PAST SEVEN DAYS, on how many days did you consume each type of beverage in the DC? If you did not consume a particular type of beverage in the DC in the past seven days, mark ZERO DAYS.

	ZERO Days	One Day	Two Days	Three Days	Four Days	Five Days	Six Days	Seven Days
Water (Citrus, Sparkling or Plain)	☐	☐	☐	☐	☐	☐	☐	☐
Skim, Lowfat, 2% Milk, Rice Milk or Lactaid	☐	☐	☐	☐	☐	☐	☐	☐
1% Chocolate Milk or Soy Milk	☐	☐	☐	☐	☐	☐	☐	☐
Sweetened Iced Tea (Green, Black or Nestea)	☐	☐	☐	☐	☐	☐	☐	☐
Unsweetened Iced Tea (Black)	☐	☐	☐	☐	☐	☐	☐	☐
100% Fruit Juice (Apple or Orange)	☐	☐	☐	☐	☐	☐	☐	☐
Fruit Drinks (Grape, Orange-guava, Powerade, Hi-C Lemonade)	☐	☐	☐	☐	☐	☐	☐	☐
Diet Drink (Minute Maid Light Lemonade, Diet Coke, Coke Zero, Spite Zero)	☐	☐	☐	☐	☐	☐	☐	☐
Regular Soda (Coke, Sprite, Root Beer, Orange, Gingerale)	☐	☐	☐	☐	☐	☐	☐	☐

Hot Cocoa	☐	☐	☐	☐	☐	☐	☐	☐
Hot Herbal, Green or Black Tea	☐	☐	☐	☐	☐	☐	☐	☐
Coffee	☐	☐	☐	☐	☐	☐	☐	☐

Question BREAKFASTBEV

Next, please think of what you typically drink AT BREAKFAST in the Dining Commons. How much of each type of beverage do you drink at a TYPICAL BREAKFAST in the DC? If you do not typically consume a particular beverage, mark 'None.'

	None	About 1/2 a glass	About 1 full glass	About 1 1/2 glasses	About 2 glasses	More than 2 glasses
Water (Citrus, Sparkling or Plain)	☐	☐	☐	☐	☐	☐
Skim, Lowfat, 2% Milk, Rice Milk or Lactaid	☐	☐	☐	☐	☐	☐
1% Chocolate Milk or Soy Milk	☐	☐	☐	☐	☐	☐
Sweetened Iced Tea (Green, Black or Nestea)	☐	☐	☐	☐	☐	☐
Unsweetened Iced Tea (Black)	☐	☐	☐	☐	☐	☐
100% Fruit Juice (Apple or Orange)	☐	☐	☐	☐	☐	☐
Fruit Drinks (Grape, Orange-guava, Powerade, Hi-C Lemonade)	☐	☐	☐	☐	☐	☐
Diet Drink (Minute Maid Light Lemonade, Diet Coke, Coke Zero, Spite Zero)	☐	☐	☐	☐	☐	☐

Regular Soda (Coke, Sprite, Root Beer, Orange, Gingerale)	☐	☐	☐	☐	☐	☐
Hot Cocoa	☐	☐	☐	☐	☐	☐
Hot Herbal, Green or Black Tea	☐	☐	☐	☐	☐	☐
Coffee	☐	☐	☐	☐	☐	☐

Question LUNCHBEV

Next, please think of what you typically drink AT LUNCH in the Dining Commons. How much of each type of beverage do you drink at a TYPICAL LUNCH in the DC? If you do not typically consume a particular beverage, mark 'None.'

	None	About 1/2 a glass	About 1 full glass	About 1 1/2 glasses	About 2 glasses	More than 2 glasses
Water (Citrus, Sparkling or Plain)	☐	☐	☐	☐	☐	☐
Skim, Lowfat, 2% Milk, Rice Milk or Lactaid	☐	☐	☐	☐	☐	☐
1% Chocolate Milk or Soy Milk	☐	☐	☐	☐	☐	☐
Sweetened Iced Tea (Green, Black or Nestea)	☐	☐	☐	☐	☐	☐
Unsweetened Iced Tea (Black)	☐	☐	☐	☐	☐	☐
100% Fruit Juice (Apple or Orange)	☐	☐	☐	☐	☐	☐
Fruit Drinks (Grape, Orange-guava, Powerade, Hi-C Lemonade)	☐	☐	☐	☐	☐	☐
Diet Drink (Minute Maid Light Lemonade, Diet Coke, Coke Zero, Spite Zero)	☐	☐	☐	☐	☐	☐

Regular Soda (Coke, Sprite, Root Beer, Orange, Gingerale)	☐	☐	☐	☐	☐	☐
Hot Cocoa	☐	☐	☐	☐	☐	☐
Hot Herbal, Green or Black Tea	☐	☐	☐	☐	☐	☐
Coffee	☐	☐	☐	☐	☐	☐

Question DINNERBEV

Next, please think of what you typically drink AT DINNER in the Dining Commons. How much of each type of beverage do you drink at a TYPICAL DINNER in the DC? If you do not typically consume a particular beverage, mark 'None.'

	None	About 1/2 a glass	About 1 full glass	About 1 1/2 glasses	About 2 glasses	More than 2 glasses
Water (Citrus, Sparkling or Plain)	☐	☐	☐	☐	☐	☐
Skim, Lowfat, 2% Milk, Rice Milk or Lactaid	☐	☐	☐	☐	☐	☐
1% Chocolate Milk or Soy Milk	☐	☐	☐	☐	☐	☐
Sweetened Iced Tea (Green, Black or Nestea)	☐	☐	☐	☐	☐	☐
Unsweetened Iced Tea (Black)	☐	☐	☐	☐	☐	☐
100% Fruit Juice (Apple or Orange)	☐	☐	☐	☐	☐	☐
Fruit Drinks (Grape, Orange-guava, Powerade, Hi-C Lemonade)	☐	☐	☐	☐	☐	☐
Diet Drink (Minute Maid Light Lemonade, Diet Coke, Coke Zero, Spite Zero)	☐	☐	☐	☐	☐	☐

Regular Soda (Coke, Sprite, Root Beer, Orange, Gingerale)	☐	☐	☐	☐	☐	☐
Hot Cocoa	☐	☐	☐	☐	☐	☐
Hot Herbal, Green or Black Tea	☐	☐	☐	☐	☐	☐
Coffee	☐	☐	☐	☐	☐	☐

Question WHICHOFTHESEA

The next series of questions is designed to see what students know about Calcium & Vitamin D, Added Natural Sweeteners, and Artificial Sweeteners.

Which of these help to strengthen your teeth?
(Check ALL that apply)

- ☐ **Calcium & Vitamin D**
- ☐ **Added Natural Sweeteners (Sugar, Corn Syrup, Cane Syrup)**
- ☐ **Artificial Sweeteners (Splenda, NutraSweet)**

Which of these may increase your sense of hunger?
(Check ALL that apply)

- ☐ **Calcium & Vitamin D**
- ☐ **Added Natural Sweeteners (Sugar, Corn Syrup, Cane Syrup)**
- ☐ **Artificial Sweeteners (Splenda, NutraSweet)**

Question WHICHOFTHESEB

Which of these may promote cavities?
(Check ALL that apply)

- ☐ **Calcium & Vitamin D**
- ☐ **Added Natural Sweeteners (Sugar, Corn Syrup, Cane Syrup)**
- ☐ **Artificial Sweeteners (Splenda, NutraSweet)**

Which of these promote bone health?
(Check ALL that apply)

- ☐ **Calcium & Vitamin D**
- ☐ **Added Natural Sweeteners (Sugar, Corn Syrup, Cane Syrup)**
- ☐ **Artificial Sweeteners (Splenda, NutraSweet)**

Question CALCIUMVITD

Please indicate, to the best of your knowledge, whether or not each of the beverage-types listed below contains CALCIUM & VITAMIN D.

	YES, contains CALCIUM & VITAMIN D	NO, does not contain CALCIUM & VITAMIN D	I Don't Know/I'm Not Sure
Water (Citrus, Sparkling or Plain)	☐	☐	☐

Skim, Lowfat, 2% Milk, Rice Milk or Lactaid	☐	☐	☐
1% Chocolate Milk or Soy Milk	☐	☐	☐
Sweetened Iced Tea (Green, Black or Nestea)	☐	☐	☐
Unsweetened Iced Tea (Black)	☐	☐	☐
100% Fruit Juice (Apple or Orange)	☐	☐	☐
Fruit Drinks (Grape, Orange-guava, Powerade, Hi-C Lemonade)	☐	☐	☐
Diet Drink (Minute Maid Light Lemonade, Diet Coke, Coke Zero, Spite Zero)	☐	☐	☐
Regular Soda (Coke, Sprite, Root Beer, Orange, Gingerale)	☐	☐	☐
Hot Cocoa	☐	☐	☐
Hot Herbal, Green or Black Tea	☐	☐	☐
Coffee	☐	☐	☐

Question ARTSWEETENERS

Please indicate, to the best of your knowledge, whether or not each of the beverage-types listed below contains ARTIFICIAL SWEETENERS (e.g. Splenda, NutraSweet).

	YES, contains ARTIFICIAL SWEETENERS	NO, does not contain ARTIFICIAL SWEETENERS	I Don't Know/I'm Not Sure
Water (Citrus, Sparkling or Plain)	☐	☐	☐
Skim, Lowfat, 2% Milk, Rice Milk or Lactaid	☐	☐	☐

1% Chocolate Milk or Soy Milk	☐	☐	☐
Sweetened Iced Tea (Green, Black or Nestea)	☐	☐	☐
Unsweetened Iced Tea (Black)	☐	☐	☐
100% Fruit Juice (Apple or Orange)	☐	☐	☐
Fruit Drinks (Grape, Orange-guava, Powerade, Hi-C Lemonade)	☐	☐	☐
Diet Drink (Minute Maid Light Lemonade, Diet Coke, Coke Zero, Spite Zero)	☐	☐	☐
Regular Soda (Coke, Sprite, Root Beer, Orange, Gingerale)	☐	☐	☐
Hot Cocoa	☐	☐	☐
Hot Herbal, Green or Black Tea	☐	☐	☐
Coffee	☐	☐	☐

Question NATSWEETENERS

Please indicate, to the best of your knowledge, whether or not each of the beverage-types listed below contains ADDED NATURAL SWEETENERS (e.g. Sugar, Corn Syrup, Cane Syrup).

	YES, contains ADDED NATURAL SWEETENERS	NO, does not contain ADDED NATURAL SWEETENERS	I Don't Know/I'm Not Sure
Water (Citrus, Sparkling or Plain)	☐	☐	☐
Skim, Lowfat, 2% Milk, Rice Milk or Lactaid	☐	☐	☐

1% Chocolate Milk or Soy Milk	☐	☐	☐
Sweetened Iced Tea (Green, Black or Nestea)	☐	☐	☐
Unsweetened Iced Tea (Black)	☐	☐	☐
100% Fruit Juice (Apple or Orange)	☐	☐	☐
Fruit Drinks (Grape, Orange-guava, Powerade, Hi-C Lemonade)	☐	☐	☐
Diet Drink (Minute Maid Light Lemonade, Diet Coke, Coke Zero, Spite Zero)	☐	☐	☐
Regular Soda (Coke, Sprite, Root Beer, Orange, Gingerale)	☐	☐	☐
Hot Cocoa	☐	☐	☐
Hot Herbal, Green or Black Tea	☐	☐	☐
Coffee	☐	☐	☐

Question HEALTHYBEVSTATE

The next series of questions asks about your attitudes about healthy beverages. By healthy beverages, we mean LOW-FAT MILK (including rice milk, soy milk, Lactaid, and chocolate milk), WATER (including seltzer, sparkling water, citrus water with slices of lemon, lime or orange, and purified water), 100% FRUIT JUICES (orange juice or apple juice), and unsweetened TEA or COFFEE.

Which of the following statements best fits your current philosophy with respect to healthy beverages?

☐ **I am not currently thinking about making healthier beverage choices**

☐ **I am not considering making healthier beverage choices in the next month**

☐ **I am planning to make healthier beverage choices within the next month**

☐ **I have been making healthier beverage choices for the past 1 to 3 months**

☐ **I have been making healthier beverage choices for the past 3 to 6 months**

☐ **I have been making healthier beverage choices for the past 6 months to 5 years**

☐ **I used to choose healthy beverages but have recently resumed choosing less healthy beverages**

Question ATTITUDES

Please indicate the extent to which you agree or disagree with each statement. Remember -- by healthy beverages, we mean any type of low-fat milk (including rice and soy milks and Lactaid), water, 100% fruit juice, and unsweetened coffee or tea.

	Agree Strongly	Agree Somewhat	Neither Agree nor Disagree	Disagree Somewhat	Disagree Strongly
Drinking healthy beverages in the DC will make me healthier.	☐	☐	☐	☐	☐
Drinking healthy beverages in the DC will make me fitter.	☐	☐	☐	☐	☐
It is important to me to be healthier than I am now.	☐	☐	☐	☐	☐

It is important to me to be fitter than I am now.	☐	☐	☐	☐	☐
People important to me think that I should drink healthy beverages.	☐	☐	☐	☐	☐
When it comes to drinking healthy beverages, I want to do what people important to me think is best.	☐	☐	☐	☐	☐
Signs and information in the DC would help remind me to drink healthy beverages.	☐	☐	☐	☐	☐
I expect to see signs and information in the DC reminding me to drink healthy beverages.	☐	☐	☐	☐	☐

Question HEALTHINFO

The next set of questions asks for some general, health-related information.

Do you consider yourself to be someone who exercises regularly?

- ☐ **Yes**
- ☐ **No**

Which of the following best describes you?

- ☐ **I am very health conscious**
- ☐ **I am somewhat health conscious**
- ☐ **I am not too health conscious**
- ☐ **I am not at all health conscious**

Which of the following best describes you?

- I am currently trying to gain weight
- I am currently trying to lose weight
- I am trying to maintain my current weight
- None of the above

Question CLASSES

Have you ever taken a Public Health course here at UMass?

- Yes
- No

Have you ever taken a Nutrition or Food Science class here at UMass?

- Yes
- No

Have you ever taken a Kinesiology class here at UMass?

- Yes
- No

Question DEMO2

The last set of questions asks for demographic information. This information allows us to compare differences, if any, among groups.

You are a:

- ☐ **First-year student**
- ☐ **Sophomore**
- ☐ **Junior**
- ☐ **Senior**

Where do you live?

- ☐ **Northeast**
- ☐ **Sylvan**
- ☐ **Orchard Hill**
- ☐ **Central**
- ☐ **Southwest**
- ☐ **North Apartments**
- ☐ **Off campus**

Question DEMO3

You are:

- ☐ **Female**

- [ ] **Male**
- [ ] **Transgender**
- [ ] **Other**

To which racial or ethnic group(s) do you belong?

Mark all that apply.

- [ ] **African, African American or Black**
- [ ] **Asian or Asian American**
- [ ] **Cape Verdean**
- [ ] **Hispanic or Latino(a) or Chicano(a)**
- [ ] **Native American, North or South American Indian or Alaskan Native**
- [ ] **Native Hawaiian or other Pacific Islander**
- [ ] **White or Caucasian**
- [ ] **Other**

Question DEMO4

Are you a member of a University varsity athletic team?

- [ ] **Yes**
- [ ] **No**

Are you a Commonwealth College student?

- [ ] **Yes**
- [ ] **No**

Are you majoring in Communication Disorders, Kinesiology, Food Science, Nursing, Nutrition, Pre-Med, Public Health or another major that is health-related?

- ☐ **Yes**
- ☐ **No**
- ☐ **Have not yet declared a major**

Question ENDER1

Thanks anyway, but this survey is for students who eat many of their meals in the Dining Commons.

You may now close your browser.

Question ENDER

That concludes our survey. Thank you very much for your participation.

As a token of our appreciation for your feedback, your name will be entered into a raffle to win an iPad!

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