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EFFECTS OF A CAMPUS DINING TOUR INTERVENTION ON FIRST YEAR
STUDENTS PERCEPTION OF HEALTHFULNESS OF ENVIRONMENT

BY

PAIGE PAPPADACKIS

A thesis submitted in partial fulfillment of the requirements for the

Master of Science

Major in Nutrition and Exercise Sciences

Specialization in Nutritional Sciences

South Dakota State University

2020

THESIS ACCEPTANCE PAGE

Paige Pappadackis

This thesis is approved as a creditable and independent investigation by a candidate for the master's degree and is acceptable for meeting the thesis requirements for this degree.

Acceptance of this does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department.

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Date

This thesis is dedicated to my parents, Mark and Cheryl Pappadackis, for always believing me, supporting me and always pushing me to pursue my dreams.

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ABSTRACT

EFFECTS OF A CAMPUS DINING TOUR INTERVENTION FOR FIRST YEAR
STUDENTS PERCEPTION OF HEALTHFULNESS OF ENVIRONMENT

PAIGE PAPPADACKIS

2020

Many young adults experience unwanted weight gain upon entering college. Making healthy choices in a food environment with a plethora of convenience and fast foods is important for preventing unwanted weight gain. The objective of this study was to determine if a Healthy Campus Dining Tour intervention improves perception, behavior, and priorities related to healthier choices on campus.

Participants were recruited for this quasi-experimental study from freshman introductory classes at a land-grant public university and assigned to intervention or a control group. Intervention participants completed a 50-minute Healthy Campus Dining Tour that educated on how to make healthier choices at each of the campus dining locations (vending, convenience, kiosk, and all-you-can-eat dining). Both groups were assessed pre- and post- intervention for agreement with questions assessing perception of healthful food choices in the campus environment (12 questions), frequency of certain healthful dietary behaviors (12 questions) and importance of food choice priorities (24 questions). Outcomes were dichotomized as more or less positive responses and logistic regression was used to determine odds of responses between intervention and control.

There were a total 120 participants (n=45 intervention, n=75 control) that completed the surveys. Most participants were 18 years of age, female, white, of freshmen status, and lived in a campus residence hall. Greater odds of perceiving

healthier foods in restaurants [OR(CI), 2.9 (1.3-6.5)], dining halls [2.1, (0.9-4.7)], and vending [8.1 (3.4-18.7)] were seen in intervention group versus control group. Odds of increased frequency of healthful behaviors and increased importance of food choice priorities did not differ between groups. Participation in the Healthy Campus Dining Tour intervention was associated with greater odds of agreeable perceptions regarding availability of healthy foods on campus. Additional programming and environmental changes may be necessary to change food behavior and priorities.

INTRODUCTION

Transitioning from high school to college can be an overwhelming experience for some young adults. For most young adults going to college means leaving the parents or guardians house and moving to a different place and experience different living arrangements. These young adults are now making more individual decisions whether it comes to social events or choosing what to eat in the dining hall. Thus, may experience unhealthy eating habits that may not be the healthiest. Huang et al. used a nutrition course that included freshmen and sophomores, to evaluate the diet of these young adults. The nutrition class required the students to complete a food intake record for one weekday. Huang and colleagues found that 20% of its participants skipped breakfast and snacks that were most consumed between both genders was carbonated beverages, potato chips, candy bars, beer, cookies, and pizza.¹ Research has shown that individuals in the freshman year of college experience a gain in weight.¹⁻⁶ There have been multiple interventions such as a course, self-regulation or self-monitoring of weight or physical activity, or nutrition labeling of food menus, messaging, social marketing, cooking videos and classes implemented on college campuses to prevent the excessive weight gain.²⁻⁷ There has not been an intervention to address freshmen's weight related behavior that has utilized a campus dining tour to increase student's knowledge and awareness of healthier foods. It is important to increase the knowledge of healthier foods on campus to increase the consumption of healthier food and improve the diets of young adults.

The overall objective of this study is to enhance the diet quality of first year college students. This objective will be obtained through the following specific aims. The first specific aim of this study is to use healthy campus dining tours as an intervention to

improve perception of healthier choices at convenience and dining locations. We hypothesize that those who participate in a healthy campus dining tour will have increased perception of healthier food choices. The second specific aim of this study is healthy campus dining tours will promote healthier eating behaviors. We hypothesize that students who completed the healthy campus dining tour will have greater odds of reporting healthier eating behavior scores.

LITERATURE REVIEW

College is a time where young adults gain more freedom, more choices, and hopefully more knowledge. With increased independence, students may experience different eating habits that were not necessarily experienced growing up in the parent or guardians home. These changes in eating behaviors may lead to changes in weight for an individual. The “freshmen 15” has long been a saying that individuals believe can or will happen during the freshmen year of college. Although, research has conflicting findings on such a large gain of weight, especially in the freshmen year alone.

Weight Gain During College

Levitsky et al. found a significant weight gain of 1.9 ± 2.4 kg during a 12-week span or specifically the first semester of the freshmen year of college.² If the study was conducted again for the second semester of college and similar results were found, the weight gain during the freshmen year of college would not have come close to a weight gain of 15 pounds as promoted by the “freshmen 15” perception. Racette et al. found similar results of weight gain, although the study period started at the first semester of the freshmen year and the second semester of the senior year. Overall, the reported weight change was 2.5 ± 5.3 .⁵ Thus, the issue is not that students are gaining as much weight as the “freshmen 15”, but that students are gaining weight in college, whether it’s through one year or four years. This is important as the prevalence of obesity has increased from 30.5% in 1999-2000 to 39.6% in 2015-2016 for adults 20 years of age and older.⁸

Cluskey and Grobe found differences in weight gain between gender. Out of 379 subjects, 236 had increases in weight during the two-month study period.⁹ There were differences in weight gain between males and females. Males had a slightly higher weight

gain than females. Body mass index (BMI) also showed differences in weight change between genders. Females had a slightly lower BMI at 22.94 ± 4.0 compared to males at 24.1 ± 3.8 .⁹ Economos et al. also found weight gain differences between males and females.¹⁰ Females had a higher mean weight change than males, 5.5 ± 6.4 and 5.0 ± 8.5 respectively.¹⁰ To contrast, Anderson et al., did not find any effect on weight gain between genders, but did find significant weight gain of 1.3 kg during a four-month period.¹¹ When looking at weight change, 70% of the participants in this study gained ≤ 2.3 kg and 26% gained ≥ 2.3 kg.¹¹ Overall, during the freshmen year of college, 96% of participants in this study experienced a gain in weight, regardless of the amount.¹¹ Others have also found weight gain occurring in college freshmen.^{12,13,14,15,16}

College Behaviors

Behaviors in young adults are changing and developing during the college years. Some of these behavior changes may be healthful for the individual or may be hurtful. Although, this is a crucial time to develop healthful behaviors, which include healthy eating behaviors. Lowe et al. looked at different dieting habits that may predict weight gain in the future. This study primarily focused on the prediction of weight gain through restrained eating, disinhibition and emotional eating. Over 80% of the participants gained weight during the first month of the study. Although, after further analysis, restrained, disinhibition, and emotional eating did not predict weight gain.³

Enrollment in college usually means that young adults are living away from parents or guardians. Growing up, children eat what adults cook and eat at home and form an appetite and eating behavior based on the food environment experienced during childhood. Although, once the child leaves the home to attend and live on a college

campus, the food environment changes. Demory-Luce et al. conducted a study specifically to observe the difference in food consumption between childhood and young adults. Of the multiple food groups that were tested, young adults were consuming less fruits and vegetables at ages 19-28 years than during childhood or at 10 years old.¹⁷ On the contrary, young adults were consuming more sweetened beverages, beef, seafood, cheese, and salty snacks than during childhood.¹⁷ Lien et al. found similar results with both males and females experiencing decreases in fruit and vegetable consumption and increases in soft drinks from age 14 to 21 years.¹⁸ College can be a stressful time for many individuals. Students have new living situations, new people around, and new classes and expectations. Economos et al. conducted a study that looked at how stress affects weight change by gender.¹⁰ At baseline, male students cited a lack of academic confidence as the most powerful effect on weight change. Meanwhile, females reported a correlation with weight gain and an increased workload during the academic year.¹⁰

Not all young adults attend 4-year colleges, some go to 2-year colleges and some decide to not attend college at all. The dietary practices of these different groups of young adults may also be as different as the career path that was chosen. Nelson et al. conducted a study on three subgroups of young adults: nonstudents, 2-year college students, and 4-year college students. Most young adults did not meet national recommendations for dietary intake, but the 4-year college student subgroup had better dietary intakes than the subgroups in a 2-year college or who did not attend college at all.¹⁹ Nelson Laska et al. conducted another study looking at the weight-related behaviors in young adults attending 2-year and 4-year colleges. Females that attended a 2-year college were more likely to be overweight and obese, engaged in less physical activity, watched television

more frequently, consumed more soda and fast food and used diet pills than females who attended a 4-year college. Females who attended a 4-year college were more likely to engage in binge eating, induce vomiting to control weight and play video games. Males that attended 2-year colleges were less likely to engage in strenuous activity and drink more soda and eat fast food than males in 4-year colleges. In this study, when variables were controlled for, some of these variables became non-significant. In females, consumption of diet soda, taking diet pills, and strength training became non-significant and in both males and females, fast food consumption became non-significant.²⁰

The way young adults perceive food and health can impact behavior. De Vos et al. found an increase in weight in Dutch students during the first semester of college. Students who did not live under the roof of a parent or guardian showed a higher increase of weight (0.5 kg) compared to students who lived with a parent or guardian. Through a questionnaire, the researchers observed perception of health by the students. When asked about the feeling of individual health, poor or bad health was perceived by 12% of students. An even larger percent, 30%, felt less healthy than a year before.⁴ Hekler et al. found that a university course increased students' beliefs on the importance of the environment and a healthful diet.²¹ This study was indirectly looking at how to promote behavior change through a stealth approach and found that motivation for process of dietary behavior change can improve, on the short-term, if food-related social matters is focused on instead of health-related matters.²¹

College Campus Interventions to Prevent Weight Gain

To improve the lives of young adults, multiple interventions have been conducted on college campuses. Matvienko et al. conducted a study on female students, either

freshman or sophomores, that took a university course, specifically a nutrition science class, or did not as part of the control group.²² Anthropometrics, dietary intake, and knowledge were assessed in both study groups. After the intervention was complete, the intervention group reported an increase in knowledge, but the control group stayed the same. For dietary intake, the intervention group reported eating less calories per day while the control group reported eating more calories per day compared to the beginning of the study. The researchers divided the subjects into two BMI groups: desirable and higher. The higher BMI group saw differences between intervention and control groups. After the intervention, those with a higher BMI in the intervention group reported consuming over 500 calories less per day while those with a higher BMI in the control group reported consuming more than 300 calories per day, marked at four months.²² Although, mean weight and BMI did not change at the four-month mark of intervention or at the 12-month follow-up.²²

Hekler et al. also used a university course to promote eating of healthier foods. The class that Hekler and colleagues taught was about food-related issues, but was not directly centered on health issues. A food frequency questionnaire was used to assess dietary intake. The university course group increased in overall healthful eating compared to the control group, specifically vegetable consumption increased and high-fat dairy consumption decreased.²¹ Kattelman et al. developed a web-based university course that focused on lifestyle behaviors, such as eating behavior, physical activity, stress management, and weight management. At post-intervention, the intervention group saw an increase in fruit and vegetable consumption from baseline. To contrast, the control group decreased in fruit and vegetable consumption. The intervention group also

decreased fat intake from baseline all the way through follow-up while the control group saw no change in fat intake.²³

Weight-monitoring is another intervention college campuses have tried to understand and prevent weight gain. Levitsky et al. conducted two experiments on female freshmen. These participants were given an analog scale and instructed to weigh themselves every morning. The intervention group also received basic nutritional information while the control group did not. After analysis, the control group gained an average of 3.1 ± 0.51 kg while the experimental group saw a change in weight of 0.1 ± 0.99 kg. This study helps confirm that individuals, specifically college freshmen, are gaining weight even through just one semester.²⁴

A nutrition label is found on packaged foods and contains the nutrition content such as calories and sodium. This can be helpful to individuals who are buying packaged foods to make an informed decision about the healthfulness of the food. Although, this only applies to packaged food and not prepared meals.²⁵ Therefore, when individuals are sitting in a restaurant, reading the menu, the nutrition information does not have to be listed next to every prepared item on the menu. This also applies to food sold on a college campus if the dining location is not a chain restaurant of 20 or more locations, operating under the same name, and offering the same menu items.²⁵ A study conducted in southeastern Missouri looked at the healthfulness of the diet if nutrition labels are read through a questionnaire. Kreuter et al. found that the more nutrition labels were used, the healthier the dietary practices. Individuals that consumed a diet higher in fruits, vegetables, and fiber and lower in fat reported reading labels most or all the time.²⁶

Nutrition labeling has also been another avenue that college campuses have navigated to prevent weight gain. Chu and colleagues took research findings related to Kreuter et al. and created a study on a college campus. Chu et al. wanted to determine whether nutrition information located on signs next to entrées in the dining facility on campus would change the food individuals chose to eat. There were three different periods throughout the study and each lasted about two weeks long. The pre-treatment period used the signs that were already available to the students that contained descriptions of the entrees that were created by the dining facility. The treatment period contained signs with entrée descriptions along with nutrition labels. During the post-treatment period, treatment signs were returned to original signs before the study began. Chu et al. found that from the end of the pre-treatment period and the start of the treatment period, entrées sold decreased by 12.4 kcals in one day of treatment signs being hung in the dining facility. For the post-treatment period, the signs were taken down. Also, once the post-treatment period began, the number of calories in the entrées sold began to increase again.²⁷

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MANUSCRIPT

EFFECTS OF A CAMPUS DINING TOUR INTERVENTION ON FIRST YEAR STUDENTS PERCEPTION OF HEALTHFULNESS OF ENVIRONMENT

INTRODUCTION

Transitioning from high school to college can be an overwhelming experience for young adults. For many young adults going to college means leaving the parents or guardians house and moving to a different place and experience different living arrangements. These young adults are now making more individual decisions, and in many cases this results in less healthy eating habits. Huang et al. used a nutrition course that included freshmen and sophomores, to evaluate the diet of these young adults. The nutrition class required the students to complete a food intake record for one weekday. Huang and colleagues found that 20% skipped breakfast. Additionally, snacks that were most consumed included carbonated beverages, potato chips, candy bars, beer, cookies, and pizza with no differences reported between genders.¹ Research has shown that individuals in the freshman year of college experience a gain in weight.¹⁻⁶ There have been multiple interventions such as a course, self-regulation or self-monitoring of weight or physical activity, nutrition labeling of food menus, messaging, social marketing, cooking videos and classes implemented on college campuses to prevent the excessive weight gain.²⁻⁷ There has not been an intervention to address freshmen's weight related behavior that has utilized a campus dining tour to increase student's knowledge and awareness of healthier foods. It is important to increase the knowledge of healthier foods on campus to increase the consumption of healthier food and improve the diets of young adults.

The overall objective of this study was to enhance the diet quality of first year college students. This objective was obtained through the following specific aims. The first specific aim of this study was to use healthy campus dining tours as an intervention to improve perception of healthier choices at convenience and dining locations. We hypothesize that those who participate in a healthy campus dining tour will have increased perception of healthier food choices. The second specific aim of this study was healthy campus dining tours will promote healthier eating behaviors. We hypothesize that students who completed the healthy campus dining tour will have greater odds of reporting healthier eating behavior scores.

MATERIALS AND METHODS

Overall Study Design

The Healthy Campus Dining Tour was a quasi-experiment design with intervention and control groups that resulted from the Get Fruved intervention.⁸ Briefly, GetFruved was a social marketing intervention designed using community-based participatory research methodology to improve the healthfulness of college campus environments. One of the outcomes from GetFruved was the request by students for healthier options on campus.⁸ The Healthy Campus Dining Tour intervention participants participated in healthy eating campus tour conducted by trained Campus Dining Ambassadors. The tour encompassed two dining locations on campus as well as a healthy vending machine and a convenience store. Information about the healthy options at each of these locations was provided. The tour took approximately 50 minutes or less to complete.

Participants and Recruitment

Participants for this study were recruited from primarily freshmen classes at South Dakota State University, a land-grant institution in the Midwest. Recruitment occurred via word-of-mouth and through an introductory freshmen class, EHS-119, in the College of Education and Human Sciences in fall of 2017. The control group included a convenience sample of students from other freshmen-level courses and other courses on campus that did not participate in the intervention, but responded to the survey. Professors were contacted via email to initiate permission to begin recruitment of students in their class. This study was approved by South Dakota State University

Institutional Research Board and all students provided consent prior to assessment and participation.

Intervention Healthy Campus Dining Tour

The Healthy Campus Dining Tour was developed in collaboration with the campus registered dietitian, extension registered dietitian, Aramark marketing coordinator and by other faculty in response to student body requests for healthier foods on campus. Healthier options were highlighted at each dining location, vending machine, and convenience store specified on the Healthy Campus Dining Tour. A brochure was made with these options at each location and was given to the participants to follow along with on the tour and for the participants to take home. The Healthy Campus Dining Tour ambassadors were trained through a train-the-trainer system. Individuals were trained with a tour script and walk-through and then a final test run. After each trainer was approved, these individuals then trained the Healthy Campus Dining Tour ambassadors. The tour ambassadors also had the same script that were to be followed to ensure the same information was being relayed during each tour.

Measures

All participants were surveyed at the beginning of the semester, prior to implementation of the tour, and at the end of the semester on the student's perception and knowledge of healthier foods on campus. The perception of the campus food environment was assessed using 12 questions (Table 1) from the Campus Environmental Perception survey that queried for availability of healthful foods, water, and cost.⁹ The responses ranged from strongly agree to strongly disagree using a 5-point Likert scale.

Dietary behavior was assessed using 12 questions (Table 1) from the Behavior, Environment, and Changeability survey that queried current food behaviors.¹⁰ Responses to “My current behavior is that...”, “I look for healthy food...” and “I use water...” ranged from never to always using a 5-point Likert scale.

Food choice priorities were assessed by asking participants to respond to 24 different questions from the Food Choice Priority Survey and the importance of the factors in influencing their food choices.¹¹ Questions (Table 1) that asked, “What are the main factors...” ranged from not important to extremely important using a 5-point Likert Scale and responses to “Indicate below how often...” ranged from never to always using a 5-point Likert scale. Height and weight were self-reported by the participant and BMI was calculated through the standard formula of weight in kilograms divided by height in meters squared. Demographic information on age, race, gender, year in school, living location were collected. Whether participants attended a tour or not was asked through a simple yes or no question on the post survey. All questions had a choose not to answer option while some had both an I don’t know and choose not to answer option.

Table 1. Assessment of Perception of Campus Food Environment, Food Behavior, Desired Food Environment, and Food Choice Priorities	
Perceptions of Food - Campus Environmental Perception Survey -	
Q1	Healthy foods are available at grocery stores around campus.
Q2	The healthy foods on campus are more expensive than the unhealthy foods on campus.
Q3	The water in water fountains on campus taste good.
Q4	There are healthy foods available at restaurants on or around campus.
Q5	There are lots of healthy choices in vending machines on campus.
Q6	There are healthy foods available on campus.
Q7	There are healthy foods available where I usually eat in dining halls on campus.
Q8	There are healthy foods available at convenience stores on campus.
Q9	There are signs telling me which foods are healthy in vending machines on campus.
Q10	The water/drinking fountains on campus look clean.
Q11	Most buildings on campus have water/drinking fountains.
Q12	The university encourages students to eat healthy.
Food Behavior - Behavior and Changeability Survey	
Q1	My current behavior is that: I eat healthy food.
Q2	My current behavior is that: I eat healthy foods at my dining hall/apartment/home.
Q3	My current behavior is that: I eat healthy foods at local restaurants.
Q4	My current behavior is that: I eat healthy foods from local food/grocery stores.
Q5	My current behavior is that: I eat healthy foods on campus or at work.
Q6	My current behavior is that: I prepare healthy meals.
Q7	My current behavior is that: I eat 2-3 cups or more of vegetables daily.
Q8	My current behavior is that: I eat 1-2 cups or more of fruits daily.
Q9	My current behavior is that: I eat whole grain foods.
Q10	My current behavior is that: I eat healthy snacks.
Food Behavior - Campus Environmental Perception Survey	
Q11	I look for healthy food options when I shop and eat (including grocery stores, vending machines, dining halls, restaurants, convenience stores and food courts/snack bars).
Q12	I use water fountains on campus.
Desired Food Environment Changes - Behavior and Changeability Survey	
Q11	I would like to see: More healthy foods available at my dining hall/apartment/home.
Q12	I would like to see: More healthy foods available at local restaurants.
Q13	I would like to see: More healthy foods available in local food/grocery stores.
Q14	I would like to see: More healthy foods available on campus or at work.

Q15	I would like to see: My eating environment become more pleasant (cleaner, more comfortable surroundings).
Food Choice Priorities - Food Choice Priority Survey	
Q1	Indicate below how often in the past 3 months have you done the following: Remind myself that planning quick and simple meals is important.
Q2	Indicate below how often in the past 3 months have you done the following: Tell myself that healthy meals do not require a lot of work.
Q3	Indicate below how often in the past 3 months have you done the following: Remind myself to eat in moderation.
Q4	Indicate below how often in the past 3 months have you done the following: Tell myself to allow room for an occasional treat food or dessert for just plain enjoyment.
Q5	Indicate below how often in the past 3 months have you done the following: Remind myself to think about my beverage choices.
Q6	Indicate below how often in the past 3 months have you done the following: Tell myself that fruits and vegetables should be included in every meal.
Q7	Indicate below how often in the past 3 months have you done the following: Planned quick, easy, and healthy snacks.
Q8	Indicate below how often in the past 3 months have you done the following: Select beverages with my health in mind.
Q9	Indicate below how often in the past 3 months have you done the following: Purposely added vegetables to my meals and snacks.
Q10	Indicate below how often in the past 3 months have you done the following: Was flexible and sensible with my food choices
Q11	What are the main factors that influence the food you eat on a regular basis? Price
Q12	What are the main factors that influence the food you eat on a regular basis? Health
Q13	What are the main factors that influence the food you eat on a regular basis? Taste
Q14	What are the main factors that influence the food you eat on a regular basis? Convenience
Q15	What are the main factors that influence the food you eat on a regular basis? Stress
Q16	What are the main factors that influence the food you eat on a regular basis? Family
Q17	What are the main factors that influence the food you eat on a regular basis? Effect on physical appearance
Q18	What are the main factors that influence the food you eat on a regular basis? Social Media
Q19	What are the main factors that influence the food you eat on a regular basis? Advertising
Q20	What are the main factors that influence the food you eat on a regular basis? Routine/What I'm used to

Q21	What are the main factors that influence the food you eat on a regular basis? Ability to feel full
Q22	What are the main factors that influence the food you eat on a regular basis? Peer and social situations
Q23	What are the main factors that influence the food you eat on a regular basis? Boyfriend/Girlfriend/Significant other
Q24	What are the main factors that influence the food you eat on a regular basis? Freshness/Quality/In Season

Statistical Analysis:

Participants were assigned to intervention or control based on completion or non-completion of a Healthy Campus Dining Tour. Responses to the questions from the Campus Environmental Perception survey were dichotomized with strongly agree and agree being coded as one response and neutral, disagree and strongly disagree being put into the other category. Responses to “My current behavior is that...” were dichotomized with always and often being coded as one response and sometimes, rarely and never being put into the other category. Responses to “I look for healthy food...” and “I use water...” were dichotomized with always and often being coded as one response and occasionally, seldom and never being put into the other category. From the Food Choice Priority Survey, responses to “What are the main factors...” were dichotomized with extremely important and very important being coded as one response and important, slightly important and not important being put into the other category. Responses to “Indicate below how often...” were dichotomized with always and often being coded as one response and occasionally, seldom and never being put into the other category.

Logistic regression modeling was used to determine odds ratios associated with improving perception and behavior due to the tour. Initially, gender, age, ethnicity, body mass index, year in school, and living location were screened in bivariate models and any

variable with a significance of $P < .2$ was kept and further evaluated in the full model for each question. Using all of these variables, a full model was fit and variables were removed one by one based on lack of significance at $P < .05$. When only significant variables remained, all the variables that were previously removed were tested in the final model individually until a final model was reached in which all variables were significant at $P < .05$. Final data are reported as odds ratios and confidence intervals.

RESULTS

Participant Demographics

There were 546 (intervention = 258, control = 288) participants eligible for inclusion and of those 120 participants completed pre- and post-surveys (intervention = 45, control = 75), figure 1. Table 2 reports the demographics of the subjects that were included in this study. Most of the participants were white, 18-year-old females that lived in a campus residence hall and were considered freshmen status.

Campus Environment Perception and Behavior Change

Greater odds of perceiving healthier foods in restaurants [OR(CI), 2.9 (1.3-6.5)], dining halls [2.1, (0.9-4.7)], and vending [8.1 (3.4-18.7)] were seen in intervention group versus control group. Odds of increased frequency of healthful behaviors and increased importance of food choice priorities did not differ between groups. Participation in the Healthy Campus Dining Tour intervention was associated with greater odds of agreeable perceptions regarding availability of healthy foods on campus.

Figure 1. Consort Diagram for Recruitment of Participants

*Invited by class enrollment – intervention participants from an introductory freshmen class, EHS-119, in the College of Education and Human Sciences in fall of 2017 and control participants from convenient sample of students from other freshmen-level courses and other courses on campus that did not participate in the intervention, but responded to the survey

**Number of participants that completed both pre- and post-surveys

Table 2. Demographics*		
	Intervention n = 45	Control n=75
Age (Years)		
<i>18</i>	35	22
<i>19</i>	4	8
<i>20</i>	1	11
<i>21</i>	1	12
<i>22</i>	1	14
<i>23 and older^a</i>	3	8
Gender		
<i>Males</i>	4	11
<i>Females</i>	41	63
Ethnicity		
<i>White</i>	43	73
<i>Non-White^b</i>	2	2
BMI (kg/m²)		
<i>Males</i>	(4) 24.4 ± 1.0	(11) 25.7 ± 3.5
<i>Females</i>	(39) 24.2 ± 4.7	(63) 23.8 ± 4.1
School (Years)		
<i>Freshmen</i>	39 (86.7%)	26 (34.7%)
<i>Non-Freshmen^c</i>	6	49
Live		
<i>Campus Residence Hall</i>	38 (84%)	29 (38.7%)
<i>Off Campus Housing^c</i>	7	46
<p>^aCombined anyone 23 years of age and older into 1 category ^bCombined anyone who was not of Caucasian race into 1 category ^cCombined anyone who was of sophomore status and higher into 1 category ^dCombined anyone who did not live in a campus residence hall into 1 category *Totals are different from recruitment due to missing data</p>		

Table 3. Odds of Perceiving a Healthy Campus Environment*	
aQuestions	Tour (OR,CI)
1. Healthy foods are available at grocery stores around campus.	1.226, (0.575 - 2.612)
2. The healthy foods on campus are more expensive than the unhealthy foods on campus.	1.263, (0.512 – 3.114)
3. The water in water fountains on campus taste good.	0.732, (0.344 – 1.558)
4. There are healthy foods available at restaurants on or around campus.	2.968, (1.349 – 6.533)
5. There are lots of healthy choices in vending machines on campus.	1.806, (0.774 – 4.216)
6. There are healthy foods available on campus.	0.461, (0.156 – 1.359)
7. There are healthy foods available where I usually eat in dining halls on campus.	2.153, (0.979 - 4.736)
8. There are healthy foods available at convenience stores on campus.	2.057, (0.948 – 4.463)
9. There are signs telling me which foods are healthy in vending machines on campus.	8.105, (3.496 – 18.794)
10. The water/drinking fountains on campus look clean.	0.674, (0.320 – 1.417)
11. Most buildings on campus have water/drinking fountains.	1.905, (0.690 – 5.259)
12. The university encourages students to eat healthy.	0.738, (0.352 – 1.551)
*Ran logistic regression controlling for freshmen status, race, sex, BMI aQuestions 1-12 were taken from Campus Environmental Perception Survey Stratified race into white and non-white because of the lack of variability	

Table 4. Odds of Having Healthier Food Behavior Due to Completion of Tour*	
aQuestions	Tour (OR,CI)
1. My current behavior is that: I eat healthy food.	0.946, (0.444 – 2.014)
2. My current behavior is that: I eat healthy foods at my dining hall/apartment/home.	0.930, (0.441 – 1.960)
3. My current behavior is that: I eat healthy foods at local restaurants.	1.130, (0.513 – 2.492)
4. My current behavior is that: I eat healthy foods from local food/grocery stores.	0.941, (0.428 – 2.068)
5. My current behavior is that: I eat healthy foods on campus or at work.	1.299, (0.610 – 2.768)
6. My current behavior is that: I prepare healthy meals.	0.702, (0.328 – 1.504)
7. My current behavior is that: I eat 2-3 cups or more of vegetables daily.	1.341, (0.567 – 3.173)
8. My current behavior is that: I eat 1-2 cups or more of fruits daily.	1.422, (0.669 – 3.022)
9. My current behavior is that: I eat whole grain foods.	1.875, (0.888 – 3.960)
10. My current behavior is that: I eat healthy snacks.	1.405, (0.669 – 2.951)
11. I look for healthy food options when I shop and eat (including grocery stores, vending machines, dining halls, restaurants, convenience stores and food courts/snack bars).	0.861, (0.384-1.931)
12. I use water fountains on campus.	0.606, (0.285 – 1.289)
<p>* Ran logistic regression controlling for freshmen status, race, sex, BMI aQuestions 1-10 were taken from Behavior and Changeability Survey and questions 11-12 were taken from Campus Environmental Perception Survey Stratified race into white and non-white because of the lack of variability</p>	

Table 5. Odds of Desiring Food Environment Changes*	
aQuestions	Tour (OR,CI)
1. I would like to see: More healthy foods available at my dining hall/apartment/home.	1.246, (0.461 – 3.365)
2. I would like to see: More healthy foods available at local restaurants.	1.089, (0.484 – 2.448)
3. I would like to see: More healthy foods available in local food/grocery stores.	1.409, (0.651 – 3.048)
4. I would like to see: More healthy foods available on campus or at work.	0.631, (0.262 – 1.521)
5. I would like to see: My eating environment become more pleasant (cleaner, more comfortable surroundings).	0.571, (0.268 – 1.219)
* Ran logistic regression controlling for freshmen status, race, sex, BMI aQuestions 1-5 came from Behavior and Changeability Survey Stratified race into white and non-white because of the lack of variability	

Table 6. Odds of Having Healthier Food Choice Priorities*	
aQuestions	Tour (OR,CI)
1. Indicate below how often in the past 3 months have you done the following: Remind myself that planning quick and simple meals is important.	0.881, (0.418 – 1.858)
2. Indicate below how often in the past 3 months have you done the following: Tell myself that healthy meals do not require a lot of work.	0.649, (0.307 – 1.372)
3. Indicate below how often in the past 3 months have you done the following: Remind myself to eat in moderation.	0.853, (0.391 – 1.860)
4. Indicate below how often in the past 3 months have you done the following: Tell myself to allow room for an occasional treat food or dessert for just plain enjoyment.	0.805, (0.382 – 1.695)
5. Indicate below how often in the past 3 months have you done the following: Remind myself to think about my beverage choices.	1.158, (0.517 – 2.596)
6. Indicate below how often in the past 3 months have you done the following: Tell myself that fruits and vegetables should be included in every meal.	1.349, (0.629 – 2.892)
7. Indicate below how often in the past 3 months have you done the following: Planned quick, easy, and healthy snacks.	0.883, (0.421 – 1.850)
9. Indicate below how often in the past 3 months have you done the following: Select beverages with my health in mind.	1.191, (0.548 – 2.590)
10. Indicate below how often in the past 3 months have you done the following: Purposely	0.574, (0.272 – 1.212)

added vegetables to my meals and snacks.	
11. Indicate below how often in the past 3 months have you done the following: Was flexible and sensible with my food choices	0.805, (0.382, 1.695)
12. What are the main factors that influence the food you eat on a regular basis? Price	0.697, (0.331 – 1.468)
13. What are the main factors that influence the food you eat on a regular basis? Health	1.650, (0.783 – 3.480)
14. What are the main factors that influence the food you eat on a regular basis? Taste	1.158, (0.517 – 2.596)
15. What are the main factors that influence the food you eat on a regular basis? Convenience	0.915, (0.437 – 1.917)
16. What are the main factors that influence the food you eat on a regular basis? Stress	1.000, (0.457 – 2.190)
17. What are the main factors that influence the food you eat on a regular basis? Family	2.071, (0.922 – 4.654)
18. What are the main factors that influence the food you eat on a regular basis? Effect on physical appearance	1.096, (0.517 – 2.322)
19. What are the main factors that influence the food you eat on a regular basis? Social Media	1.258, (0.464 – 3.408)
20. What are the main factors that influence the food you eat on a regular basis? Advertising	0.895, (0.307 – 2.613)
21. What are the main factors that influence the food you eat on a regular basis? Routine/What I'm used to	1.119, (0.524 – 2.388)
22. What are the main factors that influence the food you eat on a regular basis? Ability to feel full	0.675, (0.320 – 1.421)

23. What are the main factors that influence the food you eat on a regular basis? Peer and social situations	1.294, (0.534 – 3.134)
24. What are the main factors that influence the food you eat on a regular basis? Boyfriend/Girlfriend/Significant other	1.031, (0.391 – 2.721)
25. What are the main factors that influence the food you eat on a regular basis? Freshness/Quality/In Season	1.833, (0.835 – 4.023)
<p>* Ran logistic regression controlling for freshmen status, race, sex, BMI</p> <p>^aQuestions 1-25 came from Food Choice Priority survey</p> <p>Stratified race into white and non-white because of the lack of variability</p>	

DISCUSSION

The study found that participants who went on the Healthy Campus Dining Tour had greater odds of perceiving that healthier foods were available in restaurants [OR(CI), 2.9 (1.3-6.5)], dining halls [2.1, (0.9-4.7)] and vending [8.1 (3.4-18.70)] than the control group. Educating individuals regarding locations of healthier foods may be the first step in engaging in a healthier diet. Although conducted in another population, Rustad and Smith used nutrition education to help change dietary behaviors. Their study focused on the health benefits of different food groups, identifying healthful foods, grocery shopping, cooking, gardening, and energy balance. Nutrition education was given for three weeks and one week was allotted for the opportunity to change behavior.¹² Like Rustad and Smith, our study also looked at identifying healthful foods, focusing on where individuals are getting such foods as well as identifying which healthful foods are being consumed. Unfortunately, our study did not find behavior change, but Rustad and Smith did successfully find that imparting nutrition knowledge did yield behavior change.¹² Carson and Hedl used a grocery store tour to improve the shopping habits of low-income women with children. The tours were given in supermarkets and focused on education of consuming a balanced diet of grains, fruits and vegetables, low-fat meat, meat alternatives and dairy as well as tips for meal planning and shopping. Knowledge scores increased from pre-tour to post-tour.¹³ Although this study was conducted in another setting, using a tour to improve the knowledge of individuals may be the first step in changing dietary behavior. There have been other grocery store tours that have been used and have improved the knowledge of healthier options.^{14,15} However, changing an individual's behavior can be a strenuous task.

There are multiple reasons, influences, and environments that play a role in an individual's behavior. To change behavior, it may be important to understand what makes an individual unique. Understanding what is important to an individual, what influences an individual, why does an individual do what they do may be the first steps in learning how to change one's individual behavior. College students or young adults 18-24 years of age will have different influences and values than an older adult or a young child. Young adults in college have busy schedules with school work, jobs, and a social life. Bost conducted a study to see what the barriers to participating in a health assessment might be for college students. Over half of the participants cited busy schedules for a barrier and 9% of the participants felt they did not need the program now.¹⁶ The authors indicated that young adults may not be concerned with health consequences at this age because they currently feel healthy. Therefore, it may be important to understand if an individual is even ready to change a behavior before attempting to change it. A systematic review looked at the effectiveness of multiple interventions that were directed at changing behavior. The review dubbed the term "Behaviour Change Technique" for an "active ingredient" that was used in an intervention. When behavior change techniques were compared for effectiveness to see which Behavior Change Techniques are the culprit of change, habit formation had the highest percentage effectiveness ratio.¹⁷ Combining the results of the study that this paper encompasses with the current research, changing knowledge of where and what healthful food is can be a first start, but more effective strategies should be implemented to change behavior. Relating back to the systematic review and the effectiveness of habit formation, if helping individuals form healthy habits

is the best way to change overall behavior, then educating these individuals and building their knowledge may be useful in forming these healthy habits.

Limitations

Caution needs to be used when extrapolating findings to other populations.

Although this study was a quasi-experimental design, the participants were assigned to intervention and control based on convenience. Additionally, the study was conducted on only one campus.

Conclusion

Participating in a Healthy Campus Dining Tour was found to have greater odds of perceiving healthier foods in restaurants, dining halls, vending machines and overall availability of healthy foods on campus. The positive aspects of the study were that the curriculum was developed with input from the target audience using outcomes from GetFruved. Additionally, collaboration with the institutional foodservice provider and student wellness center registered dietitian contributed to sustainability. A practical implication of this study helped the college population perceive healthier options on campus with the goal of these students consuming more of the healthful foods that were pointed out on the tour. Additional programming and environmental changes may be necessary to change food behavior and priorities.

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APPENDIX 1

TITLE PAGE FOR MANUSCRIPT

EFFECTS OF A CAMPUS DINING TOUR INTERVENTION ON FIRST YEAR
STUDENTS PERCEPTION OF HEALTHFULNESS OF ENVIRONMENT

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KEYWORDS: COLLEGE, CAMPUS NUTRITION TOURS, OBESITY PREVENTION