Affecting the Eating Habits of College Students:
Understanding Eating Patterns and Influencing Factors to Create Effective Dietary Interventions

By: Kaitlyn Offhaus

Advisor: Cindy Swann
Committee Members: Brittany Johnson, Brandon Sawyer

Introduction

Obesity prevalence is at an all time high. Current statistics state that 39% of Americans suffer from obesity [1]. Individuals who are obese are also at risk for other health complications such as heart disease and Type 2 diabetes. Additionally, obesity costs the government over 147 billion dollars each year [2]. Obesity is caused by a variety of factors, including genetics, activity level, and diet. While some of these factors are beyond our control, the others can be affected by lifestyle changes. Diet in particular plays a key role in controlling, and preventing obesity [3].

College students are a particularly vulnerable population when it comes to weight gain. Certain lifecycle stages are known to contribute to weight gain and the transition from high school to college is one of those times. There are a variety of factors that bring about this weight gain, including the change in dietary and exercise habits as well as the increased consumption of alcohol [4]. The long standing statement about the freshman fifteen, does indeed happen to be at least somewhat true, though the actual amount of weight gained seems to be much lower. One study found that on average students gain about 3.74 lb during their freshman year with more of the weight gain occurring during the first semester and stabilizing as the year goes on [4]. For many students, college is the first time that they are responsible for the preparation of their own meals, be that picking foods from the cafeteria, or the actual combining and cooking of ingredients. Without proper nutrition education, they are apt to follow advice from a variety of sources and make food choices that are not necessarily beneficial. They are also likely to follow fad diets and information gleaned from nutrition sources that are not necessarily backed by science. It is particularly important to educate this group for several reasons. First, the habits formed and solidified in college are likely to be carried out in the rest of life [5]. Additionally, food

plays a major role in not only physical health, but also mental and emotional health, thus eating healthy is tied to academic performance [6, 7].

While a good diet is considered essential for physical health, it is equally important for mental health. A diet high in saturated and trans fat may decrease the effectiveness of neurotransmitters [6]. A diet deficient in iron leads to anemia which causes a feeling of lethargy and decreased motivation. A diet high in simple carbohydrates can lead to dramatic blood sugar changes causing grogginess after the consumption of a large meal and leaving the person feeling hungry and irritable before it is time to eat again. Deficiency in B vitamins can also lead to a feeling of lethargy [6].On the other hand, students who consumed a greater quantity of fruits and vegetables reported a greater sense of well being [8]. This mental and emotional well being is essential for college students as they deal with the stresses of life and transition.

Further, a healthy diet is necessary for improved academic performance. Consumption of fruits, vegetables, and low fat dairy has been linked to increased academic performance [7]. For this reason the need for good nutrition information and the increased consumption of a healthy diet benefits not only the student but also the university as a whole. Therefore, universities should do their part to support campus-wide health initiatives which focus on improving the overall health of the student because when the students thrive the university thrives as well.

The United States Department of Agriculture (USDA) has recognized the importance of the health of college students. In 2014 the USDA gave a grant to the University of Tennessee to conduct large scale research on the health of college students. The eight initial universities University of Tennessee, University of Florida, West Virginia University, South Dakota State University, Syracuse University, University of Auburn, University of Kansas, and University of

Maine were broken up into two groups, control campuses and intervention campuses. This program has now been expanded to over 90 campuses across the nation. Their goal is to "help students manage weight and live healthier lives by focusing on three areas: improving dietary intake, increasing physical activity, and improving overall stress management skills" [9]. In order to do this, an initial survey is sent out to the student body to get an idea of where students are healthwise and what sort of health related programs they believe would most benefit them. Next the schools conduct interventions including different aspects of health and wellness. In some cases schools also provide a peer mentorship program to encourage lifestyle change. Finally, the survey is sent out again and the results are compared. Our campus, Point Loma Nazarene University, received the grant to participate in this larger study as an intervention school. Thus throughout the year we performed four different interventions, each focusing on a slightly different area of health. The intervention specific to this research project dealt with My Plate and portion control.

MyPlate is an infographic developed by the USDA to help Americans visualize how much they should consume from each food group at a given meal. This updated version of the food pyramid contains the same five groups as before: grains, protein, fruits, vegetables, and dairy. Compared to the food pyramid, MyPlate features a plate which depicts the percent of each food group that should be consumed at any given meal. The goal of MyPlate is to help everyone "build a healthy style of eating." [10] For example, they suggest that half of the grains consumed be whole grains, that protein be varied, that a variety of fruits and vegetables are consumed with special consideration being paid to not drinking fruit juice or canned fruit that is high in added sugar, and that all dairy consumed be low fat or fat free. This added advice makes it so that

people who follow My Plate for their meals get a balanced diet that is nutrient dense, without having to work too hard to try to understand all the numbers associated with nutrition. In addition it demonstrates that all foods fit into balanced diet as long as they are consumed in moderation.

However, consuming foods in moderation is not necessarily something that Americans are good at. Incorrect portion size plays a large role in the contribution of unnecessary calories to our diet. These added calories can be a contributor to obesity [11]. In addition, a lack of understanding of portions is often the reason people have difficulty dieting. Any food consumed in too large of a portion can have negative effects. Further, some people eliminate foods and then end up eating them anyway and feeling guilty about it when they could just consume a smaller portion instead [12]. Part of developing healthy eating habits is developing an understanding of what a portion size is. In doing this, healthy foods can then be consumed in larger portions and less healthy foods can be consumed in smaller portions.

In providing nutrition education, it is crucial to have a baseline to understand where the students being educated are coming from. This means understanding not only what they are eating but why they are eating those particular foods. By better understanding these two components, nutrition interventions can be more efficient and effective. Having a baseline of the food students consume is key in providing nutrition education because this baseline allows the educator to understand the areas where there is a nutrition deficit and more efficiently target educational messages.

The way we eat has a variety of influences, some of them more obvious than others, however each of them play a large role in why we consume both healthy and unhealthy foods.

By better understanding the key drivers in what college students are eating, more effective programs can be created to target these influencing factors. This can be through providing nutrition interventions or enacting policies to mitigate the barriers to healthy eating, which provide more support to the positive influences. While there is information on what influences society as a whole, it is important to understand the important influencing factors for college students in particular since they may be different based on the specific challenges and life experiences unique to individuals in this particular category.

A greater understanding of the influencing factors and eating habits of college students is essential in creating effective interventions. These health interventions are crucial in the development of healthy lifestyle habits both for the college years and beyond. If we hope to see a decrease in heart disease, diabetes, and obesity, we must target populations at pivotal points in life so as to have the greatest impact. Providing nutrition education to college students helps not only benefit them in the long run in terms of chronic diseases, but also has benefits in the short term such as an increase in energy, mental health, and academic performance.

Literature Review

Before trying to make changes to the diet of college students, it is important to understand what sort of foods they are consuming. This will give a better idea of what aspects of diet change should be emphasized for optimal results.

The transition between childhood and young adulthood results in a change in food consumption patterns. This shift is largely because young adults have the power to shop for themselves and make more of their own food choices as well as a variety of other influences. However, this increased autonomy does not always result in healthier eating habits. A study surveyed 246 young adults, both when then were 10 years old and again when they reached

young adulthood, sometime between the ages of 19 and 28 years old. On both occasions, the participants were asked to fill out a twenty four hour dietary recall [13]. Upon examining the data, it was found that children consumed significantly more fruits, fruit juices, and mixed meats ($P < 0.05$), desserts, candy, and milk ($P < 0.0001$) than young adults. Conversely, young adults consumed a greater amount of salty snacks ($P < 0.05$), beef ($P < 0.01$), and sweetened beverages, poultry, and seafood ($P < 0.001$). While their diet did diversify as the children aged, not all of the diversification was positive, especially in regards to beverages. The dramatic decrease in milk consumption and increase of sugar sweetened beverage consumption demonstrated an unhealthy trend. The study did find that only 52% of the increase in sugar sweetened beverage consumption came from carbonated beverages and that the rest came from fruit drinks, and coffee and tea with sugar. While this demonstrates that while soda consumption is not as high as we may have thought, the other beverages are potentially just as dangerous, especially since they can be seen as healthy and not for the amount of added sugar that they actually have. While this study is not ideal as it uses data from two different 24 hour recalls, and extrapolates that data to demonstrate a typical diet at age ten and then again at young adulthood, the study does create a picture of the change in diet that is common during the transition between childhood and adulthood. The change it finds is not a positive one, but rather that diet quality decreases overall as a result of this transition.

Another set of researchers further examined the changing diet trends in young adults and college aged students. The five year transition after high school led to a decrease in fruit and vegetable consumption. As a result, college aged students consumed less than one serving of fruits and vegetables per day, and only 6% of students consumed the recommended five servings

of fruits and vegetables per day [14]. This number included potatoes as a vegetable, making the already low consumption of fruits and vegetables even more extreme. In addition to the decrease in fruit and vegetable consumption, breakfast consumption decreased, and fast food consumption increased. Further analysis of diet quality showed a dramatic quality decrease during freshman year of college, however over the next several years, it did not increase very much. This results in the creation of poor eating habits which are continued into adulthood.

Increased consumption of fat is a key factor leading to obesity. For this reason, a group of researchers felt that it was important to assess which foods contribute most highly to fat intake in young adults between the ages of 18 and 24. The researchers asked 1062 subjects from the coterminous United States to complete a 24 hour food recall, and two one day food records. The dietary fat, vitamin and mineral, and food groups intakes were measured recorded. The study compared students by sex and also looked at the differences between students consuming a high fat and a low fat diet from each gender. Over 75% of the students consumed more than 30% energy from fat thus classifying them as consuming a high fat diet. Ground beef was a key fat contributor for both men and women, as were salad dressing, whole milk, pizza, lunch meat and eggs. Both men and women with a low fat diet consumed an increased amount of legumes, rice, fruit, low fat dairy products and whole grains [15]. The results of this study demonstrates that some college students are making better food decisions than their peers. The low fat group did not necessarily consume smaller portions of the same foods as the high fat group, instead they consumed healthier foods such as whole grains, fruits and vegetables, and low fat dairy. This demonstrates that it is not enough to decrease the consumption of high fat foods, that healthy foods must be consumed in their place for optimal health results. Additionally, students

consuming a healthy, and thus lower fat diet were in the minority. Only 25% of students made up the low fat group. While the study only required one 24 hour food recall, and two one day food diaries, the large sample size makes it somewhat more reliable. Additionally, the use of two different methods of assessment allows for a more comprehensive picture of what students are eating. For this reason this study shows a reliable picture of the foods being consumed by college students. Given this knowledge, it is clear that part of the focus of an intervention should be to address simple switches which will result in lower fat options and increased nutritional value, such as switching ground beef out for ground turkey, and switching from whole milk to low fat milk. Further, interventions should address the addition of healthy, naturally low fat foods such as fruits and vegetables into the diet.

Fast food consumption is also common among college students. A cross-sectional study of 17,370 adults and children examined the dietary intake of individuals who consumed fast food, both on the days that they did eat fast food, and on the days that they did not. The data was collected by 2 non- consecutive 24 hour dietary recalls. This study found 37% of adults and 42% of children consumed fast food [16]. However participants were surveyed between 1994 and 1998 so it is likely that the percentage of people consuming fast food has increased since then. Those people who consumed fast food had a higher fat, saturated fat, sodium, soft drink, and caloric intake. They also demonstrated a lower intake of vitamins A, C, milk, fruits and vegetables than those who did not eat fast food ($P < 0.001$). Similar differences were seen on the days fast food was consumed compared to the day that they did not consume fast food. While only about half of the adults and children surveyed reported consuming fast food, of the 4746 students between 11 and 18, 75% reported consuming fast food at least once per week. Men consumed fast food more

frequently than women, and so did those with a high school diploma and some college units. These results demonstrate that fast food is a contributor to increased caloric and fat intake in college students. Further these habits show the need for education programs that target the entire diet, and not just food consumption in the cafeteria, as students are making unhealthy food choices outside of the cafeteria as well. It is important to address that fact that part of fast food consumption is driven by convenience, and thus it is necessary to address this concern in order to create the most effective program that provides students with the resources necessary to make healthy choices inside and outside the cafeteria, as well as making the convenient choice.

The foods found in student dorm rooms are also an indicator of the type of foods, particularly snacks, that students consume. A study was conducted on 100 students living in the dorms of a large, public university. Food found in the dorm rooms of these students was inventoried by the research staff and analyzed for nutritional content. Students were also asked about where the food was purchased and who purchased it. Additional information regarding eating habits was collected as well. The researchers found that the majority of the students surveyed (83%) were first year undergraduate students who were on a university meal plan which provided them with at least 14 meals per week. In addition to the food consumed through the meal plan on campus, the researchers found that 96% of students also had food in their dorm rooms, with 70% of students having less healthy foods such as salty snacks, cereal, main dishes, desserts, candy, and sugar sweetened beverages. Fewer students had healthy foods such as fruits and vegetables, dairy products, tea and coffee, and 100% vegetable juices in their dorm rooms. As a result, it was found that the average student dorm room contained 22,888 calories [17]. Grocery stores and superstores (e.g. Target and Walmart) accounted for 75% of food purchase

location. Other locations food was purchased from include warehouse stores such as Costco, campus stores, dining halls, off campus convenience stores, and other sources such as care packages and homemade gifts. Parents purchased 47.8% of the food items, and students purchased 44.5% of items. Interestingly, parents were more likely to purchase foods that are high in calories and fat than foods that were purchased by the student. There are several implications of this research. First, since student dorm rooms contain so many calories worth of food, this food must be included when assessing the overall eating habits and food choices of the student. A high percentage of the goods purchased for dorm room consumption were high in fat, salt and sugar demonstrating that students are not necessarily making healthy choices when it comes to what they will consume in their dorm rooms, either as snacks or as meal replacements. This demonstrates a need for education on easy, healthy snacks that can be good alternatives to the high fat, high sugar foods currently being consumed in dorm rooms. Another interesting fact to note is that parents were more likely to purchase unhealthy foods than students demonstrating that all the blame on unhealthy dietary patterns should not fall to the student. The research study was conducted during the first week of school so it is possible that parents helped pay for groceries for students so examining the goods purchased later in the semester and comparing them would most likely yield more realistic results. However, even given this information, it is still clear that parents play an important role in food choice and food consumption of college students even if the student no longer lives under their roof.

Since college is considered a time of change and growth, the question arises whether this change and growth applies to eating habits of college students. However a study conducted on 144 underclassmen (freshmen/ sophomores) and 114 upperclassmen (junior/ seniors) found that

overall, there were relatively few differences in eating habits between the two groups. Food consumption was very similar however, upperclassmen were significantly ($P < 0.05$) more likely to consume an afternoon snack and than their underclassmen counterparts [18]. Over 75% of students reported snacking at some point throughout the day, and over two thirds of the students snacked multiple times per day further emphasizing the importance of education on good snacking habits. The researchers also found a significant difference between the two groups in number of students who ate in the dining hall. Underclassmen were more likely than upperclassmen to eat in the dining hall. This is likely due to the fact the underclassmen are more likely to live on campus, and thus consume their meals there. Conversely, upperclassmen are more likely to live off campus and consume the majority of their food off campus. The lack of difference in eating habits between the two groups demonstrates that, without intervention, students are not particularly likely to change their eating habits while they are in college. The roots of lack of change must be assessed and then addressed so that eating habits can be influenced for the better and students can graduate not only with the ability to work in their chosen career path, but also feed themselves along the way.

It is important to examine not only the foods that college students are consuming, but also the reason they are consuming those particular foods. Without an understanding of the influencing factors, motivations, and barriers, it would be impossible to create a program that implements effective change. Change will only occur when the root of an issue is addressed and influenced. Therefore it is important to examine the influencing factors for college students in particular as they may differ from other adults due to the difference in their life stage and situation.

A qualitative study examined 147 focus groups containing multicultural participants from both rural and urban environments. The participants aged 18- 50 were separated into focus groups based on ethnicity. Participants were asked qualitative questions regarding their fruit and vegetable consumption including: general determinants, barriers, enablers, knowledge, and attitudes. This study found that across all demographics the most common facilitators of fruit and vegetable consumption include family tradition, health benefit, and advice of the physician. The most common barriers among all groups include inaccessibility, cost, and time. While all groups, regardless of age and ethnicity believed that a diet high in fruit and vegetables was good for their health, they stated lack of time was the key reason that they did not consume more fruits and vegetables. High cost and high spoilage rates were also stated as reasons that participants did not consume more fruits and vegetables, despite their knowledge of health benefits [19]. Therefore, it is essential to provide education that reduces the barriers and increases the facilitators of healthy food consumption. This means providing practical tips for decreasing the time and cost associated with healthy food, particularly fruit and vegetable consumption. While this study was performed on a much wider age range than would be prefered to gain specific information about factors that influence the eating habits of college students, it still lends some valuable information as to what influences the way the general population eats. While there are also influences more specific to college students, it is important to understand the things that will influence eating habits later in life as well so that college students can be better prepared to cope with nutritional challenges later in life.

Food intake is directly related to the food availability, but what if both healthy and unhealthy foods are present? This phenomena is known as the “competitive food choice

construct" and it is a reality for many college students. A study of 408 college freshmen at a diverse, public, urban university examined the relationship between less- healthy foods and their barrier on the consumption of fruits and vegetables. The competitive food choice construct has three major indicators or causes: the presence of competitive food, time, and quality barriers. While all three of these criterion are experienced by college students to some degree, the researchers found that competitive food was the most valid and reliable aspect and thus chose to further examine its implications. Competitive food is that food which is competing with healthy food to be chosen by students, whether in the cafeteria or while the students are eating out. At many schools this is the presence of pizza, burgers, and other calorie dense comfort foods that are available in the cafeteria at every meal. These foods then "compete" with other, healthier foods. This demonstrates that simply providing healthy foods for students is not enough. As long as the less- healthy foods are still present and students remain uneducated, the less- healthy foods will be selected instead of the healthier ones. The researchers also found that craving was one of the key obstacles in fruit and vegetable consumption, as students typically craved sweet or salty snacks as opposed to vegetables, further illustrating the disconnect between the presence of healthy foods and student's desire to actually consume those foods [20]. In order to be effective, interventions must address the fact that healthy food is not the first choice of students, and that they are faced with multiple other food options, which they choose often to consume instead of healthy foods. While this study does not provide answers on how to combat this issue, it is clear that more must be done to override initial reaction of college students to consistently go for the less healthy foods in the cafeteria and unhealthy snacks. The benefits of healthy food must be

stressed in a way which incentivizes students to make a change and do something that is not as easy or comfortable for them.

Time is considered to be another important factor which influences the way in which students eat. Time scarcity affects the food choices of many groups. The researchers in this study specifically discuss employed parents and families living in poverty as people at risk for making poor food choices due to time scarcity. While college students are not specifically mentioned or examined in depth, the findings can still be applied as many students list time as being one of the key factors which influences the way they eat. The researchers of this study found that both money and time played a large factor in food choices, and that the least expensive, time saving options were often chosen by families, especially those living in poverty or where both parents worked. These inexpensive, time saving foods were typically energy dense, and high in fat, sugar and calories which is somewhat expected. What was unexpected however, was the fact that even if families had more money, they were not likely to purchase healthier foods if they perceived that those foods would take a longer time to prepare. Further, when asked if they had more time if they would spend it on cooking, few people said they would [21]. These findings demonstrate that lack of time and resources are just part of the problem in regards to poor food consumption. Perhaps the greater issue that is more entrenched are people's patterns and own personal food systems and beliefs. Therefore, in order to affect change this root problem must be identified and addressed. However this is not to say that time and money are not factors that should not be addressed during education, especially for college students. After students leave college it is likely that they will experience an increase in time and money. Without reason to change, it is likely that students will fall into the same poor eating habits that they developed in college and

use their newfound time and resources on others things. By learning healthy habits that fit into busy college schedules when time and resources are scare, hopefully graduates will carry on these healthy habits once they move into adulthood. One way to do this is to create interventions keeping time in mind. Teaching students how to make healthy meals and snacks in a time crunch is going to be the most effective strategy in the long run.

Living arrangement can also play a critical role in student nutrition. A 24 hour recall was given to 585 students to determine what sort of foods they were consuming. Additionally, students were asked to self report their height and weight, and to mark whether they lived on-campus, off- campus, or with their parents. BMI was then calculated from the self reported height and weight and a general linear model was used to examine the differences between students based on their living arrangement. The researchers found that students who lived off campus (n= 329) were significantly more likely to be overweight or obese than students who lived on- campus (n= 220), or with their parents (n= 36) ($P = 0.003$) [22]. There was no statistical significance in BMI between students living on- campus and those living with their parents. The 24 hour recalls demonstrate that eating habits play a role in the prevalence of obesity in off-campus students. Students living on- campus or with their parents were significantly more likely to consume fruits ($P = 0.001$), vegetables ($P = 0.042$), and dairy ($P = 0.001$) than students living off campus. Off- campus students were significantly more likely to consume pork ($P = 0.009$), green leafy vegetables ($P = 0.044$), fruit juice ($P = 0.043$), white bread ($P = 0.041$), sweet baked goods ($P = 0.008$), and alcoholic beverages ($P = 0.003$). While students living on- campus or with their parents tended to make healthier choices and consume more fruits and vegetables, those living off campus tended to make poorer food choices and consume foods higher in

calories, fat, and sugar. These results demonstrate that dining hall options are not completely negative in regards to healthy eating. Even with the presence of competitive food choices, the availability of healthy foods in the dining hall increases the likelihood that students will eat fruits, vegetables and dairy. When students are on their own and make their own food choices, their health tends to suffer, as can be seen from the fact that students living off- campus were significantly more likely to be overweight or obese. Given this information, it is imperative that educational activities include not only students living on campus, but also those who live off-campus, specifically those who are living on their own. Additionally, off campus students should be surveyed in order to determine what their greatest barriers to consuming healthy foods and maintaining a healthy weight are. Once this information is obtained, it should be incorporated into the intervention so as to make it most effective in creating healthy eating habits for all students, no matter their living situation.

As seen in the previous study, students living on- campus made better food choices and were less likely to be overweight or obese than those living off- campus. This is likely the result of the on- campus students having a meal plan. A group of 503 undergraduate students kept a food diary for three days. Food Guide Pyramid (FGP) intake for grain, vegetables, fruit, milk, and meat were then compared. Food Guide Pyramid is comparable to MyPlate and contains the same groups and very similar recommendations. Students were also asked whether they participated in the school meal plan. The meal plan was paid for with a flat rate at the beginning of the semester with an access to the “all you can eat” school cafeteria for breakfast, lunch, and dinner, or a $9.80 daily allowance to be used at campus restaurants or vending machines. Of the 503 students surveyed 94 participated in the prepaid meal plan while 409 were responsible for

their own food. None of the students did a good job meeting the FGP requirements, however students with a meal plan were more likely to meet the recommendation for all of the groups, excluding grains, than those not participating in a meal plan. Those with a meal plan were significantly more likely to meet their daily requirement for fruit ($P = 0.01$), and meat ($P= 0.5$). These results demonstrate again the role that convenience plays in making food choices. Students with a meal plan have greater access to meat, fruits and vegetables and are thus able to consume more of these foods [9]. It is likely that grain consumption is higher among off campus students as breakfast cereals, pasta and sandwiches tend to be frequently consumed by students without a meal plan as they are quick and easy to prepare. On their own, the results of this study are not convincing. Of the group surveyed less than 20% of the students were actually on the campus meal plan creating a somewhat small sample. However, when the results of this study are taken in combination with the results of the previous study, it is clear that easy access to healthy foods allows for healthier eating habits. These results emphasize the importance of maintaining healthy foods in school cafeterias and to be available under meal plans as students on meal plans eat the foods that are available to them. When food competitivity is factored in, it is obvious that an increase in healthy foods is necessary in order to combat the less- healthy foods that students are drawn to. Additionally, these studies make it clear that nutrition education is essential, as students who do not receive nutrition education typically go on to make less healthy food choices when they are shopping for and preparing their own food.

Objective

The objective of this study was to take an area in student diet that needs improvement and develop and implement an effective intervention to influence that area. This study sought to

influence the diet as a whole by providing education on MyPlate and proper portions, it also incorporated some of the key influencing factors of student eating habits such as convenience and perception of health.

Methods

Initial Survey

A survey created by Fruved was used to gather preliminary data on the population. This survey was, not only on Point Loma Nazarene University's campus, but on all campuses who have received the Fruved mini grant. The data was provided not only to each individual school but is also used to get an idea of the overall health of college students across the nation.

There were several survey options available. All consisted of a basic survey to which supplementary questions could be added. The basic survey was used with the addition of two supplemental portions. The survey asked a series of ~ 50 questions relating to health on campus. Respondents were asked to name health programs they felt were effective on campus, and programs they would like to see instituted. Additionally, the survey included a food frequency questionnaire in order to assess how frequently students consumed different types of vegetables. The survey also included questions relating to stress, sleep, and physical activity so as to get an idea of overall student wellness. Finally, the survey asked students what factors motivated their eating habits, and asked them questions relating to nutrition efficacy. The purpose of this initial survey was to get an idea of what sort of interventions would be most useful to the campus, and specific to this project to provide background information on the health status of the overall campus population.

This initial survey was sent out to student, faculty, and staff through email. In addition to the ability to respond via email, students sat outside of the cafeteria in order to recruit other

students to take some time before or after eating a meal to fill out the survey on an iPad. The Ipads with the survey on it were also brought to the anual Department of Sociology, Social Work, and Family Sciences chili dinner where attendees were encouraged to take the survey while they ate.

Overall, the survey was open between September 1 and November 1 and 150 people participated. Participants were sent an automatically generated health report card comparing their stress level, activity level, and fruit and vegetable intake to the national average of everyone who has taken the furved survey this year. At the end of the school year, the survey was sent out again, however the results of that survey are not be included in this paper.

Intervention

Four Interventions are a required part of the Fruved program for intervention campuses.

Purpose

The purpose of this intervention was to educate college students on MyPlate and teach them to recognize proper portions so that they can make healthier, more informed decisions in the cafeteria. Additionally, this intervention was used as a way to gather data regarding fruit and vegetable consumption, whole grain consumption, sugar sweetened beverage consumption, sugary and salty snack consumption, as well as factors influencing food consumption.

Objectives

This intervention had two objectives. First, by the end of the intervention, the participants will be able to identify the five components of MyPlate, the foods that make up these groups, and the proper portion for for foods in each component. The second objective was that by the end of

the intervention, participants will be able to identify the healthier option for each components of MyPlate and feel equipped to make healthier food choices in the cafeteria.

Marketing

The intervention was marketed on several fronts. First a flyer was created advertising the intervention as an opportunity for students to learn how to eat healthy in the cafeteria, and the more specific focus, targeting portion size and MyPlate. The flyer included the location and four different times the intervention was taking place. The flyers were posted on billboards around campus. The flyers were also distributed through an email that was sent to all department heads to send out to their students. The event was promoted on the Fruved Facebook page and Instagram. In addition the Student Dietetics Association promoted the intervention on their Instagram account as well. Several professors promoted the event by encouraging their students to come. Finally, the researcher promoted the intervention to those she came in contact with frequently.

Environment

The intervention was conducted in two different environments. Two interventions were conducted in Cunningham dining room which is adjacent to the cafeteria. The room was set up with chairs in rows facing a screen. A table was set up in the front and was used to hold props. The researcher's computer was connected to the projector via an HDMI cable and was used to project a powerpoint onto the screen.

These four interventions were conducted on two seperate days at different times in order to attract a broader audience. Two interventions were offered on Tuesday, November 28 during lunch time, at 11:45 am and 12:30 pm. Additionally, two interventions were offered Thursday,

November 30 during dinner time at 5:45 pm and 6:30 pm. Each intervention lasted approximately 20 minutes.

The second set of interventions were conducted on two sections of a Fundamentals of Nutrition (FCS 225), in room 212 at Liberty Station Conference Center. The students sat at desks facing a screen in the front and a table was set up in the front and was used to hold props. The researcher's computer was connected to the projector via an HDMI cable and was used to project a powerpoint onto the screen. The Powerpoint was advanced using the spacebar at the end of each slide. These interventions were conducted on Wednesday, January 12, 2018, at 12:00, and 1:00 and each lasted 20 minutes.

Subjects

The study consisted of 51 subjects over the course of six presentations. Subjects were all college aged students attending Point Loma Nazarene University. It is unknown how many of the subjects had also filled out the initial survey.

Survey

At the beginning of the intervention, all participants were given a pretest containing questions relating to the proper position size for each component of MyPlate. The pre- test, as seen in **Appendix A** also asked participants to identify how many serving of fruits and vegetables and whole grains they should be consuming a day. Additionally, participants were asked how many servings of fruits and vegetables they consume per day, how frequently the consume sugar sweetened beverages, sweet and salty snacks, and the factors affecting their eating habits. After the intervention, participants were given a post test which contained the same questions as the pre- test regarding portion size and recommendations for consumption. Instead

of asking participants how frequently they consumed certain foods, this survey asked how likely students were to change their eating habits as a result of the intervention. Surveys remained anonymous.

Lesson

The interventions were taught by the researcher. Slides were used as a visual aid to accompany the presentation and provide visuals when appropriate. The presentation took place in three parts. First, importance was established, and participants were informed of the objectives. Next, background information on the subject was given. Participants were asked to collectively try to name the five components of MyPlate. Then a brief history of MyPlate was discussed as well as its importance as a tool for making healthy food choices. Next, the importance of portion size was discussed and participants were introduced to the concept of using the hand as a way to measure proper portion size when measuring scoops are not available. The third portion of the presentation examined each of the five food groups, vegetables, fruits, grains, protein, and dairy. In each section the benefits of consuming foods from that food group were discussed as well as the proper portion size, how many portions should be consumed in a day, and ways to met those recommendations while eating in the caf. Hand comparisons were used to help participants better understand portion size. Additionally, rubber food models of foods in the proper portion size were passed around so that students could compare the proper portions to the size of their hand and gain a clearer understanding the effect portion distortion has on perception. Finally, tips were given on increasing consumption of healthy foods such as fruits and vegetables and whole grains, and swaps that can be made in the cafeteria to make meals healthier.

At the end of the intervention, before the post test was given, the participants were asked to talk to each other about changes that could make to their eating habits to better comply with MyPlate. Participants were then asked to share some of their suggestions. The purpose of this portion of the intervention was to check if participants were able to synthesize the information they had been given by seeing if their planned changes aligned with me material presented in the intervention and to give them the opportunity to own the material they had been taught. Finally participants were given the post test, a drawing was done for a gift card, and then there was a time for questions either pertaining to the presentation or to nutrition in general.

Health Index

A health index was created to reflect the level of risk of students for making unhealthy food decisions. This index was created to reflect the eating behaviors of students based on their snacking behaviors. It operates under the assumption that students who engage in less healthy snacking habits are also likely to engage in less healthy dietary patterns across the board. In addition to providing relevant information as the the level of health of participants in the interventions, by providing each student with a health score, it can be assessed whether students with greater health knowledge make better health choices.

The health index ranges from one to 21 and is based on student responses to three questions on the pre- test. These questions asked on a scale of one to seven, with one being never and seven being every day, how frequently participants consumed sugar sweetened beverages, sweet snacks, and salty snacks. The frequency of consumption for each group was added up to given students and overall health score. These scores fall within three ranges on the health index.

Students at low risk for unhealthy eating behaviors scored between one and seven, students at medium risk scored between eight and 14, and students at high risk scored between 15 and 21.

Statistical Analysis

The data was analyzed using Microsoft Excel. A ttest was conducted comparing the average score on the pre- test as compared to the post test. Percentages were also found.

Results

Initial Survey

The results from the initial Fruved survey paint a picture of the overall health of the campus. Of the students surveyed, 83.62% were female, and 15.52% were male. In terms of ethnicity, 89.7% were White and 11.3% were Latino. The median student surveyed was in their third year of college (n= 2.8). Participants were on average 20.83 years of age. The average weight of students surveyed was 144 lbs and the average desired weight was 134 lbs. The average BMI of participants was 23.31. For greater detail on survey results see **Appendix B**.

Participants were asked a variety of questions relating to their perceptions of opportunities to engage in health related behaviors on campus. The responses were rated on a scale from one to five with one being strongly agree, and five being strongly disagree. Participants responded between neither agree nor disagree and agree that there are healthy foods available on campus in general (n= 2.2). Participants responded similarly about the perception that healthy food is available to them in the cafeteria (n= 2.3).

Participants were also asked to rank how much of a priority certain health initiatives were for them on a scale of one to five with one being not important at all and five being very important. Overall, highest rated priorities of students centered around healthy eating. Students

wanted to “have more healthy food options available in campus dining halls” (n= 4.38) and “more healthy food options available in campus convenience stores” (n=4.21). Students also wanted “healthy food options available on campus [to be} of equal or lesser price to comparable less healthy food choices” (n= 4.47). Finally, there was some desire for having “programs and resources available that promote healthier dietary behavior (e.g. smaller beverage glasses, access to Registered Dietitian Nutritionists (RDNs), cooking classes, etc.)” (n= 4.01). Other programs rated as a priority by students included programs relating to stress management and greater access to exercise facilities.

Part of the survey also included a food frequency questionnaire, asking students how frequently they consumed a variety of different foods. Students consumed fruit approximately one time per day, salad between three and five times per week, and vegetables 5- 6 times per week. Respondents consumed both fried potatoes and non-fried potatoes approximately one time per week. Cooked, dried beans were only consumed a couple of times per month on average. In addition to these vegetables, students also reported eating other miscellaneous vegetables approximately once per day during the last month.

Participants were also asked to rate the main factors that influence the foods they consume on a daily basis on a scale of one to five with one being “not important” and five being “Extremely Important.” Overall, taste and convenience were the two greatest influences (n= 3.94), closely followed by price (n= 3.83), and perception of health (n= 3.70).

Finally, students were asked questions regarding their nutrition thoughts and attitudes. They were asked, on a scale of one to five, how frequently they had done the item in question with one being never and five being always. Students often tell themselves that fruits and

vegetables should be included in every meal (n = 4.11) and purposefully added vegetables to their meals and snacks (n = 4.0). Participants were also very likely to select beverages with health in mind (n = 4.11). Students less frequently reminded themselves that planning quick and simple meals is important (n = 3.19) and that healthy meals do not require a lot of work (n = 3.01), and actually follow through and plan quick, easy, and healthy snacks (n = 3.34).

Intervention

The first seven questions of the intervention survey were the same on both the pre and post test. These questions assessed participant knowledge of number of servings and portion sizes for the components of MyPlate. As demonstrated in **Table 1**, in the pretest, participants answered approximately 3.45 (SD = 1.42) questions correctly for an average score of 49% (SD = 20%). On the post test, participants answered approximately 5.11 (SD= 1.21), question correctly for an overall average of 73% (SD=17) on the post test. These changes were significant to the .001 level ($P < 5.83$ E-09).

Table 1

	Pre Test number	Post Test number	Pre- Test percentage	Post- Test Percentage
Average	3.45	5.12	49%	73%
Standard Deviation	1.42	1.21	20%	17%

In terms of individual questions, on average students were more likely to answer the questions correctly on the post- test than on the pre- test. **See Figure 1.** On all questions (excluding question 5, which asked how many whole grains should be consumed), a greater percentage of students answered correctly on the posttest than on the pre- test. Students increased

their scores by the most on question one (51%), which concerned the number of servings of fruits and vegetables to be consumed. The next greatest increase in percent of students answering the question was on question six which dealt with the proper portion size for protein. Additionally, the post test demonstrated that after the nutrition intervention, 92% of participants were able to correctly identify the proper serving size for vegetables, 80% were able to identify the proper serving size for fruit and 76% percent of participants were able to identify how many servings of fruits and vegetables should be consumed per day.

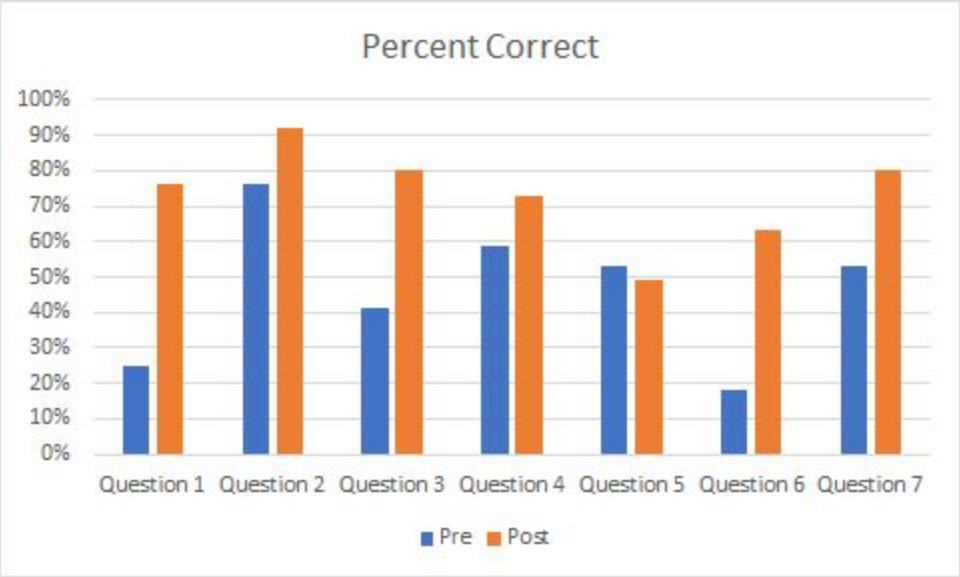

Figure 1

Participants were asked to rate how frequently they consumed foods from three different categories (sugar sweetened beverages, salty snacks, and sweet snacks), on a scale of one to seven with one being never and seven being several times per day. On average students consumed sugar sweetened beverages between one per month (2) and several times per month (3) (n= 2.68 SD= 1.34). Students consumed salty snacks between once per week (4) and several times per week (5) (n= 4.25 SD= 1.45). Students were somewhat more likely to consume sweet

snacks, though they did fall within the same frequency as the consumption of salty snacks, that being between once per week (4) and several times per week (5) (n= 4.39).

In order to understand in greater detail the potentially unhealthy eating patterns of students, a health index was created using the responses to the aforementioned questions. The scores from each question were totaled to create an overall health score. This score was then put on a scale of potentially unhealthy eating activity. Participants with scores between one and seven were considered to be at low risk. Participants with scores between 8 and 14 were considered to be at medium risk, and participants with scores between 15 and 21 were considered to be at high risk. The average health score was 11.3 (SD= 3.2), and as seen in **Figure 2**, the majority of the participants fell within the medium risk range.

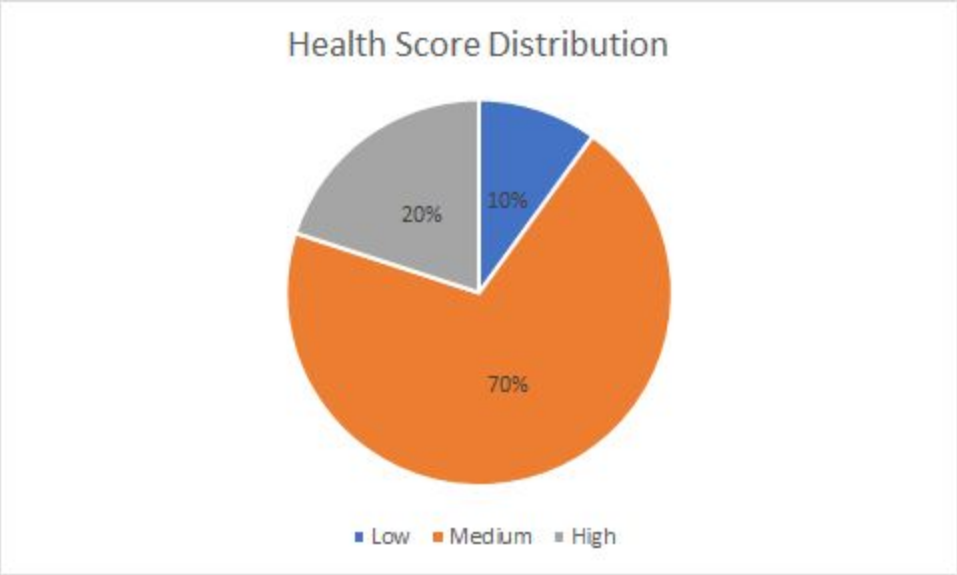

Figure 2.

The relationship between health risk score and score on the pretest was examined. Participants in the low risk group scored an average of 66% on the pretest, participants from the

medium risk group scored an average of 48% on the pretest, and participant from the high risk group scored and average of 50% on the pre- test.

Participants were provided a list of seven potential influencing factors of their eating habits. These included convenience, perception of health, foods eaten growing up, flavor, quality, what friends are eating, and price. Participants were asked to circle which of the above they perceived influenced the way they eat. As seen in **Figure 3**, convenience (82%), perception of heath (80%), flavor (78%), quality (78%) and price (74%) were considered influential by the greatest percentage of students.

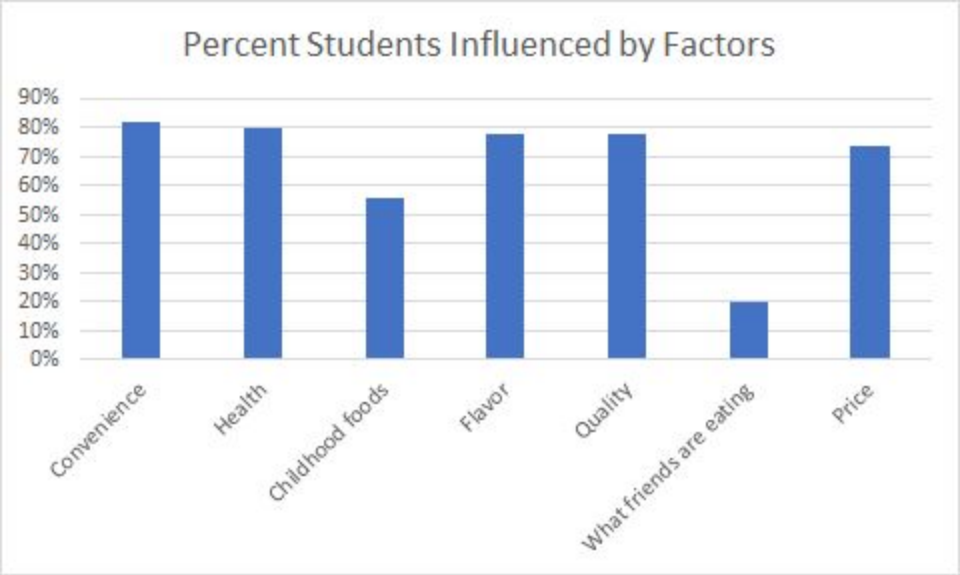

Figure 3

In addition to being asked which of the seven factors influenced their diets, students were also asked to pick which of these factors they deemed to be the greatest influence. As seen in **Figure 4**, while no one factor was the greatest influencing factor for a majority of the population, health at 33% and convenience at 23% were the two most popular. They were followed closely behind by flavor at 19% and quality at 17%. Less than 5% of students named price, foods eaten

in childhood, and foods their friends are eating as the most important influence on their eating habits.

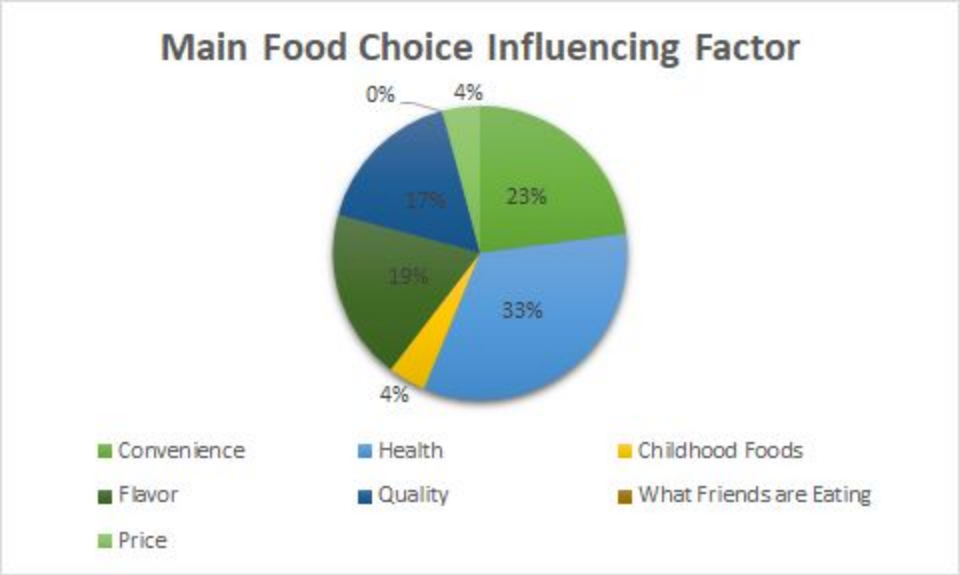

Figure 4

After taking part in the intervention, students were asked how likely they were to change the way they eat in the cafeteria. As seen in **Figure 5**, students responded positively to the intervention and 86% indicated that they would likely change the way they eat in the cafeteria to some degree. Only 6% of students responded that they were very unlikely to change the way the way they eat in the cafeteria.

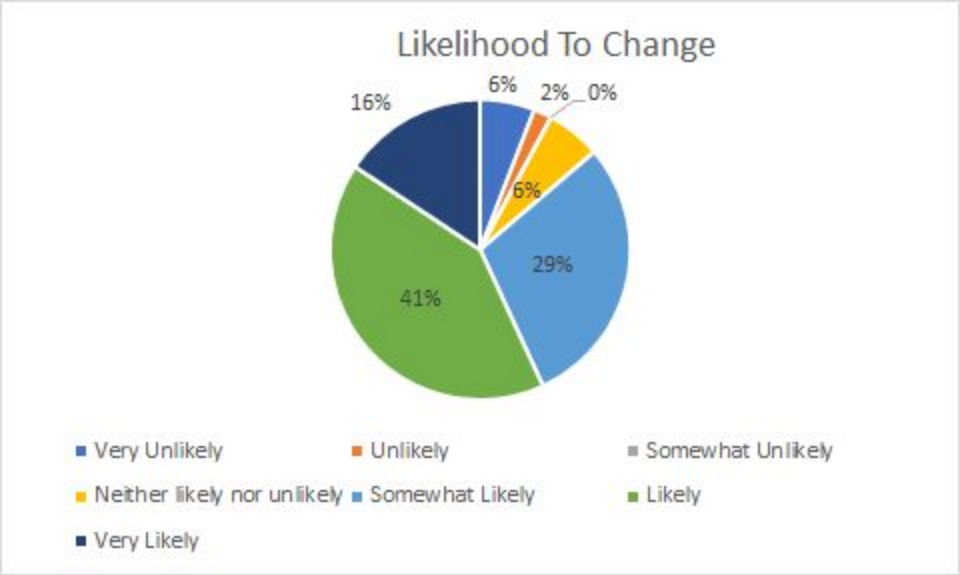

Figure 5

Discussion

Intervention

The intervention conducted was effective on two levels. First it provided health information to students, thus empowering them to go out and make healthy choices while eating in the cafeteria. Second, the intervention took into account several of the influencing factors on the eating habits of college students and worked to incorporate them so as to allow for optional, sustainable change. Students were taught that it was easy to have a healthy diet while eating in the school cafeteria which addressed both their desire for the foods they eat to be convenient and healthy. In terms of health, the intervention further emphasized balance and the importance of eating a wide variety of foods. Perception of health means nothing if students lack nutrition education. Since it cannot be assumed that the average student is a nutrition expert, it is important to provide quality, accurate nutrition information so that perception of health can align with actual health knowledge.

Comparison of the percent correct on the first seven questions of the pre- and post- tests demonstrated that this intervention was effective in providing nutrition education to students. After the pretest, students averaged 49%. When the same questions were given again after listening to the intervention, students averaged 73%. This change was statistically significant demonstrating that students did learn something by sitting through the intervention. While there is no data to determine if students retained or utilized this information, teaching the intervention was still valuable as it provided students with the knowledge, and thus the opportunity to make the healthier decisions.

In terms of individual questions, the only question in which a lower percentage of students answered correctly was question 5 which asked about the proper number of servings of whole grains. It is possible that students did not read the question closely and instead of answering how many whole grains should be consumed, they answered how many servings of grains they should consume in total. However, knowledge of fruit and vegetable serving size and frequency of consumption increased dramatically, and by the end of the intervention, 92% of participants were able to correctly identify the proper serving size for vegetables, and 80% were able to determine the proper serving size for fruits. Since there is a connection between health knowledge and health behaviors, this increase in knowledge is extremely important. This intervention did not measure whether students were able to retain this information over a long period of time, or if a change in knowledge actually brought about diet changes in terms of vegetable consumption however education is the first step in the behavioral change process. Since the goal of the intervention was to provide nutrition education in regards to portion size with a specific emphasis on fruits and vegetables, it can be considered successful.

The question regarding protein portion size saw the greatest jump in percentage of students who correctly answered the question. Our culture is currently protein obsessed, and as a result individuals tend to consume more protein than is necessary [23]. This incorrect belief was demonstrated in the fact that only 17% of participants were able to correctly identify the proper portion size for protein. However, after the intervention, over 60% participants were able to correctly identify the 4 oz serving of protein. It is especially important that students understand the proper serving size for protein as ground beef was one of the leading contributors of fat in this age group [15]. By helping students to more properly portion protein, their total fat intake can be decreased thus also decreasing their risk for obesity and heart disease.

The intervention providing tips on healthy eating in the cafeteria through education on My Plate and proper proportion sizes was successful. This is demonstrated not only by the fact that a statistically significant number of students scored better on the post- test than on the pre-test, but also by the fact that the number of students who answered each question correctly also dramatically increased. However, though there is a correlation between health knowledge and health decision making, it is essential that students take the information and put it in to practice. Of the students who participated in the intervention, 86% indicated that they were likely to change their eating habits in the cafeteria to some degree, and only 6% stated that they were very unlikely to change the way they eat. Overall, the majority indicating intent to change demonstrated the value of the information taught. This intervention was also effective because it incorporated principles regarding the key influencing factors for college student eating habits. By targeting eating habits in the cafeteria, the intervention helped students to eat better in their most convenient food location. Almost all of the students who attended eat at least one meal in the

cafeteria per day and for many students eating in the cafeteria is the most convenient option. In terms of perception of health, this intervention provided health education in order to help students calibrate their perception of health and choose foods which fit into that framework.

While the intervention addressed two of the main influencing factors in student food consumption, it did not account for all of them. However, of the influencing factors not included, some of them are out of the control of students eating in the cafeteria. Price, flavor, and food quality for example are set by the school, and the foods eaten during childhood are more challenging to address. Despite not including education on all influencing factors, this intervention provided students with the skills to use both in the cafeteria, and when they go on to cook for themselves. By encouraging students to build healthy habits while eating in the cafeteria, they can continue these habits when they have the opportunity to shop and cook for themselves.

This intervention is just one step in the fight in helping college students to develop healthy eating habits. Examination of the research and analysis of this intervention make it clear that while interventions are on the right track, there is more work to be done in making interventions even more effective. An important aspect to address when planning interventions for college students is that healthy eating is not necessarily their priority. Though students on the pre- test indicated that perception of health was an important factor in determining how they eat, the survey, and literature seem to disagree. Students are faced with many competitive food options making their switch to healthy eating a challenge. Therefore, it is essential to ensure that there is plenty of healthy food available in the cafeteria so that after students have received nutrition education, they can go on to make good food choices. With the availability of healthy

foods as a basis, interventions can be both broad and specific. It is essential that interventions provide education on both the diet as a whole, typically in the form of basic nutrition education, but also though more specific approaches. Snacking is one area in which further intervention would be useful. Since snacking is common among all grade levels, providing education in this area is a great way to address a need of the entire student population. Further, the data gathered in the pre- test demonstrated that while on average, snacking habits are not awful, they leave something to be desired. By providing students with dorm friendly snacks, students can develop healthy habits which they will utilize through their college career and life. This also caters to convenience, as students will often snack on whatever is close and convenient for them. If healthy snacks are convenient, then students are more likely to consume them. Overall, this concept of providing interventions which stress the conveniences and low cost of healthy eating are essential in creating an effective intervention to target this age group.

Health Index

Snacking habits provide insight into this mindset and serve as an example to the potentially unhealthy food decisions being made by college students. This is not to say that snacking is always a negative event. When done correctly, snacking helps to maintain blood sugar throughout the day and prevent overeating at meals [24]. However, improper snacking, can be related to weight gain. This is especially concerning for college students as 70% of students were found to have less healthy snacks in their dorm rooms and students who reported consuming more sugar sweetened beverages or certain types of snacks had those snacks in their dorm rooms [17]. With the total number of calories in a given dorm room averaging over 2000, it is clear that snacking is an integral part of college life. Though the study did not look at the

frequency snacks were consumed, it stands to reason that the those who consumed less healthy snacks more frequently were likely to have increased caloric consumption.

These snacking habits are the basis for the creation of the health index which was used to examine the risk for potentially unhealthy eating activities in students. This index system operates under the assumption that there is a connection between increased consumption of less healthy snacks and other undesirable nutrition behaviors. Sugar sweetened beverages, salty snacks, and sweet snacks were used to account for snacking habits. Students rated their frequency of consumption from a scale of one to seven, with one being never and seven being every day. To determine the health score the scores from each section were added together to get an overall score. The index was created by dividing the total possible score into three separate groups: high, medium, and low. These numbers indicated the relative frequency of consumption of foods from the three food groups.This index is based on the assumption that there is a direct correlation between less healthy snack consumption and an increased risk for other unhealthy nutrition behaviors. Therefore students who snacked or consumed sugar sweetened beverages less frequently would be at a lower risk for poor nutrition patterns than those who consumed these foods more frequently. This is because if students are making healthier choices in snacking they are not only consuming fewer calories, grams of fat, sodium, and grams of sugar, but also are likely making other healthy food choices.

Analysis of the health scores found that the majority of students fell into the medium risk group meaning that they neither frequently or infrequently consumed less healthy snacks. This is consistent with the average frequency of consumption of both sweet and salty snacks foods in which on average students consumed both types of snacks between several times per week and

once per day. Sugar sweetened beverages were only consumed between several times per month and once per month. This corroborates the initial survey result which found that students tended to select their beverages with health in mind.

Student health scores were also used to examine the relationship between student health knowledge and decision making. It was found that students in the low risk category scored an average of 66% on the pre- test as compared to the average of 48% in the medium risk group, and 50% in the high risk group. These scores demonstrated that there was some connection between nutrition knowledge and healthy eating behaviors as those who were more knowledgeable about nutrition tended to make healthier choices. This further demonstrated the importance of nutrition education in this age group, as an increase in knowledge will likely result in healthier eating patterns.

Influences

The pre- test given at the intervention found that 82% of students found convenience to be an influence on their eating habit and 23% listed it as the greatest influence on their diet. These results are corroborated by the initial survey in which convenience was tied with taste as being the highest rated on a scale of one to five in terms of importance. Since college students live busy lives, it makes sense that convenience is on the forefront of their minds. This is one of the reasons fast food consumption is so prevalent, as it provides a quick easy way for students to get sustenance [16]. The existence of a meal plan and a cafeteria are the definition of convenient. They provide students with the ability to consume a wide variety of foods throughout the day. This is part of the reason that the intervention focused on healthy eating in the cafeteria. With the knowledge that students are influenced by convenience is logical to assume that those with a

meal plan will eat in the cafeteria and utilize that resource. If healthy foods are available, and skills in choosing healthy foods in the cafeteria are also present, convenience can work in favor of students instead of against them. Instead of getting fast food, students eating in the cafeteria can experience the ultimate convenience of not having to leave campus, and the ability to obtain optimal nutrition. This means that further interventions targeting the way students eat in the cafeteria are essential in helping students to develop healthy eating patterns.

Convenience is directly related to time in terms of influence. In addition to picking foods that are accessible, students choose foods while keeping their busy schedules in mind. While participants in the initial survey responded that planing quick and easy meals is important and does not require a lot of work and even followed through with this by planning their own quick easy snacks, time remains a key barrier in fruit and vegetable consumption. However, by ensuring that future interventions provide further education on the preparation of quick easy meals and snacks, this influence can be addressed and can become less of a barrier

Perception of health was another key influencing factor with 80% stating it played some level of influence and 33% stated that it was the most important influencing factor. By contrast, though perception of health was within the top five most ranked influencing factor in the initial survey, it fell behind taste, convenience, and price. The fact that a convenience sample of people attending a talk to learn more about healthy eating in the cafeteria or a fundamentals of nutrition class, it makes sense that perception of health would be ranked as a more important influencing factor than in other studies. Though one study found health to be a facilitator of fruit and vegetable consumption, it was not the greatest influencing factor [19]. However, even if there is bias in the sample, these results demonstrate that students are concerned about health and have a

desire to make healthy choices. This is encouraging for educators and those planning interventions because a desire to consume foods that are healthy is necessary for individuals to overcome the competitive food construct as described in Yen et. al. study [20]. This study found that cravings were a key factor in determining food consumption, and students tended to crave unhealthy foods as opposed to healthy ones. By further educating students on the benefits of healthy eating, it is likely that health becomes an even greater driving force in what students choose to eat.

Of the participants taking the pre- test, 78% stated that flavor influenced how they chose to eat, and 19% listed it as their greatest influence. These results are somewhat lower than those of the initial survey in which participants rated taste at the same level as convenience in terms of importance in choosing their foods. While this still demonstrates that taste is an important part of the way students eat, it is somewhat surprising that taste was not ranked higher.It is possible that there is a relationship between the decrease in flavor and increase in health as influencing factors as some health minded individuals will choose to consume a food that they do not think tastes in exchange for getting key nutrients. Since the students surveyed tended to be somewhat more health conscious, it is possible that this was the case, and the reason that taste scored lower than would be expected.

Quality played a similar role in influencing food choices as flavor. In both cases, 78% of pre- test respondents named quality as an influence, however only 17% of respondents listed it as their greatest influencing factor. While quality is an important factor in why we choose to eat what we eat, there are two possible reason why it is not highly rated for college students. The first is that students eating in the cafeteria have little choice in the level of quality of food they

consume. In this way convenience wins out over quality in importance. Further, students who are preparing food on their own are typically doing so on their own time and with their limited budget, this means that excepcations for food quality are reduced as price and time are more important factores.

Price also played a role as an influencing factor, however it was not as influential in the intervention group than as projected in the initial survey or literature. While 74% of students stated that price was an influencing factor in their food choices, only 4% listed it as the most important factor in determining what they ate. Comparatively, one study found cost to be one of the key barriers to fruit and vegetable consumption [19]. However something to consider is that since almost all of the students surveyed eat in the cafeteria at least once per day, they do not necessarily consider food costs on a daily basis. Thus, to get a better idea of how price plays a role in influencing all college students, it would be important to survey both students who have a meal plan and those who do not. However, despite this stipulation, it is clear that price might not play as large a role in food choices as previously thought. It is also possible that there is a price window which as long as food falls within what students would consider an acceptable price, it will remain a secondary factor. However, price should still be considered when preparing educational materials for this age as teach skills in budgeting is as important as teaching healthy choices in terms of maintaining good nutrition in the long term. Indeed, interventions should focus more closely on other factors while always keeping price in mind.

The foods eaten growing up, and the foods that friends are eating garnered relatively low to nonexistent responses in terms of perceivable influences. Low levels of response indicate that either students are unaware the extent to which their past and present circumstances shape the

way they eat. This makes creating interventions to affect change regarding these topics incredibly difficult. Peer influence can be affected by providing widespread nutrition education in hopes that affecting change among some individuals will result in change among their friends. This may only be somewhat effective as students do not actively recognize the role their peers have on their eating decisions. It also warrants further research to determine whether there are some cases or food choices in which peers influence eating habits more than others. In terms of interventions surrounding the foods consumed as a child, nothing can be done to go back and change that experience or those preferences. However, by having students take time to think about the food culture they were raised in and how that has affected their food preferences and decisions, they can become more self aware and begin to make decisions that fit with their updated health beliefs.

Health Beliefs and Attitudes

However, it is not fair to say that college students do not consider nutrition. Students surveyed agreed that there was healthy food available to them both on campus and in the cafeteria. This corroborates Brown's research which found that meal plans and on-campus food options allow for a more optional nutritional intake [9]. They also felt that fruits and vegetable were part of a healthy meal and worked to include them into their meals. They also seemed to understand the importance of planning quick healthy meals and had some success putting this belief into practice. They also chose beverages with nutritional value in mind. These survey responses make it clear that while as a whole college students are at high risk for unhealthy behaviors, they are not completely uneducated in terms of nutrition. Further, when these same students were asked about priorities in regards to wellness initiatives that the school institute,

they positively responded to an increase in healthy options in the cafeteria and campus convenience store revealing that nutrition is an important consideration. Further, these responses demonstrate that while students may believe there are some healthy options in the cafeteria and campus stores, there are not enough, and the food they are being provided in the cafeteria, campus restaurant, convenience store, and vending machines must improve in terms of health. This demonstrates a health conscious audience who is open to educational opportunities. This was further emphasized by the response that students would like program resources such as access to an RD or educational events available. The desire to have healthy food options priced at equal or lower value than less healthy options of the same type reflects the roles that price and the competitive food construct play in food choice decision making.

Examination of eating patterns of college students around the nation found a decrease in diet quality particularly in regards to fruit and vegetable consumption [13, 14]. College students who consumed the most fruits and vegetables were those who lived on campus and who had a meal plan demonstrating [22] again the important role the cafeteria plays in providing optional nutrition to students. The initial survey found that students consumed fruits and vegetables between one time per day and five to six times per week, which is consistent with the average determined in other studies [14, 20] though is much lower than the recommended intake of five servings of fruits and vegetables per day. Interestingly, the same students who only eat a serving of fruits and vegetables per week stated that they felt fruits and vegetables were important and should be included in every meal. This demonstrates a disparity between thought and action which must be addressed if diet changes are to be made. This may indicate that more education is necessary to

help students to bridge the gap between a desire to change, and actually making healthier decisions.

Limitations

One of the limitations educationally of this intervention is that the majority of the students who attended lived on campus and eat at the cafeteria at least once per day. This leaves out the off campus students who the literature shows tend to engage in less healthy eating patterns. Therefore, in further interventions, it would be important to address those who are cooking for themselves as well, as everyone can benefit from basic nutrition education.

Another limitation of the study is the lack of a random sample. Both the initial survey and the intervention used a convenience sample. While the majority of students across campus were prompted to take the survey through email, only 150 ended up participating. Some departments, such as the Department of Sociology, Social Work, and Family Sciences, further encouraged students to take the survey, and time was taken at the department dinner for students to take the survey. Further, some students were recruited to take the survey while they were coming in to the cafeteria. Therefore, though we can say that the survey results are somewhat representative of the actions and beliefs of students campus wide, there is possibility for error. The sample for the intervention was even less random than for the initial survey. Half of the participants in the intervention chose to attend because they were interested in the material being presented and the other half attend as part of a Fundamentals of Nutrition class. While the class provided somewhat of a random sample, the majority of students taking the class were freshman nursing students thus decreasing variety. In general it is likely that the students attending the interventions are

healthier, or at least more interested in health than the average student, which is likely why perception of health ranked so high as an influencing factor on the pretest.

Another possible source of error is the fact that the survey did not specify portion size for sweet and salty snacks consumed. While students indicated how many times per day they consumed the foods, they did not indicate how much they consumed. Therefore it is challenging to get the full picture of the snacking patterns and number of calories being consumed. Further, it is possible that students understated the frequency they were snacking. Therefore future research should more specifically address snacking patterns in order to gain a more cohesive picture of the snacks students are consuming.

Further, the health index is created based on the idea that snacking habits are directly related to eating habits as a whole. While this is likely true for most participants, it is unlikely that is is true for everyone, meaning that some participants might be in the wrong risk level group which could make the data regarding the relationship between health knowledge and health behavior less reliable. Further, since the majority of students fell into the medium risk group, less scores were factored into that test average in the two other groups, possibly skewing results. Future interventions which include a health index should ask more in depth questions to assess eating behaviors and examine positive behaviors as well as negative ones to get a better picture of the student's eating habits as a whole.

This study examined the averages on the exams of the group as a whole instead of as individuals, particularly in regards to improvement between pretest and post test. Therefore, though it can be said that participants overall scored significantly better after the intervention, there is no way to tell how many students increased their score between the two trials.

While this study measured intent to change, it does not assess whether students actually planned on going through with the change. Education is useful and is linked to increased healthy choices, however each individual must make the decision to change and then make the changes on their own. In future research, it would be beneficial to follow up with students at a later date and test how well they remembered the information presented and assess whether they had applied the information to their lives. This would also provide an opportunity to further understand why students had or had not applied the information which would further the knowledge as to why college students eat the way they do.

Conclusion

Overall, nutrition interventions are essential for influencing the eating habits of college students. Effective dietary interventions lead to the development of healthy eating patterns which are continued throughout life and passed on to the next generation. Not only does a healthy lifestyle help to prevent disease in the long run, it is also effective in boosting mood and overall feelings of health in the short run and may influence academic performance. Therefore, it is essential to do our best to influence college students at this pivotal time in life so as to help them live better lives far into the future.

"This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2014-67001-21851. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture."

USDA United States Department of Agriculture National Institute of Food and Agriculture

Sources

1. Hales CM, Carroll MD, Fryar CD, Ogden CL. Prevalence of Obesity Among Adults and Youth: United States 2015- 2016. *US Department of Health and Human Services*. October 2017.
2. Adult Obesity Facts. *Center for Disease Control and Prevention.* August 29, 2017. Viewed November 1, 2017.
3. Hensrud DD. Diet and Obesity. *Current Opinion in Gastroenterology.* 2004. 20(11). 119- 124.
4. Anderson DA, Shapiro JR, Lundgren JD. The freshman year of college as a critical period for weight gain: and initial evaluation. *Eating Behaviors*. 2003; 4(4), 363- 367.
5. Brown LB, Dresen RK, Eggett DL. College Students Can Benefit by Participating in a Prepaid Meal Plan. *Journal of the American Dietetic Association.* 2005. 105(3); 445- 448.
6. Dunne A. The Effect of Food on Emotional Wellbeing and Mental Health. *Journal of Nursing and Residential Care.* 2010. 12(4). Pg 165- 168.
7. Kicklighter, J., Jonnalagadda, S. S., McClendon, J., & Hopkins, B. L. (2005). Nutrition Education Module Appeals to Students at Georgia State. *Journal Of Family And Consumer Sciences*, *97*(4), 68-72.
8. Conner, T. S., Brookie, K. L., Carr, A. C., Mainville, & Vissers, M. M. (2017). Let them eat fruit! The effect of fruit and vegetable consumption on psychological well-being in young adults: A randomized controlled trial. *Plos ONE*, *12*(2), 1-19.
9. What we are about. *Get Fruved.* 2017. Accessed December 1, 2017
10. What is MyPlate?. *USDA.* 2017. Accessed December 1, 2017
11. Young L, Nestle M. The Contribution of Expanding Portion Sizes to the US Obesity Epidemic. *American Journal Of Public Health* . February 2002;92(2):246-249.
12. Mathieu J. What you Should Know about Mindful and Intuitive Eating. *Journal of the Academy of Nutrition and Dietetics.* 2009. 109(12). 1982- 1987.
13. Morales DM, Nicklas T, Baranowski T, Zakeri D, Berenson G. Changes in food group consumption patterns from childhood to young adulthood: The Bogalusa Heart Study. *Journal of the American Dietetics Association.* 2004. 104(11). 1684-1691.
14. Nelson MC, Story M, Larson NI, Neumrk- Stinger D, Lytle LA. Emerging Adulthood and College- aged Youth: An Overlooked Age of Weight- related Behavioral Change. *Obesity.* 2008. 16(10); 2205- 2211.
15. Hampel J, Bette NM. Comparison of Dietary Intake and Sources of Fat in Low- and High- Fat Diet of 18- to 24 Olds. *Journal of the American Dietetics Association.* 1995. 95(8); 893- 897.
16. Paerataku S, Ferdinand DP, Champagne CM, Ryan DH, Bray GA. Fast Food Consumption among US adults and Children: Dietary and Nutrient intake profile. *Journal of the American Dietetic Association.* 2003. 103 (10); 1332- 1338.

17. Nelson MC, Story M. Food Environments in University Dorms: 20000 Calories per Dorm Room and Counting. *American Journal of Preventive Medicine.* 2009. 36(6); 523-526.
18. Driskell JA, Kim Y, Goebel KJ. Few Differences Found in the Typical Eating and Physical Activity Habits of Lower- Level and Upper Level University Students. *Journal of the American Dietetic Association.* 2005. 105(5); 798- 801.
19. Yen MC, Ickes SB, Lowenstein LM, Shuval K, Ammerman AS, Farris R, Katz DL. Understanding Barriers and Facilitators of Fruit and Vegetable consumption among a diverse, multi- ethnic population in the USA. *Health Promotion International.* 2008. 23(1); 42- 5,1.
20. Yen MC, Matsumori B, Obenchain J, Viladrich A, Das D, Navader K. Validity of a Competing Food Choice Construct Regarding Fruit and Vegetable Consumption among Urban College Freshmen. *Journal of Nutrition Education Behavior.* 2010. 42 (5); 321-327.
21. Jabs J, Devine CM. Time Scarcity and Food Choices: an Overview. *Appetite.* 2006. 47(2); 196- 204
22. Brunt AR, Rhee YS. Obesity and Lifestyle in U.S. College Students Related to Living Arrangements. *Appetite.* 2008. 5(3); 615- 621.
23. Delimaris I. Adverse Effects Associated with Protein Intake Above the Recommended Dietary Allowance for Adults. *ISRN Nutrition*. July 18, 2013. Viewed February 25, 2018
24. Weisenberger J. What Science Says about Snacking. *Food and Nutrition*. June 29, 2015. Viewed February 25, 2018.

Appendix A

Pre Test

1. How many servings of fruits and vegetables is it recommended that Americans consume every day?
    a. 3
    b. 4
    c. 5
    d. 6
    e. I don't know
2. Which of the following is the proper serving size for vegetables?
    a. 1 cup broccoli
    b. ½ cup baby carrots
    c. ⅓ cup beans
    d. 1 stalk celery
    e. I don't know
3. Which of the following is the proper serving size for fruit?
    a. 1 cup raisins
    b. ½ large banana
    c. 1 orange
    d. ½ cup strawberries
    e. I don't know
4. Which of the following is the proper serving size for grains?
    a. 2 slice bread
    b. ½ cup cooked rice
    c. 1 cup pasta
    d. 10 crackers
5. At least how many servings of whole grains should you consume per day?
    a. 1
    b. 3
    c. 5
    d. 7
    e. I don't know
6. What is the proper serving size of protein?
    a. 1 cup beans
    b. 2 tablespoons peanut butter
    c. 8 oz steak
    d. 2 eggs
    e. I don't know
7. Which of the following is the proper serving size for dairy?
    a. 2 cups milk
    b. 1 cup yogurt
    c. 1 cup shredded cheese
    d. 2 scoops ice cream

e. I don't know

8. How frequently do you consume sugar sweetened beverages (juice, soda)?
    a. Never
    b. Once a month
    c. Several times per month
    d. Once a week
    e. Several times per week
    f. Once per day
    g. Several times per day
9. How frequently do you consume salty snacks (chips, crackers pretzels etc.)?
    a. Never
    b. Once a month
    c. Several times per month
    d. Once a week
    e. Several times per week
    f. Once per day
    g. Several times per day
10. How often do you consume sweet snacks/ desserts (cookies, candies, ice cream etc.)?
    a. Never
    b. Once a month
    c. Several times per month
    d. Once a week
    e. Several times per week
    f. Once per day
    g. Several times per day
11. Which of the following influences your eating? Circle all that apply.
    a. Convenience
    b. Perception of health
    c. Food eaten growing up
    d. Flavor
    e. Quality
    f. What friends are eating
    g. Price
12. Which of the following is the **Greatest** influence on what you eat?
    a. Convenience
    b. Perception of health
    c. Food eaten growing up
    d. Flavor
    e. Quality
    f. What friends are eating
    g. Price

Post Test

1. How many servings of fruits and vegetables is it recommended that Americans consume every day?
    a. 3
    b. 4
    c. 5
    d. 6
    e. I don't know
2. Which of the following is the proper serving size for vegetables?
    a. 1 cup broccoli
    b. ½ cup baby carrots
    c. ⅓ cup beans
    d. 1 stalk celery
    e. I don't know
3. Which of the following is the proper serving size for fruit?
    a. 1 cup raisins
    b. ½ large banana
    c. 1 orange
    d. ½ cup strawberries
    e. I don't know
4. Which of the following is the proper serving size for grains?
    a. 2 slice bread
    b. ½ cup cooked rice
    c. 1 cup pasta
    d. 10 crackers
5. At least how many servings of whole grains should you consume per day?
    a. 1
    b. 3
    c. 5
    d. 7
    e. I don't know
6. What is the proper serving size of protein?
    a. 1 cup beans
    b. 2 tablespoons peanut butter
    c. 8 oz steak
    d. 2 eggs
    e. I don't know
7. Which of the following is the proper serving size for dairy?
    a. 2 cups milk
    b. 1 cup yogurt

    c. 1 cup shredded cheese
    d. 2 scoops ice cream
    e. I don't know
8. Given the information you have been given today, how likely is it that you will change the way you eat in the caf?
    a. Very Unlikely
    b. Unlikely
    c. Somewhat unlikely
    d. Neither likely nor unlikely
    e. Somewhat likely
    f. Likely
    g. Very Likely

Appendix B

Initial Survey Results

the median student in this data set is a 3rd year (average is about 2.8 yr)

16.52% have been a student tutor

20% have been a campus organizer or club officer

17.39% have been a student researcher

4.35% have been a student government member or official

6.09% have been a residential advisor

6.96% have been an athletic team captain

0.87% have been a greek life officer

7.83% have been an orientation leader

8.67% have been a university or college ambassador

0% have been a community service chair

10.43% have been other, whatever that means

40.87% have been none of the above

83.62% are female

15.52% are male

0.87% identifies as other

100% of those identifying as female are not pregnant

11.30% are latino

89.66% are white

the following are on this scale:

1) Strongly agree

2) Agree

3) Neither Agree nor Disagree
4) Disagree
5) Strongly disagree

2.54 average for "There are plenty of exercise classes offered at the rec center on campus."
2.74 average for "There are policies (e.g. no cars on campus) that promote physical activity."
3.23 average for "There are policies on campus (e.g. limits on sizes of sodas, minimum healthy items in vending machines) that promote healthy eating."
3.52 average for "The university's exercise facilities and equipment are in good condition."
2.25 average for "The water in the water fountains on campus taste good."
2.34 average for "The campus living environment allows for quiet and restful sleep."
2.18 average for "There are programs on campus that promote stress management."
2.20 average for "There are healthy foods available on campus."
3.78 average for "There are lots of healthy choices in vending machines on campus."
1.54 average for "There are sports (intramural or club) available to play on campus."
2.30 average for "There are healthy foods available where I usually eat in dining halls on campus."
3.68 average for "There are signs telling me which foods are healthy in vending machines on campus."
1.97 average for "The water/drinking fountains on campus look clean."
1.71 average for "Most buildings on campus have water/drinking fountains."
2.11 average for "There are plenty of opportunities on campus to be moderately or vigorously active."

the next section is the "priorities" section and it is rated on this scale:
1) Not important
2)
3)
4)
5) Very important

4.38 for Have more healthy food options available in campus dining halls.
4.24 for Have more healthy food options available in campus restaurants.
3.77 for Have more healthy food options available in campus vending machines.
4.21 for Have more healthy food options available in campus convenience stores.
3.70 for Have more healthy food options available through catering on campus.
3.96 for Implement a program to use local and sustainable foods in campus dining halls.

4.01 for Have programs and resources available that promote healthier dietary behavior (e.g. smaller beverage glasses, access to Registered Dietitian Nutritionists (RDNs), cooking classes, etc.).
3.09 for All vending machines on campus must have working student ID card readers.
4.09 for Healthy food options must be available for purchase using meal plans 24-hours a day within a ½ mile radius of any point on campus.
4.47 for Healthy food options available on campus must be of equal or lesser price to comparable less healthy food options.
4.23 for All on-campus residents must have 24-hour access to kitchen equipment (e.g. stove, oven).
3.50 for Meal plans must be available for use at farmer's markets.
2.24 for All unhealthy food advertising (posters, student newspapers, buses, etc.) should be banned on the school campus.
3.05 for There must be enough physical education courses available so that 50% of all students can register for physical education credits in any given semester.
4.05 for There must be resources available for students with limited mobility to be physically active.
2.97 for A wellness course must be required for first-year and transfer students.
3.75 for Healthier food options must be clearly labeled in all campus dining halls.
3.53 for Healthier food options must be clearly labeled in all campus vending machines.
3.64 for Healthier food options must be clearly labeled in all campus restaurants.
3.37 for The college/university must offer an incentive program to encourage students' healthy behaviors.
4.45 for Free counseling services and programs to promote stress management must be available throughout the year for all students.
4.79 for Free water must be available in all campus dining venues, recreational and educational facilities, and residence halls.
4.61 for Quality recreational facilities, programs, physical activity classes, and resources must be easily accessible to all students.
4.23 for Quality recreational facilities, resources, and classes must be accessible to all students 24-hours a day.
4.30 for Campus-wide wellness programs must be available for all individuals.
4.27 for The campus must be safely accessible by walking and biking.
3.22 for Biking on campus must be promoted through programs, policies, and resources.
4.10 for A program/policy must be implemented which assists students who may not be able to afford food and provides food assistance options on campus.
3.63 for Use of public or campus provided transportation must be implemented and/or promoted.
3.47 for A program/policy that supports and accommodates breastfeeding for mothers on campus must be implemented.

priorities31 was a write-in response and only a few people participated

the following is rated on this scale:
(1) Very healthy
(2) Somewhat healthy
(3) Neither healthy or unhealthy
(4) Somewhat unhealthy
(5) Very unhealthy

2.16 average for overall diet

the next measure is rated on this scale:
1) Never
2) 1-3 times last month
3) 1-2 times per week
4) 3-4 times per week
5) 5-6 times per week
6) 1 time per day
7) 2 times per day
8) 3 times per day
9) 4 times per day
10) 5 or more times per day
average response is 2.27 for drinking 100% juice in the last month
average response is 5.47 for eating fruit in the last month
average response is 4.49 for eating lettuce salad in the last month
average response is 2.70 for eating french fries/fried potatoes in the last month
average response is 2.58 for eating white potatoes that were not fried in the last month
average response is 2.73 for eating cooked dried beans in the last month
average response is 5.23 for eating other vegetables in the last month (restrictions apply)
average response is 2.59 for eating tomato sauce in the last month
average response is 1.66 for eating vegetable soups in the last month
average response is 4.36 for eating mixtures that contain vegetables in the last month

Workouts:
2.875 average vigorous activity days reported in a week
average of 48 minutes spent doing the vigorous activity on one of those workout days
2.78 average moderate activity days reported in a week
average of 39 minutes spent doing the moderate activity on one of those workout days

6.22 average days/week where at least 10 minutes of walking occurs
average of 39 minutes spent walking on one of those reported walking days

the following are rated on this scale:
Never (1)
Almost never (2)
Sometimes (3)
Fairly often (4)
Very often (5)

"in the last month, how often have you..."
3.81 average for dealt successfully with irritating life hassles?
3.69 average for felt nervous and stressed?
3.10 average for felt that you were unable to control important things in your life?
3.15 average for been upset because of something that happened unexpectedly?
3.76 average for felt that you were effectively coping with important changes that were occurring in your life?
3.91 average for felt confident about your ability to handle your personal problems?
3.56 average for felt that things were going your way?
2.76 average for felt that you could not cope with all of the things that you had to do?
3.71 average for been able to control irritations in your life?
3.62 average for felt that you were on top of things?
2.86 average for been angered because of things that happened that were out of your control?
4.37 average for found yourself thinking about the things that you have to accomplish?
3.78 average for been able to control the way you spend your time?
2.86 average for felt that difficulties were piling up so high that you could not control them?

6.895 average hours of sleep per night

144.41 average weight
134.13 average desired weight

the following are rated on this scale:
1) Strongly agree
2) Agree
3) Neither agree nor disagree
4) Disagree
5) Strongly disagree

2.26 average for My school's administration values promoting health and wellness.
1.81 average for Wellness programs are a good investment because they improve student health.
2.28 average for The students on campus are strongly interested in improving their health and wellness.
2.36 average for I am interested in working with other individuals and groups to help make the "healthy choice the easy choice" on campus.
2.30 average for It seems like my school's administration is interested in making changes to make things better when changes are needed.
2.56 average for I have the ability to work with other individuals and groups to help improve the health promotion resources on campus.
1.83 average for Wellness programs are a good investment because they improve student academic success.
1.83 average for I am willing to dedicate a percentage of my time to working with other individuals and groups to help make the "healthy choice the easy choice" on campus.
2.02 average for If my campus develops more health and wellness programming and resources, students will use it.
2.76 average for I have the power to influence how resources on campus are allocated to help promote health and wellness.

the following are rated on this scale:
1) Not important
2) Slightly Important
3) Important
4) Very important
5) Extremely Important
and are based off of the question: What are the main factors that influence the food you eat on a regular basis?

3.83 average for price
3.70 average for health
3.94 average for taste
3.94 average for convenience
2.98 average for stress
2.84 average for family
3.05 average for effects on physical appearance
1.66 average for advertising
3.35 average for routine
3.52 average for feeling full

2.72 average for peers
2.10 average for significant other
3.44 average for freshness

the following are rated on this scale:
1) Never
2) Seldom
3) Occasionally
4) Often
5) Always
and are based off of this prompt: Indicate how often in the past 3 months you have done the following:

3.19 average for Remind myself that planning quick and simple meals is important.
3.01 average for Tell myself that healthy meals do not require a lot of work.
3.49 average for Remind myself to eat in moderation.
3.35 average for Tell myself to allow room for an occasional treat food or dessert for just plain enjoyment.
3.86 average for Remind myself to think about my beverage choices.
4.01 average for Tell myself that fruits and vegetables should be included in every meal.
3.34 average for Planned quick, easy, and healthy snacks.
4.11 average for Select beverages with my health in mind.
4.00 average for Purposely added vegetables to my meals and snacks.
3.71 average for Was flexible and sensible with my food choices.

the average bmi in the study is 23.31
the average age of participants is 20.83