Exploring Sacramento State Students’ Fruit and Vegetable Intake and Barriers to Consumption

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Abstract

High rates of obesity in the United States are correlated to chronic diseases like cardiovascular disease, diabetes, and cancer; fruits and vegetables play a key role in preventing these illnesses. The purpose of the study was to analyze the fruit and vegetable intake of a sample of Sacramento State students (n=32). A cross-sectional design was used where data collection included a survey and a three-day food record. Demographic variables (income, ethnicity, gender, and BMI) were compared to fruit and vegetable intake. On average, students did not meet fruit and vegetable recommendations regardless of BMI, gender, or ethnicity. Students with higher incomes consumed more fruits and vegetables. Qualitative analysis indicated that time, access, and preparation were the three main obstacles to consumption.

Introduction

Obesity has become an epidemic in the United States that affects the quality of life among many Americans today. According to the National Health and Nutrition Examination Survey conducted by the Center for Disease Control (2012), more than one third of Americans are obese (Ogden et al. 2012). Due to an ample portion of the population being obese, many health concerns have arisen. These complications include Type 2 diabetes, hypertension, adverse lipid concentrations, cardiovascular disease, and high medical costs. The National Health and Nutrition Examination Survey 2009-2010 reported in 1995, that the total cost spent on health issues due to obesity was 78.5 billion dollars. In 2008, costs had risen to 147 billion dollars, and roughly half were being covered by government healthcare programs (Ogden et al. 2012).

Fruits and vegetables are rich in vitamins, minerals, fiber, and low in energy-density; therefore, promoting increased consumption of fruits and vegetables is commonly used as a prevention strategy for obesity and some cancers. Longitudinal and cross-sectional studies of adults have found an inverse relationship between fruit and vegetable consumption and obesity (Ledoux, Hingle and Baranowski 2011). Reiss et al. (2012) postulated that an adequate intake of fruits and vegetables could potentially reduce the chances of developing
oral, stomach, colon, lung, and rectum cancers. Along with cancer reduction, if one half of the U.S. population consumed one more serving of fruits and vegetables per day, an estimated 20,000 cancer cases would be avoided each year (Reiss et al. 2012).

National food guidance programs like the United States Department of Agriculture (USDA) MyPlate and Dietary Guidelines of America have been developed to assist the American population with increasing their fruit and vegetable consumption (United States Department of Agriculture n.d.). For example, the U.S Dietary Guidelines recommend that adults consume at least two and a half cups of vegetables and two cups of fruits each day, and to meet that recommendation (Dietary Guidelines for Americans n.d.), MyPlate suggests making half your plate fruits and vegetables (United States Department of Agriculture n.d.). The purpose of this study was to analyze the fruit and vegetable intake of a sample of Sacramento State students (n=32).

Literature Review

Two of the top-ten leading causes of death in the U.S are cardiovascular disease and cancer. According to the Center for Disease Control, cardiovascular disease killed 597,689 people and cancer killed 574,743 in 2010 (Center for Disease Control 2013). Organizations like the Center for Disease Control (2012), World Health Organization (n.d.), and The Mayo Clinic (2014) have come to a consensus that the risk of heart disease can be reduced with the consumption of fruits and vegetables. Fruits and vegetables are of particular concern because of the high levels of vitamins, minerals, and other nutrients that work together for optimal health. Epidemiological studies have demonstrated that higher concentrations of low-density protein (LDL) increase the risk of developing heart disease (Ledoux, Hingle, and Baranowski 2011; Reiss et al. 2012). Lipoproteins are compounds found in the bloodstream that contain various amounts of fats within a shell of protein and phospholipids. Low-density lipoprotein or LDLs however, are lipoproteins in the blood that contain high amounts of cholesterol (Wardlaw, Hampel and DiSilvestro 2004). A cross-sectional study looking at the association of fruits and vegetables to LDL levels found a correlation between the two. Subjects in the highest fruit and vegetable intake groups had LDL concentrations that were 6% to 7% lower than those in the lowest fruit and vegetable intake groups (Djoussé et al. 2004).

The National Cancer Institute of America conducted a study, examining the connection between diet and cancer (Erdman, Macdonald, and Zeisel 2012). None of the results found that food directly cures cancer; however, they did find a relationship between the two. Consuming foods high in vitamins and minerals before cancer has developed showed positive correlations to the reduction of
cancerous tumors (Erdman, Macdonald, and Zeisel 2012). The earlier in age one adopts a diet rich in nutrients from fruits and vegetables, the more one can aid in prevention of cancer. The CDC also advocates getting a daily adequate amount of fiber, folate, potassium, vitamin A, and vitamin C which may protect individuals from chronic diseases. Only seven percent of the total daily vegetables consumed by adults are dark or leafy green, and 23% are consumed as potatoes (Center for Disease Control and Prevention 2012). According to the CDC’s 2013 State Indicator Report, adults consume fruit 1.1 times a day and vegetables 1.6 times per day (Center for Disease Control and Prevention 2013). The frequency of consumption is not enough to meet daily recommendations. Choose MyPlate emphasizes the need for a variety of colorful fruits and vegetables to be the foundation of every meal (United States Department of Agriculture n.d.). A few studies (Chung and Hoerr 2005; Larson et al. 2008) have investigated young adults’ consumption of fruits and vegetables, as well as correlations between gender and transitioning to adulthood. Chung and Hoerr (2005) conducted a study involving 264 subjects and analyzed the differences between gender and consumption. Women actually consumed more daily fruits and vegetables than men did. Sixty percent of men who met their requirements did so by consuming 70% of their vegetable servings through potato products, and there were no differences in fruit/fruit juices between male and females. A higher intake of fried potato products was associated with higher total fat in the diet, as well as higher fruit juice intake was associated with a higher daily consumption of sugar (fruit juices were classified as sugar sweetened beverages) (Chung and Hoerr 2005).

The transitional period from adolescence to young adulthood has been highlighted as an important stage in terms of fruit and vegetable consumption. The American Journal of Preventative Medicine published a study drawing information from the Eating Among Teens Program (EAT), that examined the determinants of dietary intake and weight status. Larson et al. (2008) tracked 1,495 young adults during the transitional period to young adulthood, where participants were examined at fifteen years of age and again at twenty years of age; variables assessed were socioeconomic status, employment, and education. Results indicated that personal, behavioral, and socioeconomic factors influenced the decline in the intake of fruits and vegetables in that time frame. Factors like breakfast, fast food, and taste preferences were highly related to fruit and vegetable consumption habits (Larson et al. 2008). Chung and Hoerr (2005) also concluded that adolescents should be provided with the opportunity to taste a wide variety of fruits and vegetables through numerous avenues.

Since fruit and vegetables can be expensive, socioeconomic status (SES) becomes particularly important. Three main studies highlight important variables when dealing with fruit and vegetable consumption and barriers low-income families might encounter (Beydoun, Powell, and Wang 2008; Cassady, Jetter, and Culp
Affordability is one of the major obstacles that low-income individuals come across in terms of diet quality. Beydoun, Powell, and Wang (2008) examined the effects that prices of fast foods versus the price of fruits and vegetables have on dietary intake and body mass index (BMI). Individuals (n=7,331) twenty to sixty-five years old were assessed regarding dietary intake, BMI, and family income. Socio-demographic factors were associated with food price and diet quality (fruit and vegetable prices) (Beydoun, Powell, and Wang 2008). Powell, Zhao, and Wang (2009) studied the association of fast food, fruit, and vegetable prices with dietary intakes among US adults. They found that as fast food price index (FFPI) increased, their overall diet quality increased as well. As the prices rose, the more fruits and vegetables were consumed. Diet quality refers to having a balance of protein (15%), carbohydrates (55%), and fat (30%). FFPI was associated with higher fiber intake and lower saturated fat intake (Powell, Zhao, and Wang 2009). Cassady, Culp, and Jetter (2007) surveyed twenty-five supermarkets to investigate fruit and vegetable prices and the relationship to neighborhood income level. The results showed that low income families would have to devote 43% to 70% of their food budget to fruits and vegetables to meet daily recommended amounts (Cassady, Jetter, and Culp 2007). The reality of having to devote that much income to fruits and vegetables creates barriers for many low-income families who do not have the resources to meet these needs. These families consisted of young adults living on their own. Powell, Zhao, and Wang (2009) looked at the connection between fruit and vegetable consumption and food prices. This was a narrowed focus of the previous-mentioned study looking at eighteen to twenty-three year old young adults. The results showed that fruit and vegetable consumption was strongly associated with fruit and vegetable prices (Powell, Zhao, and Wang 2009). These studies highlight the fact that family income and the price of fruits, vegetables, and fast food, dictate overall diet quality.

Reviewing studies on college students revealed that exposure and environment are important factors in their fruit and vegetable intake (American College Health Association 2011; De Bruijn 2010; Yeh et al. 2012). Location and background were a reoccurring theme among these studies. Young adults who have come from low-income homes or who were not exposed to fruits and vegetables regularly are at a disadvantage. Students' residential conditions played large roles in the consumption of fruits and vegetables. Particularly, one study pointed out that living on a college campus; specifically in dormitories, increased the fruit and overall nutrient profile (Brunt and Rhee 2008). However, a similar study emphasized that males who lived on campus were three times more likely to be overweight or obese (Yeh et al. 2012). Students living on campus had higher BMI's compared to those who did not. Yet, living off campus posed barriers of cooking and preparing nutrient-dense foods. One thing they both had in common were competing foods. This is an idea that fast foods, sugary snacks, high
calorie beverages and other empty calorie foods were being chosen over nutrient-dense foods. This can lead to a reduction in fruit and vegetable intake. The American College Health Association—National College Health Assessment surveyed college students (n=105,781) at 129 different institutions across the United States, including Sacramento State and found different nutritional patterns among young college students (American College Health Association 2011). The majority of males and females consumed one to two servings of fruit and vegetables a day which is far below the recommendation of at least five servings per day. However, some females (6.5%) consumed five or more servings, while males (6.9%) reported that they consumed no fruits or vegetables that day (American College Health Association 2011).

This current study will investigate the fruit and vegetable intake of Sacramento State college students. This population is on one of the most diverse campuses across the country. These individuals are at the heart of an agricultural area with varied economic levels. Consumption patterns will be assessed using a three-day food record and analyzed using the dietary analysis software, Nutritionist Pro. The importance of this study is to gain a clearer understanding of fruit and vegetable consumption behaviors of college students in a sample attending Sacramento State. Previous studies have investigated the relationship between adults, young adults, and specifically college aged students and correlations to consumption pattern obstacles to healthy dieting and income levels. The focus of this study is to analyze the fruit and vegetable consumption patterns of a sample of Sacramento State’s students, using more rigorous data collection methods and compare the results to the current USDA Dietary Guidelines recommendations. Variables include age, Body Mass Index (BMI), income level, and average amount of fruit and vegetables consumed over a three-day period. It is hypothesized that age, race, gender, BMI, and income are correlated with fruit and vegetable intake amongst a sample of the Sacramento State students and that consumption levels will not meet recommendations.

**Methods**

**Procedure**

The current study used a cross-sectional design with data collected from October through December 2013. Participants were from Sacramento State, which is a four-year university located in an urban city. Individuals were recruited from the Student Health & Counseling Services, Health and Wellness Department. This department offers one-on-one diet counseling services to enrolled students of Sacramento State. The Student Health & Counseling office attracts individuals who want to improve their dietary behaviors and students who need the services as credit for a class. Before the consultation took place, the students
filled out health record forms. These forms asked participants to self-report their height, weight, age, weekly physical activities, and a three-day diet intake. The software used to analyze the three-day diet record was Nutritionist Pro, which is a program that analyzes an individual's diet and compares the nutrient profile to recommendations based on their lifestyle. The system factors in calorie expenditure of employment (student, construction worker, athlete, etc.), height, weight, age, gender, and weekly exercise routine to determine caloric and nutrient needs. Once completed, the students returned this form to the department and scheduled an appointment for their consultation. These consultations were conducted by student interns working for the Health and Wellness Department for academic units.

After the consultations took place, the students were invited to participate in the study. If the students agreed to participate, they signed a consent form (See Appendix A). After students consented to participate in the study, the interns administered two surveys: one about fruit and vegetable intake (Appendix C) and another about demographic background (Appendix B). The content of the fruit and vegetable survey includes questions about fruit and vegetable intake, shopping, and cooking habits adapted. The demographics page includes questions about race, age, and income. Interns were trained in the Student Health & Counseling Department on how to obtain consent, administer the surveys, and store data so that it remained confidential. Each survey has a specific ID number that correlates with an individual folder. The ID number is used to properly pair the participant’s food record with their survey, while keeping their information confidential. After consent was received, the intern blacked out all personal information on the diet records so personal information was kept confidential. The results were then placed into a sealed envelope and stored in a locked box that could not be opened by others in the health center. Surveys do not have any identifying information, just an ID number. All documents were stored in an individual file folder numbered to match the number on the survey.

Data Analysis

The survey data were entered into Microsoft Excel, and then a descriptive statistical analysis was conducted. All participants were assigned an ID number, and no identifying information was entered. Each variable was number-coded for better organization. After data were entered and cleaned, everything was counted, and percentages were determined. Two methods were used to prevent any errors in the data entry. First, a spot check was administered. This required scanning the recorded data for any outliers or missing sections and pulling the original file. Second, data sorting was done. Each section of the data was double checked to ensure data were recorded properly. Then Nutritionist Pro calculated recommendations (i.e., fruit, vegetable and fiber) based on the national guidelines.
Results

Of fifty surveys completed, thirty-two (64%) contained all the necessary components for data analysis. Data from participants who did not complete the survey or failed to sign the consent form were not used. Demographic characteristics of participants (n=32) in Table 1 show that 37.5% (n=12) were male, and 62.5% (n=20) were female. The racial breakdown was 3% African American, 28% Asian/Pacific Islander, 40% Caucasian, 6% Latin, 13% Hispanic, 6% Mixed, and 3% of other racial background. BMI ranged from 19.4 - 33.7 kg/m². The mean BMI was 23 kg/m². Approximately 69% (n=22), were classified as having a healthy weight, 22% (n=7) as overweight, and 9% (n=3) as obese. The age range was seventeen to forty-four years with the average age being twenty-three. Socioeconomic factors indicated a large portion of the sample had income level at or below 20,000 (78%).

Table 1. Demographics of Participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency (n)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>12</td>
<td>37.5</td>
</tr>
<tr>
<td>Female</td>
<td>20</td>
<td>62.5</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>100</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Asian</td>
<td>9</td>
<td>28</td>
</tr>
<tr>
<td>Mixed</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>White</td>
<td>13</td>
<td>40</td>
</tr>
<tr>
<td>Latino</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Hispanic</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Body Mass Index (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight (%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Healthy weight (%)</td>
<td>22</td>
<td>69</td>
</tr>
<tr>
<td>Overweight (%)</td>
<td>7</td>
<td>22</td>
</tr>
<tr>
<td>Obese (%)</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31,000 +</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>26-30,000</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>21-25,000</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>&lt;20,000</td>
<td>25</td>
<td>78</td>
</tr>
</tbody>
</table>

Note: n = 32
Table 2 shows fruit, vegetable, and fiber intake by gender compared to USDA Dietary Reference Intakes (DRI) recommendations. According to recommendations, men and women should consume two cups of fruit a day and twenty-eight to thirty-five grams of fiber. Men should consume three cups of vegetables while women are recommended to consume two and a half cups. The average fruit and vegetable intake was one cup of each. Men consumed more fruits, vegetables, and fiber than women. However, neither male nor female met the recommended fruit, vegetable, or fiber intake.

Table 2. Fruit, Vegetable, and Fiber intake by Gender Compared to USDA and DRI Recommendations

<table>
<thead>
<tr>
<th></th>
<th>Average intake</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit (cups)</td>
<td>1.0</td>
<td>2</td>
</tr>
<tr>
<td>Male (M)</td>
<td>1.3</td>
<td>2</td>
</tr>
<tr>
<td>Female (F)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Vegetable (cups)</td>
<td>1.12</td>
<td>2.5-3</td>
</tr>
<tr>
<td>Male (M)</td>
<td>1.4</td>
<td>3</td>
</tr>
<tr>
<td>Female (F)</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Fiber (grams)</td>
<td>20</td>
<td>25-38</td>
</tr>
<tr>
<td>Male (M)</td>
<td>24</td>
<td>38</td>
</tr>
<tr>
<td>Female (F)</td>
<td>18</td>
<td>25</td>
</tr>
</tbody>
</table>

Note: n=32

Chart 1 summarizes the differences in fruit and vegetable consumption by BMI. On the left are numbers 1.0-4.0 indicating cups of consumption. The bottom lists...
the BMI range of 19.4 - 33.7. Normal weight participants consumed an average of one cup of vegetables and .71 cups of fruit. Overweight and obese participants consumed an average of 1.3 cups of vegetables and 1.6 cups of fruit. Overall, overweight participants consumed more cups of fruits and vegetables than normal weight participants.

Chart 2 outlines the differences between income and fruit and vegetable intake. The individuals with higher incomes consumed more fruits and vegetables than any other groups. However, those earning $20,000 or less consumed more than individuals earning $26,000- $30,000.

Qualitative data was collected through surveys. The survey had three open-ended questions, including a section for participants to write personal obstacles of fruit and vegetable consumption and aspects that would help them consume more. Answers were reviewed, and three themes were identified. The most prevalent obstacles regarding consumption for these students were lack of time to buy and prepare fruits and vegetables; lack of food preparation skills; and lack of access to good quality and affordable fruits and vegetables.

**Discussion**

This sample was primarily white (n=13), traditional college age, and had more female (n=20) participants than male (n=12). Other ethnicities participating were Asian, mixed, Hispanic, African American, and other (ethnicity not listed). The BMI (19.4-33.7) results were lower than the national average, where six out of ten were classified as overweight or obese due to many participants in this study being of a healthy weight (n=22) and only a small portion (one out of three) being overweight (n=10) (Ogden et al. 2012). The average age of the participants was twenty-three years old with the median income being $20,000 or less per year. These characteristics were due to the population sample being drawn from
services given by the Health and Wellness office at Sacramento State. Students who typically use this service are required to by various classes, which include but are not limited to, nutrition, aerobics, and exercise physiology. This service is also free and available to the general student body that may have nutrition concerns or inquiries. Therefore, it is possible that the participants in this study were at a healthier weight and had a healthier diet than the general Sacramento State student population.

The current study expands on a study done by the National College Health Association Health Assessment (NCHAHA) in 2011. They found BMI range was 18.5 - 40+, with 62.7 % being of healthy weight, 21.4 % being overweight, and 11 % being obese (American College Health Association 2011). The current study conducted on Sacramento State students found BMIs ranging from 19.4- 33.7, with 69% being of healthy weight, 7% being overweight, and 3% being obese. In the current study, 60.8% of males reported consuming one to two cups of fruits and vegetables per day, and 26.9% reported consuming three to four cups per day. To compare, in the NCHAHA study, males averaged 1.3 servings of fruit per day and 1.4 servings of vegetables. In the current study, 57% of females reported consuming one to two servings, and 31.9% reported consuming three to four servings per day. However, in the NCHAHA study, females averaged one serving of fruit and vegetables per day. In the current study, females reported consuming higher amounts of fruit and vegetables compared to the NCHAHA study.

The current study further investigated the relationship between BMI, gender, ethnicity, and income with fruit and vegetable consumption. Overweight participants consumed 1.31 cups of vegetables and 1.89 cups of fruit. Obese participants consumed the lowest amount: the average intake of vegetables was 0.66 cups and 1.17 cups of fruit. Males consumed more fiber (24g) than the fiber (18g) consumed by females. Dietary fiber is also known as bulk or roughage found in plant foods that the body cannot digest or absorb. According to the Mayo Clinic (2012), fiber lowers cholesterol, aids in controlling blood sugar, and helps with weight loss. All participants failed to consume the recommended daily amount of fiber, and the sources of fiber that were consumed were not solely from fruits and vegetables. This is evidenced by the low consumption patterns of fruits and vegetables. It can be assumed that consuming more total calories may have attributed to the higher consumption rates of fruits and vegetables while raising their fiber intake in males. Overall, the sample did not meet fruit and vegetable recommendations due to various barriers.

Reviewing the open-ended survey questions (See Appendix C) on the obstacles for consuming fruits and vegetables, various themes were found. Many participants struggled with time, preparation, and access. Considering the sample was entirely made up of college students, these barriers make sense. The students of this study reported not having the time to grocery shop, cook meals, or even
learn about how to be healthy. They also reported lacking the skills to prepare fruits and vegetables in a preferred manner. That could be prepping meals for a long day/week or being able to cook them in a way that tastes good. Having access to fruits and vegetables was another barrier reported by the participants. Many mentioned the campus lacking availability of fruits and vegetables while others mentioned lacking the knowledge of knowing where to get them.

In the current study, income and gender played a factor in the consumption of fruits and vegetables. Higher income correlated with higher fruit and vegetable intake. Powell, Zhao, and Wang (2009) looked at the connection between fruit and vegetable consumption and food prices and found that there was a strong association between the two. Their study focused on individuals aged eighteen to twenty-three, which is the traditional college age range, as well as a similar age range in the current study (Powell, Zhao, and Wang 2009). Chung and Hoerr (2005) conducted a study analyzing the differences between gender and consumption. Women actually consumed more fruits and vegetables daily than men did. Compared to the current study, men in the Chung and Hoerr (2005) study consumed more fruits and vegetables on average.

Based on quantitative and qualitative data collected, students are not consuming enough fruits and vegetables and barriers preventing this are time, preparation, and access. Currently, Sacramento State’s Student Health and Counseling Services Nutrition Department (n.d.) has many programs to increase the overall nutrition of the students. The department offers free cooking demos, wellness programs, workshops, and counseling. The cooking demos expose students to new recipes, foods, and food preparation skills. The wellness program called Well into Nutrition (WIN) is a healthy lifestyles program that focuses on meal planning, mindful eating, food label knowledge, fitness, and other nutrition related topics. Sacramento State also hosts a bi-weekly farmers market funded by Associate Student Inc. (ASI).

The obstacles of preparation and time could potentially be solved if the student body was informed of the Nutrition Department’s services and took advantage of them. Attending cooking demos would allow students to be taught how to prepare fruits and vegetables and the many ways to make food taste good while being healthy. According to a systematic review of nutrition interventions, it was found that face to face education or counseling lead to higher fruit and vegetable consumption (Pomerleau et al. 2005). Participating in the WIN Program would give students the tools and confidence to make healthy decisions and have a positive relationship with food. Students are allowed to meet with interns or a Registered Dietitian (R.D) for no charge during the academic year. In a systematic review by McCormack et al. (2010), on the effectiveness of farmers’ markets, six out of sixteen studies that were reviewed, reported that participating in farmers’ markets raised fruit and vegetable consumption. Two out of the sixteen found
that either fruit or vegetable consumption would rise (McCormack et al. 2010). The current farmers’ market on campus contains fruit, vegetables, bread, and honey vendors. The Health and Wellness Department is in the process of having free food vouchers to be used at the farmers’ market as an incentive for students. These valuable services are available for the entire student body, but an area for improvement is more effective communication with students informing them of the services available and creating ways to encourage them to use the services, which could ultimately influence fruit and vegetable consumption.

**Limitations**

This study population was comprised of primarily white, college aged females. Limitations of this study were time, origin of participants, and validity of food records. The sample was not randomly selected, thus the results from this study cannot be generalized beyond this sample. This study was conducted on a strict timeline of eight months with only three months for data collection, which prevented expansion of sample size. Many individuals participated because of a class assignment, while only a few participated for personal reasons. There is a possibility that participants did not adequately report their intake over the three-day period.

**Conclusions**

The overall purpose of this study was to assess the diet quality of college students at Sacramento State, focusing on fruit and vegetable consumption. As previously mentioned, one in three Americans are obese, and according to Ogden et al. (2012), 17% of youth age two to nineteen are obese (Ogden et al. 2012). The results of the current study showed higher consumption of fruit and vegetables in the overweight individuals when compared to healthy weight and obese. Males consumed more fruits, vegetables, and fiber on average than female participants. Data showed that the participants with the highest income had a higher consumption of fruit and vegetables. Qualitative data outline several obstacles of consumption: time, preparation skills, preparation in advance, and access to fruits and vegetables. As mentioned in the literature review, college years are an important time for nutritional habits that lay a framework for adulthood. These are the years where intervention should be taken, and if utilized, the resources on campus could be one way to address the high rates of obesity in American adults. In future research, it would be beneficial to expand and randomize the sample so that the conclusions drawn could be applied to the entire campus population.
References


Appendix A

Consent Form
You are being asked to take part in a research study about fruit and vegetable consumption patterns in Sacramento State students. Please read this form carefully and ask any questions you may have before agreeing to take part in the study.

What the study is about: The purpose of the study is to see how many fruit and vegetable servings Sacramento State students are getting daily. We are also looking at if demographic factors (i.e., income, race, GPA, etc…) and BMI are correlated to intake patterns.

What we will ask you to do: If you agree to be in this study, we will use information from your diet analysis as data for the study. Also, we ask that you complete a quick survey regarding your fruit and vegetable intake and other questions regarding demographic information.

Risks and benefits:
I do not anticipate any risks to you participating in this study other than those encountered in day-to-day life.

There are no benefits to you; however, the study could increase awareness of fruit and vegetable consumption patterns of a sample of students at Sacramento State. This awareness could contribute to future research and changes on campus.

Your answers will be confidential. The records from this study will be kept private. In any report made public, we will not include any information that will make it possible to identify you. Research records will be kept in a locked file; only the researchers will have access to the records.

Taking part is voluntary: Taking part in this study is completely voluntary. You may skip any questions that you do not want to answer.

If you have questions: The researcher conducting this study is Brandon Venerable. Please ask any questions you have now. If you have questions later, you may contact Brandon Venerable at b_venerable@yahoo.com or 916-308-1852.

Statement of Consent: I have read the above information, and have received answers to any questions I asked. I consent to take part in the study.

Your Signature ______________________________ Date _______________
Your Name (printed) _____________________________________________
## Appendix B

### Demographic Information

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is your age?</td>
<td></td>
</tr>
<tr>
<td>What is your gender?</td>
<td>______ Male</td>
</tr>
<tr>
<td></td>
<td>______ Female</td>
</tr>
<tr>
<td>How many people live in your household including yourself?</td>
<td>______ People</td>
</tr>
<tr>
<td>What year in school are you ?</td>
<td>______ Year</td>
</tr>
<tr>
<td>Which group do you identify with ?</td>
<td>______ White ( non-Hispanic )</td>
</tr>
<tr>
<td></td>
<td>______ Black / African American</td>
</tr>
<tr>
<td></td>
<td>______ Hispanic</td>
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<td></td>
<td>______ American Indian</td>
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<td>______ Asian or Pacific Islander</td>
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<td>______ Latino</td>
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<tr>
<td></td>
<td>______ Other</td>
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<tr>
<td>What is your estimated income per year?</td>
<td>______ &lt;20,000</td>
</tr>
<tr>
<td></td>
<td>______ 21-25,000</td>
</tr>
<tr>
<td></td>
<td>______ 26-30,000</td>
</tr>
<tr>
<td></td>
<td>______ 31,000 +</td>
</tr>
<tr>
<td>Do you receive any of the following programs?</td>
<td>______ WIC</td>
</tr>
<tr>
<td></td>
<td>______ SSI</td>
</tr>
<tr>
<td></td>
<td>______ Food Stamps</td>
</tr>
<tr>
<td></td>
<td>______ General Assistance ( GI )</td>
</tr>
<tr>
<td></td>
<td>______ Fafsa ( Financial Aid )</td>
</tr>
<tr>
<td>* Check all that apply *</td>
<td></td>
</tr>
<tr>
<td>What is your current G.P.A?</td>
<td></td>
</tr>
<tr>
<td>How many units are you taking this semester?</td>
<td></td>
</tr>
<tr>
<td>How many hours a week do you work?</td>
<td></td>
</tr>
</tbody>
</table>
Fruit and Vegetable Survey Questions

1. Do you eat fruits and vegetables as snacks?
   no
   yes, sometimes
   Yes, often
   Yes, Everyday

2. Did you have citrus fruit or citrus juice in the past week?
   Yes
   No

3. Vegetables: How much do you eat each day?
   None
   1/2 cup
   1 cup
   1 1/2 cup
   2 cups
   2 1/2 cups
   3 cups or more

4. Fruit: How much do you eat a day?
   None
   1/2 cup
   1 cup
   1 1/2 cup
   2 cups
   2 1/2 cups
   3 cups or more

5. Do you eat more than one kind of fruit each day?
   no
   yes, sometimes
   yes, often
   yes always

6. Do you eat more than one kind of vegetable each day?
   no
   yes, sometimes
   yes, often
   yes always
7. How often do you consume fruit juice like orange, apple, grape, fresh, frozen or canned. (not soda)
   - less than one week
   - once a week
   - 2-3 times a week
   - 4-6 times a week
   - once a day
   - 2+ a day

8. How often do you consume vegetable juice, like v8, naked drink, tomato juice
   - less than one week
   - once a week
   - 2-3 times a week
   - 4-6 times a week
   - once a day
   - 2+ a day

9. How often do you consume green salads
   - less than one week
   - once a week
   - 2-3 times a week
   - 4-6 times a week
   - once a day
   - 2+ a day

10. How often do you consume vegetable soup, or stew with vegetables
    - less than one week
    - once a week
    - 2-3 times a week
    - 4-6 times a week
    - once a day
    - 2+ a day

11. Please describe what gets in the way of you eating more fruit and vegetables?

12. Please describe what would help you eat more fruit and vegetables?