

DIETARY BEHAVIORS AMONG COLLEGE STUDENTS

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ABSTRACT

Research states that college students do not meet dietary recommendations, specifically in fruits, vegetables, and dairy products. Failure to meet dietary recommendations results in diets lacking essential nutrients. Additionally, these diets can increase the risk of developing obesity, cardiovascular disease, diabetes, and hypertension.

The objectives of this study were to compare college students' dietary habits in 2013 to 2003 and to compare dietary habits between health and non-health majors in 2013. A Dietary Variety Questionnaire (DVQ) was distributed to collect information on food frequency, gender, Body Mass Index, and living arrangements.

Results indicated significant differences in dairy, protein, and vegetables between years. Results also showed no dietary differences existed between health and non-health majors in 2013. In summary, college students have improved their dietary habits; however, students within health majors do not necessarily practice better dietary habits than students from other disciplines.

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DEDICATION

I would like to dedicate this thesis to my grandfather who is currently suffering from cancer. As a former high school science teacher he instilled in me at a young age the importance of education, science, and most importantly, always striving to succeed. My ultimate success is not just completing my research, but completing my research in honor of my grandfather. I could not have asked for a better role model and mentor.

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CHAPTER 1. INTRODUCTION

Background Knowledge

The college years are filled with many significant changes for students. One of the most prominent changes that college students face is making one's own food choices (Freedman, 2010). Students living both on and off campus are faced with deciding their own eating patterns and habits. This sometimes results in poor quality diets that lack essential nutrients and/or unwanted weight gain (Grace, 1997). Poor dietary habits practiced by college students may carry long term health consequences, such as increased risk for the development of cardiovascular disease, diabetes, hypertension, and/or obesity (Engeland, Bjorge, Tverdal, & Sogaard, 2004).

A college student's diet is typically lacking in fruits, vegetables, and dairy products, and high in fat, sodium and sugar (Anding, Suminski, & Boss, 2001; Brunt & Rhee, 2008). According to the American College Health Association National College Health Assessment, only 6.4% of college students consume the recommended five or more fruits and vegetables per day. In addition, approximately 34.3% of college students are termed overweight or obese (American College Health Association, 2012). Many college students consume a diet that is limited in variety, which increases the likelihood of not meeting dietary recommendations and may play a role in weight gain resulting in obesity (Brunt & Rhee, 2008).

The Dietary Guidelines for Americans 2010 are provided to help guide individuals to consume a well-balanced, healthy diet that is plentiful in all essential nutrients (USDA, 2010). Many studies conducted among college students have concluded that this population does not meet the recommendations set by the Dietary Guidelines (Anding, et al., 2001; Brunt & Rhee, 2008; Davy, Benes, & Driskell, 2006; Hendricks, Herbold & Fung, 2004; Huang, Harris, Lee,

Nazit, Born, & Kaur, 2003; Silliman, Rodas-Fortier, & Neyman, 2004). This increases college students' risk of becoming obese, and developing obesity related diseases such as hypertension, cardiovascular disease, and diabetes later in life.

Many studies have been conducted to assess college student's diet behavior; however, limited research assesses the change in college student's dietary habits between a ten year span. The freshman 15 is a well-known phenomenon that is said to occur among college students entering their freshman year (Hoffman, Policastro, Quick, & Lee, 2006). Perhaps the media attention that has been focused on this issue has caused college students to become more conscious of their dietary habits. On the other hand, more attention focused on incorporating nutrition education in high schools could assist college students with starting their freshman year with the tools and knowledge needed to make healthier nutritional choices (Boucher, Cote, & Gagne, 2012). If college students receive effective nutrition interventions during their freshman year, it will contribute to a healthier dietary lifestyle throughout the college experience (Ha & Caine-Bish, 2009). Any one or a combination of these factors can influence a change in college students' dietary behavior throughout the past 10 years. Nevertheless, any changes that have occurred have not been assessed.

Purpose and Objectives

The purpose of this research is to compare college students' dietary behaviors today (2013) to those of ten years ago (2003). In addition, gender, body mass index (BMI), and living arrangements were examined to see if these factors made any difference in dietary intake. The results of this study may help health and nutrition educators determine how college student's dietary habits have progressed over the past ten years but will also identify areas that need improvement as well as areas of excellence.

An additional purpose of this study is to compare dietary behaviors between health and non-health majors. Within health majors, an additional assessment will be made to examine whether differences exist between gender, BMI, and living arrangements. The conclusion of this study will add to the current literature existing on dietary behaviors among health pre-professionals and encourage further research within this area.

Research Questions

The research questions that will be addressed in this study are as follows:

- (1) What, if any, are the differences in diet reported by students in an introductory nutrition/wellness class between 2003 and 2013?
- (2) What, if any, are the differences in diet reported by students who live on-campus and students who live off-campus between 2003 and 2013?
- (3) What, if any, are the differences in diet reported by students with difference BMI's between 2003 and 2013?
- (4) What, if any, are the differences in diet reported by students in a general wellness education course between health majors and non-health majors?

Definition of Terms

Body mass index (BMI) can be calculated using an individual's height and weight and is a reliable indicator of body fatness in most people (CDC, 2011). An individual's BMI can be calculated by dividing the weight in kilograms by the height squared in meters (kg/m^2) (Garrow, & Webster, 1985). Based on these numbers, individuals can be placed into BMI categories that include: underweight ($>18.5 \text{ kg}/\text{m}^2$), normal weight ($18.5\text{-}24.9 \text{ kg}/\text{m}^2$), overweight ($25.0\text{-}29.9 \text{ kg}/\text{m}^2$), and obese ($>30\text{kg}/\text{m}^2$) (CDC, 2011). This study utilizes self-reported height and weight. It is appropriate to use this type of measure since self-reported height and weight are strongly

correlated to measured height and weight (Burckes-Miller & Black, 1988). The term living arrangements used on the survey is divided into three categories: living on campus, living off campus, and living with parents/guardian. Students who live in the Greek community will be considered on campus since they receive food and beverages that are prepared and available to them. Students who are responsible for their own food will be considered off campus. Students who live with parents do not fit within either one of these categories, giving them the separate category living with parents.

Significance of the Study

The first study compares dietary behavior between students in 2003 and 2013, while also evaluating how dietary habits differ between gender, BMI, and living arrangements. This allows researchers and professionals to understand what differences have occurred over a ten year time span. With the obtained results, researchers now can explore future interventions to help students achieve a healthy dietary lifestyle. By also including gender, BMI, and living arrangements, researchers can now distinguish which factors influence dietary behavior the most.

The second study compares dietary behavior between health and non-health majors. Health majors are further analyzed by gender, BMI, and living arrangements. Since current literature in this area is limited, this study adds to current literature while also probing further research within this area. It is important to know the dietary habits of future health professionals as they will one day be influencing the health of the general population. By including analysis on gender, BMI, and living arrangements, researchers can now distinguish which factors influence health majors' dietary behaviors the most.

Limitations of the Study

The limitations of the study are as follows:

- (1) The study relied on self-reported height and weight rather than measured height and weight. This can result in inaccurate reported height and weight.
- (2) The study relied on self-reported dietary intake. Memory of some foods might have been missed due to lack of remembering them. Students may also only report consuming the listed food items instead of remembering all food items they consumed.
- (3) The study relied on a convenience sample rather than a randomly selected sample. These students may already value nutrition and healthy eating thus influencing their daily dietary habits.
- (4) It is assumed that each listed food frequency represents 1 serving of that listed food item. Students' interpretation of portion sizes may not reflect true portion sizes of that item. This would result in under or over reporting dietary intake.

Thesis Organization

This thesis is organized into chapters as follows: Chapter one consists of the introduction to the study including background knowledge, purpose and objectives, research questions, definition of terms, significance of the study, and limitations of the study. Chapter two contributes a review of the literature containing studies from ten years ago to recent studies conducted on dietary behavior among college students. Chapter three details the methods used to conduct the study, including a description of the population sample, design of survey, data collection, and method of analysis. Chapter four consists of one manuscript that reports the results of the data collected among college students taking a general education nutrition course

regarding dietary behavior. Chapter five consists of one manuscript that displays the results of the data collected among health and non-health majors. Chapter six consists of a summary of the entire thesis including major results and possibilities for further research.

CHAPTER 2. LITERATURE REVIEW

Eating Behaviors Among College Students

It has been well documented that college students do not meet the recommendations for nutrients when using comparative standards such as the DRI's and the recommendations put forth by the Dietary Guidelines for Americans (Anding, Suminski, & Boss, 2001; Brunt & Rhee, 2008; Davy, Benes, & Driskell, 2006; Hendricks, Herbold, & Fung, 2004; Silliman, Rodas-Fortier, & Neyman, 2004; Huang, Harris, Lee, Nazit, Born, & Kaur, 2003). According to previous literature, a typical college student's diet is high in sugar, fat, and sodium, and low in fruits, vegetables and dairy products (Anding, et al., 2001; Brunt & Rhee, 2008; Davy, et al., 2006; Hendricks, et al., 2004; Silliman, et al., 2004; Huang, et al., 2003). The diets of college students become a major concern as adapting poor dietary habits can have long term health consequences that affect quality of life, such as the development of cardiovascular disease, diabetes, hypertension, and obesity (Engeland, Bjorge, Tverdal, & Sogaard, 2004). Found below is a compiled list of manuscripts that study college students' dietary behavior. In addition, studies relating to BMI, living arrangements, and professional major have also been included to help understand how these factors may influence dietary behavior.

An earlier study conducted by Anding and colleagues (2001) assessed college students' dietary habits by utilizing a population of 60 females from three aerobic classes at the University of Houston, Texas. Participants completed a questionnaire that collected information on height and weight, physical activity, and food intake using a 3 day food record. The results of this study were compared with the recommendations found in the Dietary Guidelines for Americans 1995 (USDA, 1995). The study showed that participants failed to meet the minimum recommendations for bread and grains, fruit, vegetables, and dairy products. Of all 60

participants, only 9 participants consumed 5 or more servings of fruits and vegetables. Mean total fat intake per day was 37%, while the recommendation was 30% or less per day (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 1995). Daily sugar intake also exceeded the Dietary Guidelines which limits sugar to 10% of calories (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 1995). Daily sugar intake for the participants averaged 19.7% of total calories, with only 8% of participants consuming less than 10% sugar from total calories. Sodium consumption was also high among the participants within this study. The Dietary Guidelines for Americans 1995 recommended that Americans limit sodium consumption to 2,400 mg (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 1995). The participants within this study consumed an average of 3,204 mg of sodium per day with an average of 57% of the participants consuming over 2,400 mg of sodium per day (Anding, et al., 2001).

Within that same year, Debate, Topping, and Sargent (2001) found similar results. Utilizing a population of 630 U.S. college students, researchers distributed a questionnaire collecting data on nutrition intake, weight status, and dietary practices. BMI was calculated using self-reported height and weight and nutritional intake was assessed using 24 hour recall. Results of the study showed that only 18% of the participants consumed five or more servings of fruits and vegetables per day. Furthermore, only 7% of participants consumed six or more grain products per day and 53% consumed two or more dairy products per day (Debate, et al., 2001).

A year later, Hiza and Gerrior (2002) also found that college students were not meeting dietary recommendations by using the Interactive Healthy Eating Index. The Interactive Healthy Eating Index is a tool that provides an overall picture of an individual's diet variety and

compliance to the Dietary Guidelines for Americans. Utilizing a population of 100 students at a University, researchers found that college students did not meet recommendations for fruits, dairy, and protein (Hiza, & Gerrior, 2002).

In 2012, college students still were not meeting recommendations. The American College Health Association National College Health Assessment is a nationally recognized research survey distributed to college students biannually to collect data regarding alcohol, tobacco, and drug use, sexual health, weight, nutrition, and exercise, mental health, and personal safety and violence. According to the American College Health Association National College Health Assessment, only 6.4% of students consumed five or more servings of fruits and vegetables per day (American College Health Association, 2012). In 2013, this figure had not changed as only 6.3% of students consumed five or more fruits and vegetables servings per day (American College Health Association, 2013).

Chronologically throughout time, researchers have found that college students are not meeting dietary recommendations. This trend continues on even when dietary intake is assessed according to BMI and living arrangements.

Dietary Behavior by BMI

Several studies have been conducted among college students to assess the prevalence of obesity and poor dietary behavior. One particular study conducted by Huang and colleagues (2003) assessed the rate of overweight/obesity, dietary habits, and physical activity in a sample of college students at the University of Kansas. Seven hundred thirty-six students completed the cross-sectional survey. Students self-reported height and weight, dietary habits, and the amount and intensity of physical activity. BMI was calculated using self-reported height and weight, and then placed into BMI percentiles using growth charts. To assess dietary habits the Berkeley

Fruit, Vegetable, and Fiber Screener was used. This is a validated survey that assesses frequency by utilizing 10 items that address consumption of fruit juice, fruits, vegetable juice, salad, potatoes, vegetable soups, cooked vegetables, fiber cereals, beans, and dark bread (Block, Gillespie, Rosenbaum, & Jenson, 2000). To assess physical activity, three questions from the Youth Risk Behavior Survey were used. These questions addressed how often participants participated in physical activity, strength training, and physical education (Huang et al., 2003). Researchers concluded that men were more likely than women to be overweight, but not obese. In reference to dietary habits, over two-thirds of the students consumed less than the recommended five servings of fruits and vegetables per day. In addition, 67.1% of the participants consumed less than 20 g of fiber per day (Huang et al., 2003).

Another study was conducted in 2004 to assess the dietary and exercise patterns among 471 college students from both upper and lower division general education classes. Silliman and colleagues (2004) developed a survey that was designed to assess the dietary behavior, exercise habits, and perceived barrier to following a healthy lifestyle among college students. The survey was divided into three sections that gathered anthropometric and demographic data, current dietary habits, perceived barriers to eating a healthy diet, information about the participants current physical activity habits, perceived body image, and perceived barrier to an active life (Silliman, et al., 2004). Results showed that 31% of the participants were overweight or obese according to self-reported height and weight. More men (40%) than women (20%) were overweight or obese. In regards to dietary behaviors, 63% of the participants reported they were inclined to snack one to two times per day. The snack foods reported most frequently included chips, crackers, nuts, ice cream, cookies, and candy. In addition, 58% of participants said that they ate vegetables less than once per day. Even more of the participants (64%) ate fruit less

than once per day. When students were asked to rate the healthfulness of their diet, 51% of students rated their diet as “poor” or “fair”.

Yet another study conducted by Brunt, Rhee, and Zhong (2008) sought to identify the differences that existed in dietary behavior among college students according to their BMI. Students from a non-major introductory nutrition class were surveyed during the first week of classes. Of the 713 students in class, 557 surveys were usable for the study. Participants completed a diet variety questionnaire (DVQ) which included questions regarding demographics, weight control, smoking, and anthropometrics. The participants were asked to identify the listed foods that they had consumed within the past 3 days, which included one weekend day and two weekdays. This was used to test diet variety and included the food categories dairy, meat, meat alternatives, vegetables, fruits, grains, and fatty sugary snacks (A. Brunt, unpublished data, October 2000). The mean BMI for the participants within this study was 23.9 kg/m². Furthermore, 27% of the participants were overweight and 8% of participants were obese. Student residence appeared to be related to BMI since more students living off-campus were either overweight or obese (41%) compared to those students who lived on-campus or with parents (25%). Few differences were observed among BMI groups when comparing diet. A few food groups showed a significant difference when assessed by BMI category. These included green leafy vegetables, white bread, liquid supplements, and all meats. Obese participants were more likely to indicate that they consumed pork, lamb, veal, and fish. Underweight participants were more likely to indicate that they consumed cheese, green leafy vegetables, and other vegetables. Overall, the participants with lower BMI consumed more vegetables, especially green leafy vegetables.

Dietary Behavior by Living Arrangements

Several researchers have conducted studies that have found differences in dietary habits according to living arrangements (Brevard & Ricketts, 1996; Brown, Dresen, & Eggett, 2005; Brunt & Rhee, 2008; Kolondinsky, Harvey-Berino, Berlin, Johnson, & Reynolds, 2007). An earlier study conducted in 1996 by Brevard and Ricketts sought to identify the difference in nutrient intakes and exercise habits among university students who live on and off campus. The researchers gathered a sample of students enrolled within an introductory nutrition class to participate in the study. Students completed a two-page lifestyle questionnaire in order for researchers to gather information. The questionnaire gathered information on residence, age, gender, weight status, cigarette smoking, oral contraceptive use, and exercise mode, intensity, and frequency. In addition, all subjects completed a 3 day food record. Of the 104 participants who participated in the study, 84 were female (45 of the females lived on-campus, 39 lived off-campus), and 20 of the participants were males (4 of the men lived on-campus, and 16 lived off-campus). Results of this study showed a significant difference in protein intake between students living off and on-campus. A significantly higher percentage of energy from protein was seen in students who lived off-campus, particularly men who lived off-campus (Brevard, & Ricketts, 1996).

A study focusing on dietary habits by living arrangements was completed in 2005 when Brown, Dresen, & Eggett sought to understand the dietary behaviors among college students according to living arrangements. A convenience sample of 503 students from a private university was utilized for this study. Of the 503 participants, 94 students utilized the on-campus meal plan, whereas 409 were responsible for their own food. Almost all (n=93) of those who participated in a meal plan lived within residence halls. Of the 409 students who were

responsible for their own food, 343 students lived in apartments, while 24 students lived with family members. To obtain data, participants were asked to complete a 3 day diet analysis assignment. Researchers reported that students with a meal plan were significantly more likely to meet the Food Guide Pyramid recommendations for fruit ($p < 0.01$) and meat ($p < 0.05$). Males who were participating in the meal plan were 1.8 servings closer to the vegetable recommendation than males who were not utilizing the meal plan option. Female participation in a meal plan, on the other hand, did not have an effect on their vegetable consumption. Students with a meal plan were closer to the recommended fruit serving by one-half to one serving. Milk consumption was not influenced by meal plan participation. Males who were meal plan participants were closer to the meat recommendation than males who were not participating. For females, meat consumption was not influenced by female meal plan participation. In regards to grain consumption, students who did not have a meal plan were closer to the grain recommendation than students with a meal plan ($p < 0.01$) (Brown, et al., 2005).

A study conducted two years later again assessed dietary habits among college students on and off campus. Kolondinsky and colleagues (2007) stated that students who live on-campus are exposed to a food environment that is high in energy, fat, and added sugars. The same environment was also reported to have little nutrition information for student customers. A convenience sample of 200 college students (136 females, 64 males) was used to examine the relationship between nutrition related knowledge and dietary habits using an internet based survey. The students who participated had to be first year students who planned on being on a university meal plan for at least 2 years. Students attended a first meeting to get acquainted with the study, sign informed consent, and to have height and weight measured. An internet-based

questionnaire was used to gather information about baseline perceived dietary intake, nutrition knowledge, and basic demographic information. Self-reported dietary intake for the five major food groups were collected (fruits, vegetables, dairy, grains, and protein). To assess nutrition knowledge, students were asked a string of questions related to the Dietary Guidelines for Americans 2005 (USDA, 2005). Results from the study showed that eighteen percent of the participants were classified as overweight according to calculated BMI. Results of the internet survey showed that only one-third of the participants reported consuming the recommended amounts of the five major food groups. After analyzing the food groups individually, all food groups except for grains had more than one-third of the respondents consuming less than the recommended amounts. Data was also collected that analyzed nutrition knowledge and how it related to dietary habits. Individuals who had met the recommendations for fruit also showed greater knowledge than those who did not meet the recommendation. Within the protein category, those individuals who met or exceeded the recommended amount showed less knowledge than those who had consumed less than the recommended amount. Furthermore, those who reported consuming the recommended amount for dairy showed greater knowledge than those who exceeded the recommendation. Finally, for grains, those individuals who reported consuming the recommended amount of whole grains showed greater knowledge than those who had consumed less than the recommended amount (Kolondinsky, et al., 2007).

A year later, Brunt and Rhee (2008) reported how obesity and dietary behavior were influenced by living arrangements. The results they obtained were different from previous data collected by Brevard and Ricketts; Brown, Dresen, and Eggett; and Kolondinsky and colleagues. Participants were surveyed on demographics, weight control practices, smoking, and anthropometric measures. In addition students were asked to indicate which foods they had

consumed within the last three days (one weekend day and two weekdays). To identify student's living arrangements, three categories were created, living on campus, living off campus, and living with parents/guardians. After data was collected, BMI was calculated using Quetelet's index. BMI was then divided into the four weight categories set by Healthy People 2010; underweight, healthy weight, overweight, and obese. Of the 738 surveys that were administered, 585 were usable for this study. Results of the study showed that 25% of the sample (n=148) were overweight, 9% (n=53) were obese, and 4% (n=25) were underweight. The study showed that there were differences between students dietary behaviors based on where they lived. Participants who lived on-campus or with parents were more likely to consume ice cream/milk desserts, green leafy vegetables, white bread, and sweet baked products such as cookies, cake, bars, and doughnuts. There were no difference between living arrangements and the consumption of grains, meat, all meat alternatives, and snacks/treats.

Dietary Behavior Influenced by Professional Major

There is a dearth of reports regarding dietary habits and health pre-professional majors. In 2006, Bravo, Martin, and Gonzalez, sought to determine whether nutrition knowledge influences food behavior. Researchers used a questionnaire to collect data from 105 students in a nutrition class at San Pablo University. The following majors were involved in this study: Nursing (21), Pharmacy (32), Nutrition and Dietetics (34), and Podiatry (18). Students submitted information on health habits, body image perception, a 3 day food record, and a 20 question nutrition knowledge test. Height and weight were both self-reported and measured. Mean energy intake was calculated to compare results to Recommended Dietary Allowances (RDA). Results from the study showed that no difference in nutrition knowledge between the groups. Furthermore, mean energy intake was similar in all four groups. To take it a step

further, researchers compared the dietary intake they collected to the recommended dietary allowances (RDA). Once assessed, it was found that the population only met approximately 80% of RDA's for fiber, magnesium, folic acid, and vitamin E.

Another study conducted in 2006 looked at the dietary intake of first year, female nursing students compared to first year students from other disciplines. Irazusta, et al. (2006) gathered a group of 104 students to participate in their study. Forty-six students were involved in the nursing program, while 58 students were from other non-health majors. To assess dietary intake, participants kept detailed food diaries that summarized 3 consecutive days. The average sum of calories, protein, carbohydrate, fats, and dietary fiber were compared against the Recommended Dietary Intakes (DRIs). Results of the study showed that there were no dietary differences between nursing students and students from other disciplines. However, when both groups were compared to the general population, the participants in this study showed an excessive amount of fat intake (over the recommended 20-35%) while carbohydrate intake was low (under the recommended 45-65%) (Dietary Guidelines for Americans 2005). Deficiencies in fiber were also found within both groups (Irazusta et al., 2006).

A more recent study, conducted in Mexico, sought to find whether health science students have a healthier lifestyle than the general population (Gutierrez-Salmean et al., 2013). A convenience sample of 5,745 health science students was utilized for this study. Students were asked to answer a questionnaire regarding comprehension of familial antecedents of high blood pressure, diabetes, and obesity, personal smoking and alcohol habits, amount and intensity of personal physical exercise, and other various personal health behaviors. Height and weight were clinically measured as was abdominal waist circumference. BMI was calculated and expressed as kg/m². Results of the study showed that 23% of the participants were

overweight with 10% of these participants being obese. In regards to dietary behavior, a high consumption of animal derived food, breakfast cereals, pastries, white bread, and sweetened beverages were found. In addition, low intakes of fruits and vegetables were reported. Only 20% of the participants reported consuming at least one fruit a day. Approximately the same percentage of participants reported the same for vegetable consumption. When the collected dietary intake was compared to the general population, similar dietary practices were found.

Having nutrition knowledge does not necessary make one's diet better or any healthier than the general population. Individuals who will be providing health and nutrition information in the future practice similar dietary habits as non-health majors. Knowing that the average population does not meet dietary recommendations, this is of concern.

Summary

Overall, it is clear that college students fail to meet recommended dietary guidelines. According to the research, a typical college student's diet is high in sugar, fat, and sodium, and low in fruits, vegetables and dairy products (Anding, et al., 2001; Brunt & Rhee, 2008; Davy, et al., 2006; Huang, et al., 2003, Hendricks, et al., 2004; Silliman, et al., 2004). When BMI has been studied, it has been shown that dietary differences exist between BMI categories. Brunt, et al. (2008) found that obese individuals were more likely to consume a variety of meat, while healthy weight individuals were more likely to consume cheese, green leafy vegetables, and other vegetables. Furthermore, when living arrangements were assessed, it has been shown that dietary differences also exist. Brevard and Ricketts (1996) found that off-campus students consumed a higher percentage of protein, while Brown, et al. (2005) found that on-campus students who participated in a meal plan were closer to the dietary recommendations, especially for vegetables and grains. Finally, when professional major has been studied, it has been shown

that no dietary differences were present between health majors and those in other disciplines (Bravo, et al., 2006; Irazusta et al., 2006; Guitierrez-Salmean et al., 2013).

CHAPTER 3. METHODS AND PROCEDURES

Limited studies exist that assess the dietary behaviors of college students across a timespan. According to the American College Health Association National College Health Assessment (2003), only 6.9% of college students (n= 90,666) were consuming 5 or more fruits and vegetables per day. In the spring of 2012, only 6.4% of college students consumed 5 or more fruits and vegetables per day (American College Health Association, 2012). There has been little change in fruit and vegetable consumption among college students; however, changes within other dietary behaviors are unknown.

Population Sample

This study focuses on college students at North Dakota State University (NDSU) in Fargo, North Dakota. NDSU has a student population of approximately 14,000. Three hundred fifty-two students from three introductory nutrition classes were utilized for this study. Approximately 191 students were involved in the data collection in 2013, while 161 students were involved with previous data collected in 2003 by Dr. Ardith Brunt. Dr. Ardith Brunt has agreed to let me use her data for comparison among the data this researcher collected in the spring of 2013.

Design of Survey

The Dietary Variety Questionnaire (DVQ) is a validated survey that has been used in previous studies (Brunt, & Rhee, 2008). The survey consists of 42 food and beverage items. Each of the items are grouped into food categories that include dairy, protein, vegetables, fruit, grains, fat, snacks/treats, and beverages. The students reported how many times they consumed each of the listed items when assessing the past three days.

The questionnaire also gathered demographic data including gender, living arrangements, grade classification, major, and height and weight. An example of the survey is located in Appendix A.

Data Collection

The protocol for this study was approved by NDSU Institutional Review Board for the Protection of Human Participants in Research (Appendix B). An informed consent letter was attached to the survey for students to read and sign in agreement of participating in the survey. In exchange for the completion of the survey, students were given 4 bonus points within their nutrition class. The survey took the students approximately 10 to 15 minutes. This same protocol was used for both 2003 and 2013 data collection.

Analysis

Data was analyzed using SPSS version 23 (State College, PA) with a significance level set at $p < 0.05$. Descriptive statistics that were reported include means, percentages, and frequencies. A multivariate analysis of variance was used to test whether dietary intake between 2003 and 2013 differed. Several multivariate analyses of variance were then used to test whether gender, BMI, and living arrangements (independent variable) influence dietary intake (dependent variable).

Quetelet's index was used to calculate BMI from self-reported height and weight (Garrow, & Webster, 1985). If the student did not provide this information they were excluded from the analysis. BMI was divided into four categories including underweight ($< 18.5 \text{ kg/m}^2$), normal weight ($18.6\text{-}24.9 \text{ kg/m}^2$), overweight ($25\text{-}29.9 \text{ kg/m}^2$), and obese ($> 30 \text{ kg/m}^2$) (CDC, 2011).

The food items were divided into the 8 food groups to assess dietary intake. The totals for all 8 groups include six for dairy (pizza included), eleven for protein (pizza included), five for vegetables, five for fruits, eight for grains (pizza included), one for fats, three for snacks/treats, and three for beverages (liquid supplements and water were not included).

CHAPTER 4. DIETARY INTAKE AMONG COLLEGE STUDENTS IN 2003 AND 2013

Abstract

College students have failed to meet dietary recommendations throughout the years. The purpose of this study was to compare dietary intake of college students in 2003 and 2013 and to assess whether gender, Body Mass Index, and living arrangements play a role in dietary habits.

Participants of this study were students within an introductory general education nutrition course in 2003, and another group of students who were in the same nutrition course in 2013. Approximately 161 students participated in 2003 and 95 students participated in 2013. Students completed a 3 day, 42 item Dietary Variety Questionnaire. Dairy, protein, vegetables, fruits, grains, fats, snacks, and beverages were the food categories represented in the survey.

Between 2003 and 2013, dairy, protein, and vegetable consumption significantly increased. Over the 10 year span, both males and females showed a significant increase in dairy consumption. Females showed a significant increase in protein consumption and males showed a significant increase in vegetable consumption. Analysis of living arrangements by year showed that both on and off-campus students significantly increased both dairy and protein consumption, while only on-campus students significantly increased mean vegetable consumption. Although most students who participated in this study still consumed dietary intakes less than the recommended amounts, overall mean intake showed improvements in 2013.

Introduction

Throughout the years, college students have failed to meet dietary recommendations. These recommendations put forth by the Dietary Guidelines for Americans, 2010 are as follows;

5 or more servings of fruits and vegetables, 6 servings of grains, 3 servings of dairy, and 5 servings of protein.

The transition from high school to college is filled with many significant changes for students, with one of the most prominent changes of being faced with choosing one's own food (Freedman, 2010). These choices often impact health and result in poor diets that lack essential nutrients and/or result in unwanted weight gain (Grace, 1997; Wengreen & Moncur, 2009). Dietary behaviors practiced by college students are significant because of their impact on the individual's long term health status. Obesity in the college years is the leading predictor of obesity later in adulthood (Engeland, Bjorge, Tverdal, & Sogaard, 2004). Obesity increases the risk of developing diabetes, cardiovascular disease, hypertension, and stroke (James, 2008; Pi-Sunyer, 1993).

In 2001, Anding, Suminsky, and Boss compared recommendations found in the Dietary Guidelines for Americans 1995 to three day food records they collected from 60 college students at a Texas University. Participants did not meet the recommendations for grains (5.7 servings), fruit (0.8 servings), vegetables (2.4 servings), and dairy products (1.3 servings). Hiza and Gerrior (2002) also found that college students did not meet dietary recommendations for fruits, dairy, and protein using the Interactive Healthy Eating Index (IHEI) to assess dietary quality. Silliman, Rodas-Fortier, and Neyman (2004) found similar results. Out of a population of 630 college students, few (18%) consumed five or more servings of fruits and vegetables daily, fewer (7%) consumed six or more servings of grains daily, and slightly more than half (53%) consumed at least two servings of dairy daily.

Kolodinsky, Harvey-Berino, Berlin, Johnson, and Reynolds (2007) showed that college students were not meeting dietary recommendations by comparing their data to that presented in

Dietary Guidelines for Americans 2005. More than one-third of participants reported eating less than the recommended amounts within all food categories. A year later, Brunt and Rhee (2008) surveyed a group of students at a Midwest university. Results showed that 33% of students consumed one or fewer servings of fruits a day. Furthermore, 17% of students reported consuming one or fewer servings of meat.

Freedman (2010) studied dietary behavior among college students and found similar results. Prior to starting college, on-campus students were not meeting dietary recommendations for dairy (37%) and fruits and vegetables (71%). Once an official college student, the number of on-campus students meeting recommendations for both these food groups significantly dropped with dairy at 14% and fruits and vegetables at 46%. The American College Health Association National College Health Assessment (2012) reported that college students still were not meeting dietary recommendations. Only 6.4% of students consumed five or more fruits and vegetables per day. No other food category was reported in this assessment.

College students have failed to meet dietary recommendations throughout the years; however, no study has sought to determine if college students are improving their dietary habits. This study compared the dietary quality of college students between a ten year timespan (2003 and 2013). It was hypothesized that the dietary intake of the 2013 students would be closer to meeting recommendations, or at least would improve within the last 10 years. With knowledge of current intake, researchers may be able to design nutrition interventions that target improving dietary habits among the college population.

Methods

This study took place at a mid-sized land-grant institution located in the Midwest region of the United States. Participants from a non-major introductory nutrition course completed a

Dietary Variety Questionnaire (DVQ) in compensation for receiving 4 bonus points for their nutrition class during the first week of the spring semester. Previous data collected in the spring of 2003 was used to compare to the data collected in 2013. The university's Institutional Review Board for the Protection of Human Participants in Research approved protocol for this study.

The DVQ, a validated questionnaire, consists of 42 food and beverage items (Brunt, Rhee, & Zhong, 2008). Each of the food items were grouped into categories that include dairy, protein, vegetables, fruit, grains, fats, snacks/treats, and beverages. An item was added to each food category for students to indicate if they consumed foods other than those listed. The number of choices for all eight food groups included 6 for dairy (pizza included), 11 for protein (pizza included), 5 for vegetables, 5 for fruits, 8 for grains (pizza included), 1 for fats, 3 for snacks/treats, and 3 for beverages (liquid supplements and water were not included). The students reported how many times they consumed each of the listed items when recalling intake during the past three days. The questionnaire also gathered demographic data including gender, height, weight, and living arrangements. Living arrangements were originally grouped into three categories, on-campus, off-campus, and with parents. But with few participants within the with parents group, these categories were divided into two groups, on-campus and off-campus.

Quetelet's index, a relative measure of weight, was used to calculate Body Mass Index (BMI) from self-reported height and weight (Garrow, & Webster, 1985). Students who did not provide both height and weight were excluded from the BMI analysis. BMI was divided into two categories, $BMI \geq 25 \text{ kg/m}^2$ and $BMI < 25 \text{ kg/m}^2$, since there were few participants who were underweight or obese.

SPSS version 23 (State College, PA) with a significance level of $p \leq 0.05$ was used to analyze the data. Descriptive statistics were calculated utilizing means, percentages, and frequencies. Three separate multivariate analyses of variance were used to determine whether gender, BMI, or living arrangements (independent variable) were associated with dietary behavior (dependent variable). Multivariate analysis of variance was run to determine if eating behavior differed between 2003 and 2013. Each analysis was conducted separately with a total of four multivariate analyses.

Results

The demographic data are presented in Table 1 for both 2003 and 2013. In 2003, a total of 161 students participated in the survey, most being female (65%). Of the 161 participants, only 134 (83%) students provided both height and weight for calculating BMI. Most students were normal weight (67%), while some were overweight (22%), and few were either obese (7%) or underweight (4%). About 41% of students lived on-campus, 55% lived off-campus, whereas only 4% lived with parents.

Table 4.1
Demographic Characteristics of Participates Separated According to Year

	2003 (N= 161)	2013 (N= 95)
Gender		
Male	56	51
Female	105	44
BMI		
Underweight	5	2
Normal	90	58
Overweight	29	24
Obese	10	10
Living Arrangements		
On-Campus	66	40
Off-Campus	89	52
With Parents	6	3

In 2013, 95 completed the DVQ. Of the 95 students, 51 were male (54%), and 44 were female (46%). Most students (99%) reported both height and weight for calculating BMI. Most students were normal weight (62%) while some were overweight (26%) and few were obese (11%) and underweight (2%). Approximately, 42% of students lived on-campus, 55% lived off-campus, and 3% lived with parents.

There were three main significant dietary differences between 2003 and 2013. As shown in Table 2, consumption of dairy ($F=27.43$, $p<0.05$), protein ($F=14.77$, $p<0.05$), and vegetables ($F=5.16$, $p<0.05$) were significantly different between the two years. Dairy had the highest increase in consumption with a mean frequency of 7.19 in 2003 and 10.43 in 2013. Although not significant, several other food groups increased including fruit, grains, and fats. Snacks remained the same with a small decrease in mean frequency of 0.1.

Table 4.2
Dietary Frequency of Consumption of Food Groups for Three Days

Food Groups	2003	2013	F-test	p-value
Dairy	7.19	10.43	27.43	0.00*
Protein	6.75	9.13	14.77	0.00*
Vegetables	6.65	7.93	5.16	0.02*
Fruit	4.52	5.42	3.57	0.06
Grains	7.80	8.32	0.77	0.38
Fats	2.05	2.21	0.40	0.53
Snacks	3.83	3.73	0.06	0.81

* $p<0.05$

There were few significant dietary differences between males and females in 2003. As shown in Table 3, protein ($F=17.85$, $p<0.05$) and vegetables ($F=4.70$, $p<0.05$) were the only food groups to show any difference between gender compared to 2003. Males (8.45) consumed protein more frequently than females (5.85) and females (7.10) consumed vegetables more frequently than males (5.79). Females (2.14) also consumed fat more frequently than males

(1.88), while males (7.77) consumed dairy more frequently than females (6.88). Both males and females consumed similar frequency of fruits and snacks.

Table 4.3
Dietary Frequency of Consumption of Food Groups Over Three Days by Gender

	2003	2013	F	p-value
Dairy				
Male	7.77	11.51	12.32	0.00*
Female	6.88	9.18	9.75	0.00*
F-test	2.11	3.42		
p-value	0.15	0.07		
Protein				
Male	8.45	10.41	3.23	0.08
Female	5.85	7.64	7.24	0.01*
F-test	17.85	5.34		
p-value	0.00*	0.02*		
Vegetables				
Male	5.79	7.61	4.97	0.03*
Female	7.10	8.30	2.25	0.14
F-test	4.70	0.40		
p-value	0.03*	0.53		
Fruits				
Male	4.14	4.98	1.49	0.23
Female	4.72	5.93	3.20	0.08
F-test	0.99	1.38		
p-value	0.32	0.24		
Grains				
Male	8.38	8.67	0.11	0.75
Female	7.50	7.91	0.27	0.61
F-test	1.49	0.59		
p-value	0.22	0.45		
Fats				
Male	1.88	2.16	0.62	0.43
Female	2.14	2.27	0.12	0.73
F-test	0.65	0.09		
p-value	0.43	0.77		
Snacks				
Male	3.75	3.57	0.08	0.78
Female	3.87	3.91	0.01	0.94
F-test	0.05	0.30		
p-value	0.83	0.58		

*p<0.05

There were even fewer significant dietary differences between males and females in 2013. The only significant difference between males and females was seen in protein ($F=5.34$, $p<0.05$), with males (10.41) consuming protein more frequently than females (7.64). Similar to 2003, in 2013 females (8.30) consumed vegetables more frequently than males (7.61), although this difference was not significant. Males (11.51) also consumed dairy more frequently than females (9.18).

When analyzing differences in gender by year, several significant differences did occur. Both males ($F=12.32$, $p<0.01$) and females ($F=9.75$, $p<0.001$) showed a significant increase in mean frequency of dairy. In addition, females showed a significant increase in mean frequency of protein ($F=7.24$, $p=0.01$). Females increased their mean protein consumption from 5.85 times in 2003 to 7.64 times in 2013. Also, males significantly increased their consumption of vegetables ($F=4.97$, $p<0.05$) with a mean frequency of 5.79 times in 2003 to 7.61 times in 2013.

As shown in Table 4, there were no significant dietary differences between living arrangements in 2003, and only one significant dietary difference in 2013, which was snack consumption ($F=5.84$, $p<0.05$).

When analyzing data between years, significant differences were shown within mean dairy consumption for both on and off campus ($F=20.52$, $p<0.05$) ($F=8.90$, $p<0.05$), mean protein consumption for both on and off campus ($F=11.84$, $p<0.05$) ($F=4.20$, $p<0.05$), and mean vegetable consumption for on campus ($F=4.56$, $p<0.05$).

There were no significant differences in dietary variety between BMI groups in 2003 or 2013 as shown in Table 5. However, in 2003, students with a BMI ≥ 25 reported higher frequencies of protein (8.05), vegetables (6.72), fruits (4.90), and grains (8.74).

Table 4.4

Dietary Consumption of Food Groups Over Three Days by Living Arrangements

	2003	2013	F	p-value
Dairy				
On-campus	7.08	11.55	20.52	0.00*
Off-campus	7.26	9.62	8.90	0.00*
F-test	0.10	2.28		
p-value	0.76	0.13		
Protein				
On-campus	6.18	9.68	11.84	0.00*
Off-campus	7.15	8.73	4.20	0.04*
F-test	2.40	0.58		
p-value	0.12	0.45		
Vegetables				
On-campus	6.83	8.60	4.56	0.04*
Off-campus	6.52	7.44	1.45	0.23
F-test	0.28	1.13		
p-value	0.60	0.29		
Fruits				
On-campus	4.14	5.95	1.70	0.20
Off-campus	3.00	5.04	1.81	0.18
F-test	1.16	1.25		
p-value	0.28	0.27		
Grains				
On-campus	4.20	8.08	1.03	0.31
Off-campus	4.45	8.49	0.10	0.75
F-test	2.39	0.17		
p-value	0.12	0.68		
Fats				
On-campus	1.83	2.50	3.00	0.09
Off-campus	2.12	2.00	0.35	0.55
F-test	1.30	1.62		
p-value	0.26	0.21		
Snacks				
On-campus	4.18	4.58	0.36	0.55
Off-campus	3.58	3.11	0.85	0.36
F-test	1.35	5.84		
p-value	0.25	0.02*		

*p<0.05

Interestingly, students with a BMI <25 reported a higher frequency of dairy (7.40), fats (2.16), and snacks (4.01). In 2013, students with a BMI \geq 25 indicated a higher consumption of

dairy (10.83), protein (9.49), vegetables (8.57), and fats (2.60). Similar to 2003, in 2013, students with a BMI <25 reported higher frequencies of fats (1.93) and snacks (3.83).

Table 4.5

Dietary Consumption of Food Groups Over Three Days by Body Mass Index

	2003	2013	F	p-value
Dairy				
BMI <25	7.40	10.10	12.92	0.00*
BMI ≥25	7.03	10.83	4.25	0.02*
F-test	0.29	0.30		
p-value	0.59	0.59		
Protein				
BMI <25	6.63	8.85	7.83	0.01*
BMI ≥25	8.05	9.49	0.81	0.45
F-test	3.55	0.25		
p-value	0.06	0.62		
Vegetables				
BMI <25	6.64	7.22	0.64	0.43
BMI ≥25	6.72	8.57	2.09	0.13
F-test	0.01	1.68		
p-value	0.92	0.20		
Fruits				
BMI <25	4.52	5.31	2.12	0.15
BMI ≥25	4.90	5.31	0.16	0.86
F-test	0.31	0.00		
p-value	0.58	0.99		
Grains				
BMI <25	7.64	8.73	2.09	0.15
BMI ≥25	8.74	7.43	0.43	0.65
F-test	1.66	1.65		
p-value	0.20	0.20		
Fats				
BMI <25	2.16	1.93	0.77	0.38
BMI ≥25	1.72	2.60	2.04	0.14
F-test	1.45	2.82		
p-value	0.23	0.10		
Snacks				
BMI <25	4.01	3.83	0.23	0.63
BMI ≥25	3.18	3.26	0.14	0.87
F-test	1.85	0.91		
p-value	0.18	0.34		

* p<0.05

Few dietary differences exist when analyzing data between years. Mean dairy consumption increased significantly between 2003 to 2013 for both BMI<25 and BMI≥25 (F=12.92, p<0.05, F=4.25, p<0.05). In addition, mean protein consumption increased significantly for BMI<25 between 2003 and 2013 (F=7.88, p<0.05).

Discussion

The purpose of this study was to compare diet variety among college students between a 10 year span (2003 and 2013). Dairy, protein, and vegetables all increased significantly from 2003 to 2013. Research collected over the years reflects the data found in this study. According to many, a typical college student consumes a diet that is low in fruits, vegetables, and high in fat, sodium, and sugar (Anding et al., 2001; Brunt, et al., 2008; Davy, et al., 2006; Hendricks, et al., 2004; Huang, et al., 2003; Kolondinsky, et al., 2007; Silliman, et al., 2004). This low intake of fruits and vegetables not only puts college students at great risk of developing chronic diseases, but also accurately displays the need for greater attention towards this population (Graham, Pelletier, Neumark-Sztainer, Lust, & Laska, 2013).

When assuming an individual consumed at least 1 serving of a specific food item within each listed frequency, students almost meet daily dietary recommendations. Reported dairy frequency reached the recommended 3 servings per day. Reported fruit frequency in 2013 was approximately 1.5 times per day while reported vegetable frequency was approximately 2 times per day. Furthermore, reported protein consumption was 3 servings a day and reported grain frequency was approximately 3 servings per day. Although these reported frequencies still fall below the recommended dietary intakes (with the exception of dairy), they are getting much closer to recommendations than they have in the past.

At first glance it may be hard to pinpoint the possible factors that may play a role in the dietary habits made by college students. The freshman 15 is a well-known phenomenon that is said to occur among college students entering their freshman year (Hoffman, Policastro, Quick, & Lee, 2006). Perhaps because of the media attention placed on this phenomenon, college students have become more health conscious of their dietary behaviors. On the other hand, maybe because more attention is being focused on incorporating nutrition education in high schools, college students start their freshman year with the tools and knowledge needed to make healthier nutritional choices (Boucher, Cote, & Gagne, 2012). Or, perhaps college students are receiving effective nutrition interventions their freshman year that is contributing to a healthier dietary lifestyle throughout the college experience (Ha & Caine-Bish, 2009). Any one or a combination of factors can influence a change in college students' dietary behavior over the past 10 years.

When dietary intake was assessed by gender, a few differences were observed. Both males and females showed a significant increase in dairy consumption. Although both genders showed increases in both protein and vegetable consumption, females showed a significant increase in protein consumption, whereas males showed a significant increase in vegetable consumption. This data contradicts the results found by Silliman et al. (2004) which stated that men were more likely to use higher fat dairy products, eat more lean and high fat meats, and eat fewer vegetables and canned and whole fruits than women. This current study suggests that males are paying more attention to increasing vegetable consumption whereas females are making an effort to increase protein consumption. The gender specific interventions that have taken place may have impacted dietary intake (Horacek, et al., 2002). This is good news since an adequate amount of fruits, vegetables, low fat/fat free dairy, and lean meats are needed to not

only obtain a balanced diet but also to combat chronic disease with disease fighting substances such as antioxidants, folate, fiber, potassium, flavonoids, and phytochemicals (Hyson, 2002).

When living arrangements were assessed, dairy consumption significantly increased for both on-campus and off-campus students as did protein consumption. On the other hand, vegetable consumption significantly increased for only on-campus students. This data is consistent with the data collected by Brunt and Rhee in 2008. Brunt and Rhee found that participants who lived on-campus or with parents were more likely to consume green leafy vegetables. Protein consumption was also affected by living arrangements. Males who were participating within the meal plan were closer to the meat recommendation than the males who were living off-campus and not participating in meal plans. This agrees with past research conducted by Brown and colleagues (2005) who found that males who were participating in a meal plan were 1.8 servings closer to the vegetable recommendation than those students who lived off campus and did not have a meal plan.

There may be several reasons why students living on-campus with a meal plan have significantly increased their consumption of dairy, protein, and vegetables. University dining centers may provide a wider variety of fresh vegetables for students than they did 10 years ago. The accessibility of vegetables may be easier for someone living on-campus than for someone living off-campus (Booth, et al., 2001). The cost of vegetables for someone living off-campus without a meal plan may deter some individuals from consuming them, as is the short shelf life of purchasing these items (Drewnowski, & Darmon, 2005).

When BMI was assessed, several interesting results were obtained, a significant increase in dairy consumption was noted in both BMI less than 25 and BMI of 25 and greater, while a significant increase in protein consumption was noted in BMI less than 25. In addition, in both

2003 and 2013, those with a BMI less than 25 consumed a higher frequency of fats and snacks than those with a BMI of 25 and greater. This is different from the data collected by Brunt, et al. (2008). Although few differences were found, Brunt and colleagues (2008) found that obese and overweight individuals were more likely to report consuming pork and fish, while underweight individuals were more likely to report consuming cheese, leafy greens, and other vegetables. This would be expected results, while the results obtained in this study were unexpected since both dairy and protein contain more calories per serving than vegetables.

As previous authors have suggested, college students' diets are still not meeting dietary recommendations; however, the results presented in this study have shown that college students' dietary intake is improving. Whether it is the nutrition education taking place in high school to prepare students for adult life, the media focusing on healthful eating, or dreading Freshman 15, something is pushing college students to make better, healthier dietary choices. The next step will be to better understand which factors best influence college students dietary habits so further steps can be taken to potentially help college students reach dietary recommendations within all food groups.

References

- American College Health Association. American College Health Association-National College Health Assessment II: Reference Group Executive Summary Spring 2012. Hanover, MD: American College Health Association; 2012.
- Anding, J. D., Suminski, R. R., & Boss, L. (2001). Dietary intake, body mass index, exercise, and alcohol: are college women following the dietary guidelines for Americans? *Journal of American College Health, 49*(4),167-171.

- Booth, S. L., Sallis, J. F., Ritenbaugh, C., Hill, J. O., Birch, I. L., Frank, L. D., et al. (2001). Environmental and societal factors affect food choices and physical activity rationale, influences, and leverage points. *Nutrition Reviews*, 59(Suppl 2), S21-S39.
- Boucher, D., Cote, F., & Gagne, C. (2012). Promoting the consumption of fruits and vegetables in high school students: implementation of the mapping intervention protocol. *Global Health Promotion*, 19, 65-76.
- Brown, L. B., Dresen, R. K., & Eggett, D. (2005). College students can benefit by participating in a prepaid meal plan. *Journal of American Dietetic Association*, 105, 445-448.
- Brunt, A., & Rhee, Y. (2008). Obesity and lifestyle in U.S. college students related to living arrangements. *Appetite*, 51, 615-621.
- Brunt, A., Rhee, Y., & Zhong, L. (2008). Differences in dietary patterns among college students according to body mass index. *Journal of American College Health*, 56(6), 629-634.
- Davy, S. R., Benes, B. A., & Driskell, J. A. (2006). Sex differences in dieting trends, eating habits, and nutrition beliefs of a group of midwestern college students. *Journal of the American Dietetic Association*, 106, 1673-1677.
- Debate, R. D., Topping, M., & Sargent, R. G. (2001). Racial and gender differences in weight status and dietary practices among college students. *Adolescence*, 36, 819-833.
- Drewnowski, A., & Darmon, N. (2005). The economics of obesity: dietary energy density and energy cost. *American Journal of Clinical Nutrition*, 82, 2655-2735.
- Engeland, A., Bjorge, T., Tverdal, A., Sogaard, A. J. (2004). Obesity in adolescence and adulthood and the risk of adult mortality. *Epidemiology*, 15(1), 79-85.
- Freedman, M. R. (2010). Gender, residence and ethnicity affect freshman BMI and dietary habits. *American Journal of Health Behavior*, 34(5), 513-524.

- Garrow, J. S., & Webster, J. (1985). Quetelet's index (W/H^2) as a measure of fatness. *International Journal of Obesity*, 9, 147-153.
- Grace, T. W. (1997). Health problems of college students. *Journal of American College Health*, 45, 243-250.
- Graham, D. J., Pelletier, J. E., Neumark-Sztainer, D., Lust, K., & Laska, M. N. (2013). Perceived social-ecological factors associated with fruit and vegetable purchasing, preparation, and consumption among young adults. *Journal of the Academy of Nutrition and Dietetics*, 113(10), 1366-1374.
- Ha, E. J., & Caine-Bish, N. (2009). Effect of nutrition intervention using a general nutrition course for promoting fruit and vegetable consumption among college students. *Journal of Nutrition Education and Behavior*, 41, 103-109.
- Hendricks, K. M., Herbold, N., & Fung, T. (2004). Diet and other lifestyle behaviors in young college women. *Nutrition Research*, 24, 981-991.
- Hiza, H., & Gerrior, S. (2002). Using the Interactive Healthy Eating Index to assess the quality of college students diets. *Family Economics and Nutrition Review*, 14, 3-11.
- Hoffman, D. J., Policastro, P., Quick, V., & Lee, S. K. (2006). Changes in body weight and fat mass of men and women in the first year of college: a study of the "freshman 15". *Journal of American College Health*, 55, 41-55.
- Horacek, T. M., White, A., Betts, N. M., Hoerr, S., Georgion, C., Nitzke, S., Ma, J., & Greene, G. (2002). Self-efficacy, perceived benefits, and weight satisfaction discriminate among stages of change for fruit and vegetable intakes for young men and women. *Journal of the American Dietetic Association*, 102(10), 1466-1470.

- Huang, T. T.-K., Harris, K. J., Lee, R. E., Nazir, N., Born, W., & Kaur, H. (2003). Assessing overweight, obesity, diet, and physical activity in college students. *Journal of American College Health, 52*(2), 83-86.
- Hyson, D. A. (2011). Fruits, vegetables, and health: a scientific overview. *Produce for Better Health*. <<http://www.pbhfoundation.org>>.
- James, W. P. (2008). WHO recognition of the global obesity epidemic. *International Journal of Obesity, 30*, 120-126.
- Kolodinsky, J., Harvey-Berino, J. R., Berlin, L., Johnson, R. K., & Reynolds, T. W. (2007). Knowledge of current dietary guidelines and food choice by college students: better eaters have higher knowledge of dietary guidance. *Journal of the American Dietetic Association, 107*(8), 1409-1413.
- Pi-Sunyer, F. X. (1993). Medical hazards of obesity. *Annals of Internal Medicine, 119*, 655-660.
- Silliman, K., Rodas-Fortier, K., & Neyman, M. (2004). A survey of dietary and exercise habits and perceived barriers to following a healthy lifestyle in a college population. *Californian Journal of Health Promotion, 2*(2), 10-19.
- Wengreen, H. J., & Moncur, C. (2009). Change in diet, physical activity, and body weight among young- adults during the transition from high school to college. *Nutrition Journal, 8*, 32.

CHAPTER 5. DIETARY INTAKE OF HEALTH AND NON-HEALTH PRE- PROFESSIONAL COLLEGE STUDENTS

Abstract

Current literature states that students involved in health majors do not eat any differently than students in other disciplines. The purpose of this study is to compare dietary intake between health and non-health majors.

This study utilized 191 students from two introductory nutrition courses. Students completed a 3 day 42 item Dietary Variety Questionnaire within the first week of the spring semester. Food groups within the survey were dairy, protein, vegetables, fruits, grains, fats, snacks, and beverages.

There were no significant dietary differences between health and non-health majors. Non-health majors consumed higher intakes of dairy and protein while health majors consumed higher frequencies of grains and snacks; however, these results were not significant.

Even though health majors may possess greater nutrition knowledge than students from other disciplines, health majors still practice the same dietary habits as the general college population.

Introduction

A number of factors influence the development of chronic disease. Some factors are genetically influenced, while other life-style factors can be controlled by the individual themselves. Eating habits are one of those controllable factors. Health professionals, even those just starting undergraduate studies, perceive themselves as individuals who hold the highest knowledge of good health and nutritional habits, but are these individuals actually practicing what they know? It is important for future health professionals to not only obtain knowledge of

a healthy lifestyle, but actually model that lifestyle. These individuals can potentially influence the future health of the general population; therefore, it is important to understand and assess the current health status and lifestyle of students going into health careers. The purpose of this study was to compare dietary habits between pre-professionals within health and non-health majors.

Current studies published that assess pre-professional health habits have concluded that health majors do not eat any differently than those in other disciplines. For example, Irazuta, Gil, Ruiz, Gondra, Jauregi, Irazusta, and Gil (2006) found no significant differences in dietary habits between first-year female nursing students and first-year students in other majors. Moreover, the dietary intake of these individuals, both nursing students and non-nursing students, were not meeting the recommended dietary guidelines for macronutrients (i.e. Carbohydrates, protein, and fat). These students were consuming an excessive amount of fat (40.1% of total calories), while consuming very few complex carbohydrates and dietary fiber (15.7% of total calories). Students were therefore were not meeting the recommendations for dietary fiber and other macronutrients.

Bravo, Martin, and Gonzalez (2006) also found that there were no dietary differences between students of various majors within a health nutrition course. Nursing, Pharmacy, Nutrition and Dietetics, and Podiatry students demonstrated no difference in dietary intake, yet all majors reported low intake in dietary fiber, magnesium, folic acid, and vitamin E when compared to the Dietary Reference Intakes (Dietary Reference Intakes, 2002).

Gutierrez-Salmean and colleagues (2012) found similar results among students within medical-biological fields. After assessing dietary habits, researchers found that these students consumed a high amount of animal derived food, breakfast cereals, pastries, white bread and

sweetened beverages, while consuming a very low amount of fruit and vegetables. Only 20% of the studied population reported consuming at least one fruit and one vegetable a day.

These studies can attest to the theory that possessing nutrition knowledge does not change food behavior or other dietary habits. Contrary to popular belief, health majors do not make better personal dietary choices than the general population.

Methods

This study took place at a mid-size land-grant institution located in the Midwest region of the United States. Students from two introductory nutrition courses completed a Dietary Variety Questionnaire (DVQ) during the first week of spring semester in 2013. The university's Institutional Review Board for the Protection of Human Participants in Research approved protocol for this study.

The DVQ, a validated questionnaire, consists of a list of 42 food and beverage items (Brunt & Rhee, 2008). Each of the items were grouped into food categories that included dairy, protein, vegetables, fruit, grains, fats, snacks, and beverages. An item was added to each food category for students to indicate if they consumed foods other than those listed. The number of choices for all eight food groups included 6 items for dairy (pizza included), 11 items for protein (pizza included), 5 items for vegetables, 5 items for fruits, 8 items for grains (pizza included), 1 item for fats, 3 items for snack foods, and 3 items for beverages (liquid supplements and water were not included). The students reported how many times they consumed each of the listed items when recalling intake during the past three days. The questionnaire also gathered demographic data including gender, ethnicity, age, classification, major, Body Mass Index (BMI), and living arrangements.

Majors were divided into two categories, health majors and non-health majors. The majors included in the health major category included community health, dietetics, exercise science, family and consumer sciences, food science, nursing, pharmacy, physical health education, radiologic science, and wellness. All other majors were considered non-health majors and grouped as such. Health majors were then used to test whether gender, BMI, or living arrangements showed differences in reported dietary intake. Since very few students within the health majors group belonged to the underweight or obese categories, BMI was grouped into two categories, <25 and ≥ 25 . Like BMI, living arrangements were also grouped into two categories because few students identified with the category “with parents” and “living in a sorority”. Living arrangements were grouped into on-campus and off-campus.

SPSS version 23 (State College, PA) was used to analyze the data. Data with a p-value ≤ 0.05 was considered significant. Descriptive statistics were calculated utilizing means, percentages, and frequencies. A multivariate analysis of variance was used to determine whether major influenced dietary intake. Three other multivariate analyses of variance were used to determine whether health major’s gender, BMI, and living arrangements (independent variables) influenced dietary intake (dependent variable).

Results

The demographic data are presented in Table 1. A total of 191 students participated in this study. The majority of students participating in this study were health majors (53%), while the remaining students were non-health majors (47%). Of the health majors, 68 (67%) were female and 33 (33%) were male. When health majors were grouped into BMI categories, 65 (64%) participants had a BMI of less than 25. The remaining participants, 33 (33%), belonged to the BMI category of 25 or above. Three participants did not provide both height and weight

and were therefore not included in the BMI analysis. Health majors were also divided into living arrangement categories. Four participants indicated they either lived with parents or were in a sorority and were not included within the living arrangements analysis. More participants lived off campus (58%) than on campus (42%).

Table 5.1
Demographic Table Including Majors, Gender, BMI, and Living Arrangements

	N
Majors	
Health Major	101
Non-health Major	90
Gender	
Male Health Majors	33
Female Health Majors	68
BMI	
<25 Health Majors	65
≥25 Health Majors	33
Living Arrangements	
On-campus Health Majors	41
Off-campus Health Majors	56

When dietary intake within each food group was assessed by major, no significant differences were observed as shown on Table 2. Non-health majors consumed a higher intakes of dairy and protein. Dairy intake was reported 10.43 times over three days for non-health majors while dairy intake was reported 9.76 times over three days for health majors. Over three days, protein intake for non-health majors was reported 9.19 times, while health majors reported consuming protein 8.52 times. On the other hand, health majors consumed a higher frequency of grains and snacks. Over three days, reported grain intake for health majors was 8.29 times, while reported grain intake for non-health majors was 7.79 times. Reported snack intake for health majors was 3.50 times over three days, while reported snack intake for non-health majors was 3.23 times over 3 days. Both groups consumed similar intakes of fruits and fats.

Table 5.2
Mean Food Group Frequency Over Three Days by Major

Food Group	Non-health Major	Health Major	F-Test	p-value
Dairy	10.43	9.76	0.70	0.42
Protein	9.19	8.52	0.77	0.38
Vegetables	7.99	6.78	2.60	0.11
Fruit	5.47	5.46	0.00	1.00
Grains	7.79	8.29	0.68	0.41
Fats	2.01	2.08	0.07	0.79
Snack food	3.23	3.50	0.40	0.53

When analyzing health majors dietary intake by BMI, there was only one significant difference as shown in Table 3. Those with a BMI ≥ 25 ate a significantly greater amount of vegetables (F=8.43, p=0.01) than those with a BMI < 25 . In addition, although not significant, those with a BMI ≥ 25 consumed a higher frequency within all food groups except grains and snack foods. Those with a BMI < 25 and a BMI ≥ 25 consumed similar mean frequencies of grains, 8.34 and 8.24 respectively.

Table 5.3
Health Major Mean Food Group Frequency Over Three Days by BMI

Food Group	BMI < 25	BMI ≥ 25	F-Test	p-value
Dairy	9.43	10.21	0.53	0.47
Protein	8.02	9.82	3.17	0.08
Vegetables	5.72	8.82	8.43	0.01*
Fruit	4.92	6.36	2.08	0.15
Grains	8.34	8.24	0.01	0.91
Fats	1.97	2.33	0.90	0.35
Snack foods	3.51	3.40	0.03	0.86

*p < 0.05

The last analysis determined dietary differences between living arrangements among health majors. As shown on Table 4, there was only one significant difference between health majors who lived on-campus and health majors who lived off-campus. Health majors who lived on-campus consumed significantly more snack foods over a 3 day period than health majors who lived off-campus (F=14.99, p \leq 0.001). Although not significant, many other differences

were shown between on and off-campus health students. On-campus health students consumed a higher mean frequency of dairy (10.76), vegetables (7.22), fruit (6.10), fats (2.37), and snacks (4.76). Off-campus health students, on the other hand, consumed a higher frequency of protein (8.64) and grains (8.59).

Table 5.4
Health Major Mean Food Group Frequency Over Three Days by Living Arrangements

Food Group	On Campus	Off Campus	F-Test	p-value
Dairy	10.76	9.13	2.51	0.12
Protein	8.37	8.64	0.08	0.78
Vegetables	7.22	6.66	0.27	0.60
Fruit	6.10	4.98	1.33	0.25
Grains	8.05	8.59	0.44	0.51
Fats	2.37	1.84	2.06	0.16
Snacks	4.76	2.61	14.99	0.00*

*p<0.05

Discussion

The purpose of this study was to assess dietary intake of health majors and non-health majors. No significant differences were found between these two groups. Research that has been conducted over the years reflect the results found in this study (Irazuta et. al, 2006; Bravo et al., 2006; Gutierrez-Salmean et. al, 2013). According to the literature, health students who possess the highest knowledge of good health and nutrition, continue to practice the same dietary habits as the general population. Nutritional habits are greatly associated with the attitude towards health, wellness, and illness prevention. Paying attention and understanding this population of health educators is important for the future health of our nation.

When analyzing mean intake per day, students in health majors are actually eating less than students in non-health majors when it comes to healthful choices, but consuming more than non-health majors when it comes to less healthier choices. When looking at vegetable intake, both groups did not meet current dietary recommendations. Non-health majors consumed

approximately 2.5 servings per day of vegetables, while health majors consumed approximately 2.25 servings per day. Although not significantly different, health majors consistently consumed less food variety in general than non-health majors. This was true for all food categories except for grains and snack foods. Although not significant, health majors actually consumed slightly more grains per day (2.8) than non-health majors (2.6) and more snack foods per day (1.17) than non-health majors (1.08).

Several reasons might explain why health pre-professionals are not meeting more of the dietary recommendations than the general public. Preparing for a health careers can be especially intensive and require a large commitment from their students. Perhaps a lack of time for healthy eating and good nutrition is not a priority when compared to education (Gutierrez-Salmean et al., 2013). In addition, many classes required by educational institutions elaborate on how pre-professionals need to educate others on how to maintain a healthy lifestyle, but fail to stress the importance of the pre-professional modeling these behaviors themselves. Studies have shown that when nutrition knowledge is disseminated in an interactive and helpful way, it proves more effective in changing dietary behavior (Kicklighter, Koonce, Rosenbloom, & Commander, 2010).

On the other hand, perhaps the perceptions and associations with food are what drive pre-professional's dietary behavior. Sensory appeal or taste is the number one influence on food choices (Jauregui-Lobera, & Bolanos-Rios, 2011). Sensory appeal to food might influence a lot of health pre-professional's food choices. When busy, individuals more than likely will grab something to eat that is appealing to them and requires little effort. This often times ends up being food that is high in sugar, sodium, and fat. This would perhaps account for the reason why health pre-professionals consumed higher averages of snacks. Finally, health pre-professionals

may consume the diet they do because it is socially acceptable. A study conducted by Chapman and Maclean (1993) looked at the perceived meanings of food. Eating healthy food was associated with family, meals, and being at home. Liking healthy food was considered as odd and not socially acceptable. Perhaps health pre-professionals want to fit in with their non-health major peers so they succumb to the dietary behaviors practiced by their friends.

Not only is it important for health pre-professionals to practice health dietary habits from a health standpoint, but practicing health dietary habits themselves will make them hold more value with their clients and increase their credibility. A study conducted by Bleich, Bennett, Gudzone, & Cooper (2012) found that doctors within a normal BMI range felt more comfortable discussing weight loss and weight loss techniques with their clients than their overweight or obese counterparts. These doctors also felt their counseling was more effective and helpful to their patients.

Many reasons can be discussed to explain why health pre-professionals and non-health pre-professionals have similar dietary behaviors despite health pre-professionals obtaining greater health knowledge. Reasons behind this may need to be investigated further to understand this population better. Perhaps developing a more thorough analysis such as a qualitative research study will strengthen quantitative assessments. As health pre-professionals progress into their future careers it is important that they become role models for the health practices they preach. Not only will they feel more competent within their own field, but they will gain creditability with their clients.

References

Bleich, S. N., Bennet, W. L., Gudzone, K. A., & Cooper, L. A. (2012). Impact of physicians BMI on obesity care and beliefs. *Obesity, 20*(5), 999-1005.

- Bravo, M. A., Martin, U. N., & Gonzalez, G. A. (2006). Evaluation of dietary habits of a population of university students in relation with their nutritional knowledge. *Nutricion Hospitalaria*, 21(4), 466-473.
- Brunt, A., Rhee, Y., Zhong, L. (2008). Differences in dietary patterns among college students according to Body Mass Index. *Journal of American College of Health*, 56, 629-634.
- Chapman, G., & Maclean, J. (1993). "Junk food" and "health food". Meanings of food in adolescent women's culture. *Journal of Nutrition and Education*, 25, 108-113.
- Dietary Reference Intakes. (2002). Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids. Food and Nutrition Board (FNB), Institute of Medicine (IOM). Washington, DC: National Academy Press. Accessed April, 2014.
- Gutierrez-Salmean, G., Meaney, A., Ocharan, M. E., Araugo, J. M., Ramirez-Sanchez, I., Olivares-Corichi, I. M., Garcia-Sanchez, R., Castillo, G., Mendez-Bolaina, E., Meaney, E., & Ceballos, G. (2013). Anthropometric traits, blood pressure, and dietary and physical exercise habits in health sciences students; The Obesity Observatory Project. *Nutricion Hospitalaria*, 28, 194-201.
- Irazusta, A., Gil, S., Ruiz, F., Gondra, J., Jauregi, A., Irazusta, J., & Gil, J. (2006). Exercise, physical fitness, and dietary habits of first-year female nursing students. *Biological Research for Nursing*, 7(3), 175-186.
- Jauregui-Lobera, I., & Bolanos-Rios, P. (2011). What motivates the consumer's food choice? *Nutricion Hospitalaria*, 26(6), 1313-1321.

Kicklighter, J. R., Koonce, V. J., Rosenbloom, C. A., & Commander, N. E. (2010). College freshmen perceptions of effective and ineffective aspects of nutrition education. *Journal of American College Health, 59*(2), 98-104.

CHAPTER 6. GENERAL SUMMARY

It has been shown that college students practice poor dietary habits that fail to meet dietary recommendations. This seems realistic since the transition from high school to college is filled with many significant changes and challenges for students. The poor choices college students often make impact their health and often times result in diets that lack essential nutrients and present unwanted weight gain. Behaviors practiced at a young age have long term health consequences, one of them being the development of obesity. Not only is obesity the leading predictor of obesity later in adulthood, but it also increases the risk of developing diabetes, cardiovascular disease, hypertension, and stroke.

In addition to the general college population, students involved in a health major have also shown to have poor dietary habits. When compared to students in other disciplines, health majors showed no difference in dietary behaviors. It is apparent that possessing health and nutrition related knowledge does not change dietary habits. This is an unsettling fact considering that these health majors will one day be providing health information to the general population. It may be hard for the general population to follow health information provided to them when the provider doesn't practice this health information themselves.

Research had indicated that dietary habits among college students was poor, however limited studies existed to display the difference in dietary habits over a length of time. A study was conducted to understand whether dietary behaviors among college students have changed between the years 2003 and 2013. Results of the study indicated that although still falling short of dietary recommendations, college students have made dietary improvements between the two years sampled. Dairy, protein, and vegetable consumption all significantly increased between the years 2003 and 2013.

Research, although limited, also indicated that dietary habits between health majors and majors of other disciplines did not differ. A study was conducted to confirm these results and add to the current literature. Results of the study indicated that there were in fact no dietary differences between health majors and majors of other disciplines.

The results of the first study indicated a promising path for future college students. It is shown that although not yet meeting dietary recommendations, college students are eating better than they were ten years ago. With continued education and practice, college students are sure to better their current dietary habits and reach dietary recommendations. The results of the second study showed the need for following recommended nutrition practices within the core educational main for health majors. Not only is it important for individuals to know and understand this information, but have the ability to practice it in their own lives.

REFERENCES

- American College Health Association. (2012). American College Health Association-National College Health Assessment II: Reference Group Executive Summary Spring 2012. Hanover, MD: American College Health Association.
- American College Health Association. (2013). American College Health Association-National College Health Assessment II: Reference Group Executive Summary Spring 2013. Hanover, MD: American College Health Association.
- Anding, J. D., Suminski, R. R., & Boss, L. (2001). Dietary intake, body mass index, exercise, and alcohol: are college women following the Dietary Guidelines for Americans. *Journal of American College Health, 49*, 167-171.
- Bleich, S. N., Bennet, W. L., Gudzone, K. A., & Cooper, L. A. (2012). Impact of physicians BMI on obesity care and beliefs. *Obesity, 20*(5), 999-1005.
- Block, G., Gillespie, C., Rosenbaum, E. H., & Jenson, C. (2000). A rapid food screener to assess fat and fruit and vegetable intake. *American Journal of Preventative Medicine, 18*, 284-288.
- Booth, S. L., Sallis, J. F., Ritenbaugh, C., Hill, J. O., Birch, I. L., Frank, L. D., et al. (2001). Environmental and societal factors affect food choice and physical activity: rationale, influences, and leverage points. *Nutrition Reviews, 59*(Suppl 2). S21-S39.
- Boucher, D., Cote, F., & Gagne, C. (2012). Promoting the consumption of fruits and vegetables in high school students: implementation of the mapping intervention protocol. *Global Health Promotion, 19*, 65-76.

- Bravo, M. A., Martin, U. N., & Gonzalez, G. A. (2006). Evaluation of dietary habits of a population of university students in relation with their nutritional knowledge. *Nutricion Hospitalaria*, 21(4), 466-473.
- Brevard, P. B., & Ricketts, C. D. (1996). Residence of college students affects dietary intake, physical activity, and serum lipid levels. *Journal of the American Dietetic Association*, 96, 35-38.
- Brown, L. B., Dresen, R. K., & Eggett, D. (2005). College students can benefit by participating in a prepaid meal plan. *Journal of American Dietetic Association*, 105, 445-448.
- Brunt, A., & Rhee, Y. (2008). Obesity and lifestyle in U.S. college students related to living arrangements. *Appetite*, 51, 615-621.
- Brunt, A., & Rhee, Y., Zhong, L. (2008). Differences in dietary patterns among college students according to body mass index. *Journal of American College of Health*, 56, 629-634.
- Burckes-Miller, M. E., & Black, D. R. (1988). Male and female college athletes: prevalence of anorexia nervosa and bulimia nervosa. *Journal of Athletic Training*, 22, 137-140.
- CDC. (2011). BMI – Body Mass Index: About BMI for Adults. Retrieved Jan 10, 2013, from http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html
- Chapman, G., & Maclean, J. (1993). “Junk food” and “health food”. Meanings of food in adolescent women’s culture. *Journal of Nutrition and Education*, 25, 108-113.
- Davy, S. R., Benes, B. A., & Driskell, J. A. (2006). Sex differences in dieting trends, eating habits, and nutrition beliefs of a group of Midwestern college students. *Journal of the American Dietetic Association*, 106, 1673-1677.
- Debate, R. D., Topping, M., & Sargent, R. G. (2001). Racial and gender differences in weight status and dietary practices among college students. *Adolescence*, 36, 819-833.

- Dietary Reference Intakes. (2002). Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids. Food and Nutrition Board (FNB), Institute of Medicine (IOM). Washington, DC: National Academy Press. Accessed April, 2014.
- Drewnowski, A., & Darmon, N. (2005). The economics of obesity: dietary energy density and energy cost. *American Journal of Clinical Nutrition*, 82, 2655-2735.
- Engeland, A., Bjorge, T., Tverdal, A., & Sogaard, A. J. (2004). Obesity in adolescence and adulthood and the risk of adult mortality. *Epidemiology*, 15(1), 79-85.
- Freedman, M. R. (2010). Gender, residence and ethnicity affect freshman BMI and dietary habits. *American Journal of Health Behavior*, 34(5), 513-524.
- Garrow, J. S., & Webster, J. (1985). Quetelet's index (W/H²) as a measure of fatness. *International Journal of Obesity*, 9, 147-153.
- Grace, T. W. (1997). Health problems of college students. *Journal of American College Health*, 45, 243-250.
- Graham, D. J., Pelletier, J. E., Neumark-Sztainer, D., Lust, K., & Laska, M. N. (2013). Perceived social-ecological factors associated with fruit and vegetable purchasing, preparation, and consumption among young adults. *Journal of the Academy of Nutrition and Dietetics*, 113(10), 1366-1374.
- Gutierrez-Salmean, G., Meaney, A., Ocharan, M. E., Araugo, J. M., Ramirez-Sanchez, I., Olivares-Corichi, I. M., Garcia-Sanchez, R., Castillo, G., Mendez-Bolaina, E., Meaney, E., & Ceballos, G. (2013). Anthropometric traits, blood pressure, and dietary and physical exercise habits in health sciences students; The Obesity Observatory Project. *Nutricion Hospitalaria*, 28, 194-201.

- Ha, E. J., & Caine-Bish, N. Effect of nutrition interventions using a general nutrition course for promoting fruit and vegetable consumption among college students. *Journal of Nutrition Education and Behavior*, 41, 103-109.
- Hendricks, K. M., Herbold, N., & Fung, T. (2004). Diet and other lifestyle behaviors in young college women. *Nutrition Research*, 24, 981-991.
- Hiza, H., & Gerrior, S. (2002). Using the Interactive Healthy Eating Index to assess the quality of college students diets. *Family Economics and Nutrition Review*, 14, 3-11.
- Hoffman, D. J., Policastro, P., Quick, V., & Lee, S. K. (2006). Changes in body weight and fat mass of men and women in the first year of college: a study of the “freshman 15”. *Journal of American College Health*, 55, 41-55.
- Horacek, T. M., White, A., Betts, N. M., Hoerr, S., Georgion, C., Nitzke, S., Ma, J., & Greene, G. (2002). Self-efficacy perceived benefits, and weight satisfaction discriminate among stages of change for fruit and vegetable intakes for young men and women. *Journal of the American Dietetic Association*, 102(10), 1466-1470.
- Huang, T. T-K., Harris, K. J., Lee, R. E., Nazir, N., Born, W., & Kaur, H. (2003). Assessing overweight, obesity, diet, and physical activity in college students. *Journal of American College Health*, 52, 83-86.
- Hyson, D. A. (2011). Fruits, vegetables, and health: a scientific overview. *Produce for Better Health*. <<http://www.pbhfoundation.org>>.
- Irazusta, A., Gil, S., Ruiz, F., Gondra, J., Jauregi, A., Irazusta, J., & Gil, J. (2006). Exercise, physical fitness, and dietary habits of first-year female nursing students. *Biological Research for Nursing*, 7(3), 175-186.

- James, W. P. (2008). WHO recognition of the global obesity epidemic. *International Journal of Obesity*, 30, 120-126.
- Jauregui-Lobera, I., & Bolanos-Rios, P. (2011). What motivates the consumer's food choice? *Nutricion Hospitalaria*, 26(6), 1313-1321.
- Kicklighter, J. R., Koonce, V. J., Rosenbloom, C. A., & Commander, N. E. (2010). College freshmen perceptions of effective and ineffective aspects of nutrition education. *Journal of American College Health*, 59(2), 98-104.
- Kolodinsky, J., Harvey-Berino, J. R., Berlin, L., Johnson, R. K., & Reynolds, T. W. (2007). Knowledge of current dietary guidelines and food choice by college students: better eaters have higher knowledge of dietary guidance. *Journal of the American Dietetic Association*, 107, 1409-1413.
- Pi-Sunyer, F. X. (1993). Medical hazards of obesity. *Annals of Internal Medicine*, 119, 655-660.
- Silliman, K., Rodas-Fortier, K., & Neyman, M. (2004). A survey of dietary and exercise habits and perceived barrier to following a healthy lifestyle in a college population. *Californian Journal of Health Promotion*, 2, 10-19.
- U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2010. 7th Edition, Washington, DC: U.S. Government Printing Office, December, 2010. Accessed April, 2014.
- U.S. Department of Agriculture and U.S. Department of Health and Human Services. (1995). Dietary Guidelines for Americans, 1995. 4th Edition, Washington, DC: U.S. Government Printing Office. Accessed April, 2014.

U.S. Department of Agriculture and U.S. Department of Health and Human Services. (2005).

Dietary Guidelines for American, 2005. 6th Edition, Washington, DC: U.S. Government Printing Office, Accessed April 1, 2014.

U.S. Department of Agriculture and U.S. Department of Health and Human Services. (2010).

Dietary Guidelines for Americans, 2010. 7th Edition, Washington, DC: U.S. Government Printing Office. Accessed April 1, 2014.

Wengreen, H. J., & Moncur, C. (2009). Change in diet, physical activity, and body weight among young- adults during the transition from high school to college. *Nutrition Journal*, 8, 32.

APPENDIX A. DIETARY VARIETY QUESTIONNAIRE

DIRECTIONS: Think about what you ate over the last THREE days. Write in the number of times you ate each of these foods.

LIST OF FOODS

13. milk	27. nuts and seeds	41. hot cereal
14. yogurt	28. pizza	42. cold cereal
15. cheese	29. green leafy vegetables	43. pasta
16. ice cream/milk-based desserts	30. orange and yellow veggies	44. rice
17. other dairy	31. tomatoes/tomato products	45. other grains
18. eggs	32. potatoes & other root crops	46. margarine, butter, & oils
19. poultry (i.e., chicken)	33. other vegetables	47. sweet baked goods / desserts
20. beef	34. citrus fruits	48. salty snacks
21. pork	35. berries	49. candy
22. lamb, veal, game	36. melons	50. diet soft drinks
23. fish	37. other fruit	51. regular soft drinks
24. liver/organ meats	38. fruit juice	52. alcoholic beverages
25. processed meats	39. white bread	53. liquid supplements (e.g., Slim Fast)
26. beans & legumes	40. whole-wheat bread	54. water

DEMOGRAPHIC CHARACTERISTICS:

- | | |
|---|---|
| <p>1. Age: _____</p> <p>2. Sex: <input type="checkbox"/> Male
<input type="checkbox"/> Female</p> <p>3. Race: <input type="checkbox"/> White
<input type="checkbox"/> Black
<input type="checkbox"/> Native American
<input type="checkbox"/> Other: _____</p> <p>4. Smoke: <input type="checkbox"/> Yes
<input type="checkbox"/> No</p> <p>5. Living: <input type="checkbox"/> On-Campus with Meal Plan
<input type="checkbox"/> On-Campus without Meal Plan
<input type="checkbox"/> Off-Campus with Meal Plan
<input type="checkbox"/> Off-Campus without Meal Plan
<input type="checkbox"/> Sorority or Fraternity housing
<input type="checkbox"/> At Home with Parent(s)/Guardian</p> <p>6. Ever had a nutrition class <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>7. Currently Dieting? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p style="padding-left: 20px;">a. Which type of diet are you following? (i.e., Vegetarian, Weight Watchers) _____</p> | <p>8. Classification: <input type="checkbox"/> Freshman
<input type="checkbox"/> Sophomore
<input type="checkbox"/> Junior
<input type="checkbox"/> Senior
<input type="checkbox"/> Graduate</p> <p>9. Major _____</p> <p>10. Height _____ (ft/in)</p> <p>11. Weight _____ (lbs)</p> <p>12. Do you take supplements? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p style="padding-left: 20px;">a. If yes, how frequently?
<input type="checkbox"/> 1-2 x/mo
<input type="checkbox"/> 1-2 x/wk
<input type="checkbox"/> almost everyday
<input type="checkbox"/> everyday</p> <p style="padding-left: 20px;">b. Kinds: _____</p> |
|---|---|

APPENDIX B. INSTITUTIONAL REVIEW BOARD APPROVAL

NDSU

NORTH DAKOTA STATE UNIVERSITY

Institutional Review Board

*Office of the Vice President for Research, Creative Activities and Technology Transfer
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Federalwide Assurance #FWA00002439

November 5, 2012

Ardith Brunt
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EML 351F

IRB Approval of Protocol #HE13082, "Differences in dietary habits among college students"
Co-investigator(s) and research team: Desirae Kraska

Approval period: 11/5/2012 to 11/4/2013

Continuing Review Report Due: 10/1/2013

Research site(s): NDSU Funding agency: n/a

Review Type: Expedited category # 7

IRB approval is based on original submission, with revised: protocol (received 11/1/2012).

Additional approval is required:

- prior to implementation of any proposed changes to the protocol (*Protocol Amendment Request Form*).
- for continuation of the project beyond the approval period (*Continuing Review/Completion Report Form*). A reminder is typically sent two months prior to the expiration date; timely submission of the report is your responsibility. To avoid a lapse in approval, suspension of recruitment, and/or data collection, a report must be received, and the protocol reviewed and approved prior to the expiration date.

A report is required for:

- any research-related injuries, adverse events, or other unanticipated problems involving risks to participants or others within 72 hours of known occurrence (*Report of Unanticipated Problem or Serious Adverse Event Form*).
- any significant new findings that may affect risks to participants.
- closure of the project (*Continuing Review/Completion Report Form*).

Research records are subject to random or directed audits at any time to verify compliance with IRB regulations and NDSU policies.

Thank you for cooperating with NDSU IRB procedures, and best wishes for a successful study.

Sincerely,



Kristy Shirley, CIP
Research Compliance Administrator

APPENDIX C. INFORMED CONSENT



Dear Students,

My name is Desirae Kraska, and I am a graduate student within the Department of Health, Nutrition, and Exercise Sciences. I am conducting research on dietary habits among college students, and how these habits are influenced by BMI, living arrangements, and professional major. Results from this research will help us learn more about the dietary patterns associated with college students.

Because you are a member of this class, you are invited to participate in this research project. The study is completely voluntary, however if you decide to complete this survey please print your name, sign, and date this consent and hand it into your teacher, Dr. Ardith Brunt. I will be collecting the attached survey. You will receive 4 bonus points for completing this survey. These points are part of the 20 total participation/bonus points allowed in this class. At least 25 other bonus point opportunities will be available in this class for those of you who do not wish to participate in this study.

The survey should only take approximately 7-10 minutes and will ask you questions associated with your current food choices. Your responses to the survey will remain anonymous and no specific identifiers will be linked to your name.

It is not possible to identify all potential risks in research procedures, but the researcher has taken reasonable safeguards to minimize any known risks. For this particular study, psychological distress may be a risk.

Your benefit by completing this research is the opportunity to participate within a research study conducted on dietary habits among college students. Other benefits may include knowledge about food choices and related influences to food choices that current college students are making.

If you have any questions regarding this research please feel free to email my major professor at ardith.brunt@ndsu.edu. If you have questions about the rights of human participants in research, or to report a problem, contact the NDSU IRB Office at 701-231-8908 or ndsu.irb@ndsu.edu.

Documentation of Informed Consent:

You are freely making a decision whether to be in this research study. Signing this form means that

1. You have read and understand this consent form
2. You have had your questions answered, and
3. You have decided to participate in this research study
4. Your Signature

Signature _____ Date: _____

Your Printed Name