Nutrition Knowledge Among A Predominantly Hispanic College Population

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NUTRITION KNOWLEDGE AMONG A PREDOMINANTLY HISPANIC COLLEGE POPULATION

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NUTRITION KNOWLEDGE AMONG A PREDOMINATLY HISPANIC COLLEGE POPULATION

By

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THESIS

Presented to the Faculty of the Graduate School of

The University of Texas at El Paso

in Partial Fulfillment

of the Requirements

for the Degree of

MASTER OF PUBLIC HEALTH

Department of Public Health Sciences

THE UNIVERSITY OF TEXAS AT EL PASO

May 2016
ABSTRACT

Many chronic diseases such as Type 2 diabetes, cardiovascular disease and some types of cancer are prevalent and have been associated with unhealthy eating patterns. At the same time overweight and obesity are contributing factors to the development of these conditions. There are multiple factors contributing to overweight and obesity. Some of these include a frequent consumption of unhealthy or high energy-dense foods combined with the lack of physical activity. A true understanding and foundation of proper nutrition allows people to make healthy eating choices. It has been documented that among the population, college students have a limited nutrition knowledge that could prevent them from making healthy eating choices. The USDA Dietary Guidelines for Americans are released every five years and provide Americans with recommendations for healthy food and beverage choices. Adopting these recommendations can prevent the development of many nutrition related conditions such as overweight and obesity. Many times college students adopt unhealthy eating habits that might be carried out through adulthood resulting in a high prevalence of overweight and obesity that could result in the development of chronic diseases.

The purpose of this descriptive study was to assess the nutrition knowledge with respect to healthy foods and nutrition-related diseases of a predominantly Hispanic college student population living in the U.S.-Mexico border region.

A 25-item nutrition knowledge survey was developed and tested for reliability producing an α (alpha) score of 0.837. A total of 207 college students from 7 different disciplines participated in the study. Overall, it was found that the mean percentage of correct answers was 74.39% ± 11.12. There was not a significant difference in overall scores between gender but a significance difference between students who had taken a college level nutrition course (n = 23) versus those who had never taken a nutrition course (n = 184) was revealed. There was a significant difference in the mean percentage of correct answers between students enrolled in science based disciplines vs student from non-science based disciplines. Including the students
who had taken a nutrition course, there was a significant difference between students enrolled in health sciences \((p = 0.022)\) and science \((p = 0.008)\), versus those enrolled in education. After controlling for students who had previously taken a nutrition course \((n = 23)\) there was a significant difference between scores from students enrolled in education and science disciplines \((p = 0.012)\) and liberal arts and science disciplines \((p = 0.041)\).

Strengths of this study included access to a large population and the use of a reliable survey. Limitations of the study included convenient sampling therefore, results cannot be generalized for all college students. Also, the sample size was not equally balanced in regards to gender which may have affected the results when looking at gender differences. The results of this study show a trend of college students lacking proper nutrition knowledge. Evidence suggests that taking a nutrition course would increase nutrition knowledge which may help students achieve/maintain a healthy diet.
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CHAPTER 1

According to the United States Department of Agriculture 2015 Dietary Guidelines for Americans (USDA-DGA), approximately half of the American adult population has one or more avoidable chronic health condition as a result of living an unhealthy lifestyle. A healthy diet is crucial to sustain an optimal state of health and avoid nutrition-related diseases such as diabetes, obesity, cardiovascular disease, and some types of cancer (USDA, 2010; USDA, 2015). An important factor contributing to a nutritious diet is having the knowledge that allows individuals to make healthy food and beverage choices consistent with the USDA-DGA.

One of the health concerns among Americans of all ages is the growing prevalence of overweight and obesity, often times linked to the consumption of high-energy-dense diet and low intake of low-nutrient dense foods. The USDA-DGA defines nutrient-dense food as:

Food and beverages that provide vitamins, minerals, and other substances that contribute to adequate nutrient intakes or may have positive health effects, with little or no solid fats and added sugars, refined starches, and sodium. Ideally, these foods and beverages also are in forms that retain naturally occurring components (USDA, 2015).

Overweight and obesity are multi-factorial conditions that may be related, not only to the overconsumption of calories and low intake of nutrient-dense foods, but also to sedentary behavior, limited access to healthy foods, and the heredity of social and family factors, among many other factors (USDA, 2010; USDA, 2015). As a result of these and other risk factors, 63.8% of the American adult population is considered overweight or obese (CDC, 2015).

One group affected by unhealthy weight is the college student population which tends to experience weight gain by the first year of college (Graham & Jones, 2002; Holm-Denoma,
Joiner, Vohs, & Heatherton, 2008; Mihalopoulos, Auinger, & Klein, 2008). This puts students at risk for developing chronic conditions such as diabetes, obesity, cardiovascular disease, and some types of cancer at an early age, thus supporting a need to explore the true understanding of nutrition in college students (Mihalopoulos et al., 2008).

The purpose of this study was to assess the nutrition knowledge with respect to the USDA-DGA and to nutrition-related diseases among a predominantly Hispanic college student population living in the U.S.-Mexico border region.
CHAPTER 2: BACKGROUND AND SIGNIFICANCE

Nutrition Knowledge among College Students

College is a drastic lifestyle change for young adults as they become increasingly independent and take on more responsibilities (Kelly, Mazzeo, & Bean, 2013; Ruhl-Eidem, 2013; Wengreen & Moncur, 2009; Zigmont, 2012). In many cases, college students move away from home and take on the responsibility of doing their own grocery shopping and meal preparation (Kelly et al., 2013). It is important to note, that students may enter college with certain dietary habits, but without adequate nutrition knowledge the development of poor dietary habits may develop. Nutrition knowledge can be defined as the understanding of daily guidelines for fluid and food consumption requirements (Macias & Glasauer, 2014).

In general, the prevalence of obesity has increased dramatically among the general population, with the greatest spike among ages 18-29 year (Flegal, Carroll, Kit, & Ogden, 2012; Racette, Deusinger, Strube, Highstein, & Deusinger, 2010). The weight gained during college years is primarily due to a lack of nutrition knowledge, unhealthy dietary habits practice during those years, high levels of stress, sleep deprivation, and sedentary lifestyle (Ruhl-Eidem, 2013; Zigmont, 2012, USDA, 2010; USDA, 2015). This lack of knowledge is associated with the term “freshman 15” (Howell, 2010; Kelly et al., 2013). This phrase refers to the “belief” of weight increase among freshmen college students during their first year of college (Graham & Jones, 2002; Holm-Denoma et al., 2008; Mihalopoulos et al., 2008). The habits developed during an individual’s college years carry over into long-term habits, which could lead to the development of health problems (Brunt, Rhee, & Zhong, 2008; Cousineau, Goldstein, & Franko, 2004; Davy, Benes, & Driskell, 2006; Greaney et al., 2009; Kolodinsky, Harvey-Berino, Berlin, & Johnson,
2007; Krukowski, Harvey-Berino, Kolodinsky, Narsana, & DeSisto, 2006; Nelson, Kocos, Lytle, & Perry, 2009; Strong, Parks, Anderson, Winett, & Davy, 2008). Specifically, these health conditions include acute and chronic diseases such as diabetes, obesity, cardiovascular disease, and some types of cancer (Ahlstrom, 2009; USDA, 2010; USDA, 2015).

Research suggests that college students lack adequate nutrition knowledge to make appropriate dietary decisions (Elhassan, Gamal, & Mohammed, 2013; Misra, 2007; Van den Berg, Okeyo, Dannhauser, & Nel, 2007). This lack of knowledge affects college students’ ability to choose healthy foods as recommended by the USDA-DGA (Elhassan et al., 2013; Williams, 2008). Without a proper diet, college students are at risk for not performing at optimal intellectual and physical levels (Davy et al., 2006; Greaney et al., 2009; Kicklighter, Koonce, Rosenbloom, & Commander, 2010; Krukowski et al., 2006; Nelson et al., 2009; Strong et al., 2008).

**Nutrition Related Diseases**

Obesity has increased greatly over the past 35 years with the most growth among college-aged individuals (Flegal et al., 2012; Racette et al., 2010). The American College Health Association National College Health Assessment II found that 36.1% of college students are considered overweight or obese (American College health Association, 2015). The frequent consumption of unhealthy foods that are usually high in calories and low in nutritional value can result in overweight and obesity (USDA 2010; USDA, 2015). According to the World Health Organization (WHO), both overweight and obesity are defined as an “abnormal or excessive fat accumulation that presents a risk to health” (World Health Organization, 2014). Body Mass Index (BMI) scores can be used as a guideline for overweight and obesity. According to the Center for Disease Control (CDC), BMI values of 25.0 kg/m² and 29.9kg/m² are considered to be
overweight and values of 30.0 kg/m² and above are considered obese. BMI is calculated by dividing an individual’s weight in kilograms by their height in meters squared (CDC, 2015). As an individual’s BMI value increases, so does the risk for developing overweight-related diseases.

According to the CDC, a few of the risk factors associated with Type 2 diabetes include being overweight or obese, being of certain ethnic background (African-American, Hispanic/Latino, American- Indian, Asian- American, or Pacific- Islander), and being physically active less than three times a week (CDC, 2015). Type 2 diabetes was formerly referred to as “non-insulin-dependent diabetes mellitus or adult-onset diabetes” (CDC, 2014). When an individual has this type of diabetes, the pancreas is unable to make enough insulin to keep up with the body’s demands (CDC, 2014). According to the 2014 National Diabetes Statistics report, 90% to 95% of all diagnosed cases of adult diabetes are considered to be Type 2 diabetes. One of the factors contributing to the development of Type 2 diabetes is the frequent consumption of a high energy and low nutrient-dense diet.

The USDA-DGA recognizes that heart disease/cardiovascular disease (CVD) is a condition associated with a poor diet. CVD encompasses multiple disorders of the heart and blood vessels. A few health conditions that fall into this category include heart attack, stroke, and hypertension (World Health Organization, 2015). In 2014 CVD was reported as the number one cause of death among Americans, killing over 375,000 people a year, accounting for one in seven deaths in the United States (American Heart Association Statistics Committee and Stroke Statistics subcommittee, 2015).

Although many people may not realize it, unhealthy nutrition is one of many factors associated with the development of cancer (USDA, 2010; USDA, 2015). As addressed in the USDA-DGA, almost half of men and women (41% of the American population) will be
diagnosed with cancer during their lifetime. There is an extensive list of cancers associated with dietary factors. These include but are not limited to breast (post-menopausal), liver, endometrial, prostate, colorectum, kidney, mouth, pharynx, larynx, and esophagus (USDA, 2010, USDA 2015). There is an association between increased consumption of certain foods (e.g. fruits and vegetables) and decreased intake of high-energy dense foods and reduction for developing cancer.

Factors Influencing Eating Behaviors among College Students

A national study from American College Health Association, National College Health Assessment (ACHA- NCHA) released in Spring of 2015 reported that 63% of undergraduate college students were interested in receiving information about nutrition, and 54% of students received nutrition information from their college or university. Although this information is promising, there is still an overwhelming percentage of students considered overweight or obese. The ACHA-NCHA report indicates that 4.9% of college students had some form of chronic disease (e.g., cancer, diabetes, auto-immune disorders). The results from the survey also identified that throughout the 12 months of the survey, 1.1% of the students reported being diagnosed with diabetes and 3% reported being diagnosed with high blood pressure (American College Health Association, 2014). There may be other contributing factors to the development of these chronic health conditions in college students, however, an unhealthy diet can be considered a strong influence.

Although it has been documented that college students tend to have a deficient level of nutrition knowledge, there are other factors that play a role in college students’ diets and their access to healthy food. On many occasions, college students live on campus and lack the appropriate equipment (oven, stove, etc.) to create healthy meals, which leads them to rely on
consuming their meals at restaurants, fast food places, and campus cafeterias on or around campus (Ball & Brown, 2012). In some cases, meals prepared by the campus cafeterias may be of low nutritional value and be high in energy and fat (Kolodinsky et al., 2007). However, the previous statement does not apply to all campus cafeterias, or restaurants on or around college campuses. Studies have shown that although college students may have the ability and equipment to prepare meals, they still lack the basic nutrition knowledge with respect to USDA-DGA (Ball & Brown, 2012; Ruhl-Eidem, 2013; Zigmont, 2012). Without adequate knowledge, students are unable to properly prepare balanced meals that are in compliance with these guidelines.

**USDA Dietary Guidelines for Americans**

USDA released the first edition of the Dietary Guidelines for Americans (DGA) in 1980, and since then the guidelines are updated every five years, with the 8th edition released in January 2016. The purpose of these national guidelines is to encourage Americans to practice healthy living that could result in the prevention of nutrition-related diseases and subsequently leading to increased longevity. It has been stated in past and current editions that consuming an array of fruit, vegetables, and whole grains is key in maintaining weight and reducing the chance of developing chronic diseases such as diabetes, heart disease, and some types of cancers (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010; U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2015). Research has shown that frequent intake of whole grains can result in a reduction of diabetes, cardiovascular disease, cancer related death, and death at an early age (Lang & Jebb, 2003). The guidelines contained in the 2015 USDA-DGA include:
1) Follow a healthy eating pattern across the lifespan; 2) Focus on variety, nutrient density, and amount; 3) Limit calories from added sugars and saturated fats and reduce sodium intake; 4) Shift to healthier food and beverage choices; 5) Support healthy eating patterns for all (USDA, 2015).

In addition to the USDA-DGA, the U.S. Department of Health and Human Services creates goals and objectives as part of a health initiative entitled Healthy People 2020 (HP 2020).

**Healthy People 2020**

Similar to the USDA-DGA, HP 2020 provide goals and objectives that are updated every ten years to help guide the American population to improve health and prevent diseases. HP 2020 contains 42 topic areas with multiple objectives per each topic area (HP 2020, 2010; HP 2020, 2015b). For the current study, the topic area is related to Nutrition and Weight Status. The goal of this topic is to “promote health and reduce chronic disease risk through the consumption of healthful diets and achievement and maintenance of healthy body weight” (HP 2020, 2015a). The objectives associated with this topic, that apply to this research, are “healthier food access, weight status, and food and nutrient consumption” (HP 2020, 2015a). These topics, goals, and objectives are set nation-wide, and also apply to the U.S.-Mexico border population in where a high rate of chronic health conditions have been documented.

**Characteristics of the U.S.-Mexico Border Region**

Some academic institutes of higher education located in the U.S.-Mexico border region have a strong influence on the culture and their student population as many of the students are from the region. El Paso County, located on the U.S. - Mexico border region have an average median household income of $40,157 with about 23.3% below the poverty line. El Paso
population is composed of 81.2% Hispanics (U.S. Census Bureau, 2015). According to Healthy Paso del Norte, a web-based source, it was reported that in 2013, 28.6% of the El Paso population suffered from high blood pressure, of that percentage 6.3% belonged to the age group of 18-29 years, which encompasses the average age of college students (Healthy Communities Institute, 2015a; Kolodinsky et al., 2007; Ruhl-Eidem, 2013). Furthermore, the prevalence of high cholesterol in 2013 was 36.4%, which was slightly lower than the overall average in the state of Texas (37.7%) (Healthy Communities Institute, 2015b). Lastly, in 2014, 71% of the entire El Paso population was considered overweight or obese, which is slightly higher than the overall percentage for Texas (67.8%). When looking at the age group 18-29 years, 47% is considered to be overweight or obese (Healthy Communities Institute, 2015).

Due to the high rates of blood pressure, high cholesterol, overweight and obesity in this region, it can be inferred that there is a lack of nutrition knowledge in the El Paso community, thus presenting a concern of the region’s college student population. With supporting evidence presented thus far, it can be inferred that college students from the U.S-Mexico border region might lack the appropriate nutrition knowledge to perform at optimal levels. Based on previous studies reporting on the lack of proper nutrition knowledge among college students, there is a need to further explore and describe the nutrition knowledge of college students from the U.S.-Mexico border region.
CHAPTER 3: METHODS

The primary objective of this research study was to assess the nutrition knowledge of a college student population attending a public institution located in the U.S. - Mexico border region. Based on previous research studies, it is hypothesized that students participating in the study will have limited nutrition knowledge. Individuals with decreased nutrition awareness are unable to prepare or select a well-balanced diet that is consistent with the USDA-DGA, therefore, increasing students’ chances of developing unhealthy eating habits and enhancing their risk of developing health issues at an early age.

The approximate number of students enrolled at the public academic institution at the time when the study was conducted was about 23,000. The public education institution trained students in seven different disciplines with the highest enrollment in areas of liberal arts, business, and engineering. The majority of the student population enrolled were from the U.S.-Mexico border region with a large number of students identifying themselves as Hispanics (79.9%).

Specific Aims and Hypotheses

This research specifically addressed the following five aims.

Aim 1: To develop and validate a Nutrition Knowledge Assessment Tool (NKAT).

Aim 2: To assess the students’ nutrition knowledge as it relates to the current USDA-DGA using the NKAT.

It is hypothesized that the average overall score (number of questions answered correctly out of a total of 53 questions) will be 50% or lower.
Previous research suggests that college students lack adequate nutrition knowledge to make appropriate dietary decisions (Elhassan et al., 2013; Misra, 2007; Van den Berg et al., 2007). In a comparable study that used a similar survey, the overall mean score for nutrition knowledge was 46.8% (Holden, Pugh, Norrell, & Keshock, 2014).

**Aim 3:** To compare the overall score on the NKAT between male and female college students. It is hypothesized that male students will score ≥10% or higher than their female counterparts.

Research has shown that compared to females, males have higher scores in nutrition knowledge, however, this finding is not consistent (Davy et al., 2006; Kolodinsky et al., 2007; Ruhl-Eidem, 2013).

**Aim 4:** To determine if students who have taken a college level nutrition course score higher on the NKAT.

It is hypothesized that students who have taken a college level nutrition course will score 10% higher on the survey compared to students who have not taken a nutrition course before.

**Aim 5:** To compare survey scores among students enrolled in the seven different disciplines. It is hypothesized that students enrolled in science-based colleges will obtain a 10% higher score compared to students enrolled in non-science-based colleges.

A study completed by Barzegari et al., looking at nutrition knowledge showed that students completing the physical education program out scored students from other majors by approximately 10% (Barzegari, Ebrahimi, Azizi, & Ranjbar, 2011). El-Sabben and Badr completed another study exploring the nutrition knowledge between student enrolled in “theoretical colleges (e.g., arts, commerce, law, etc.)” and “practical colleges (e.g., engineering, pharmacy, science, etc.).” Although slightly different, Liberal Arts, Business, and other non-
science-based colleges are comparable to theoretical colleges as all are non-science-based.

Science-based colleges such as Health Sciences and Nursing are comparable to practical colleges (El-Sabban & Badr, 2011).

**Ethics**

This research protocol was approved by the Institutional Review Board (IRB) on September 9, 2015; protocol # 802222.

**Survey Development (Nutrition Knowledge Assessment Tool or NKAT)**

After conducting an extensive literature review to identify surveys used in previous research studies, a survey addressing all components included in the USDA-DGA was not identified. The one survey that included some elements of interest was outdated. Therefore, the NKAT was developed using 2010 and 2015 USDA-DGA as a reference in combination with the questionnaire developed and tested by Paramenter and Wardle. The reason for using both sets of USDA-DGA was due to the date the most current guidelines 2015 were released. Once the 2015 guidelines were released it was ensured that the previously formulated questions were still in alignment with the newly released guidelines (Figure 1).
Figure 1. USDA Dietary Guidelines for Americans

<table>
<thead>
<tr>
<th>2010</th>
<th>2015</th>
</tr>
</thead>
</table>
| **Consume a variety of nutrient-dense food and beverages within and among the basic food groups, while picking up foods that limit the intake of saturated and trans fats, cholesterol, added sugars, salt and alcohol.** | 1. Focus on variety, nutrient density, and amount  
2. Limit calories from added sugars and saturated fats and reduce sodium intake |
| 1. Whole fruit and vegetables are considered nutrient dense foods     | 1. Focus on variety, nutrient density, and amount  
2. Shift to healthier food and beverage choices                      |
| 2. The USDA dietary guidelines for americans recommends that the general population eat a variety of vegetables, especially dark-green, red, and orange vegetables, beans and peas |                                                                      |
| 3. Which of the following is not considered a basic food group?       |                                                                      |
| 4. Which of following nutrient(s) is/are lacking in the american diet?|                                                                      |
| 5. Do you think these foods are high or low in saturated fat?        |                                                                      |
| 6. Do you think these foods are high or low in trans-fat?            |                                                                      |
| 7. Do you think these foods are high or low in salt/sodium          |                                                                      |
| 8. What is considered moderate alcohol consumption?                 |                                                                      |
| 9. Other than drinking water and other water based beverages how can water be incorporated into the diet? |                                                                      |
| 10. Processed meat differed from red meat?                          |                                                                      |
| **Consume more dark-green and orange vegetables, legumes, fruits, whole grains, and low fat milk and milk products** |                                                                      |
| 11. Which of the following foods are considered low fat dairy products? |                                                                      |
| 12. Which of the following food(s) is/are considered a good sources of fiber and protein? |                                                                      |
| 13. Old fashion oatmeal is considered to be a whole grain?           |                                                                      |
| 14. Are the following foods considered high or low in refined grains?|                                                                      |
| **Eat fewer calories, refined grains, added sugars, and total fats. Eat food lower in sodium.** | 1. Focus on variety, nutrient density, and amount  
2. Limit calories from added sugars and saturated fats and reduce sodium intake |
| 15. Do you think these food are high or low in added sugars?         |                                                                      |
| 16. Which of the following types of fat(s) are considered a healthier choice |                                                                      |
| **Building healthy eating patterns during each stage of life-childhood, adolescence, adulthood, pregnancy and breastfeeding and older age – to meet nutrient needs and appropriate calorie amounts.** | 1. Following a healthy eating pattern across the lifespan  
2. Support health eating patterns for all. |
| 17. Which of the following is a vital nutrient that women of childbearing age need to consume on a daily basis? |                                                                      |
| 18. Compared to adults, children and adolescents need to consume more of this nutrient? |                                                                      |
Study Design

This research is classified as a descriptive study. Characteristics and nutrition knowledge information was gathered using Qualtrics, a survey based platform. This study utilized a questionnaire that was made available to undergraduate college students through an electronic link.

Survey Validation

A group of statisticians were approached to discuss the validation analysis of the newly developed survey. It was recommended that two different types of analyses were conducted. These included a qualitative and quantitative analyses. In order to address Study Aim #1, the newly developed survey was validated by obtaining feedback from a small sample of the college student population. The target goal was to recruit five males and five females enrolled in different disciplines who could provide feedback on the survey. Participants were recruited by the researcher by approaching students who were willing to participate in this portion of the validation process. After each student agreed to participate, a consent form (Appendix 1) was reviewed and initialed by the student. A hard copy of the survey was distributed to the student. Once the survey was completed, the student was interviewed and asked three questions (Appendix 1). The purpose of asking these questions was to obtain feedback from the students regarding clarity of the items in the survey. Feedback was taken into consideration and included in a revised survey. The procedure to complete the quantitative portion of the validation of the survey consisted of conducting a Cronbach’s alpha calculation to test for reliability.
Sample Size

The present study required a minimum of 121 students to detect a difference on nutrition knowledge among groups at $\alpha = 0.05$. The sample size was calculated based on a convenient sample of the total of college student population as well as the sample size reported in similar studies. In order to achieve a sufficient sample, a target of 200 participants was established.

Recruitment of Participants

In order to recruit the target number of participants, instructors teaching in different disciplines were contacted. A few of the classes that were selected for recruitment had a large enrollment. An initial email was sent to each of the professors teaching selected courses. The purpose of the e-mail was to introduce the scope of the research and to seek the instructor’s permission to briefly speak to the students about the study and why their students’ participation was important. In addition, a fewer number of students were recruited face-to-face.

Survey Distribution

After the instructor agreed to support the study, they were asked to distribute the survey link to their students. During face-to-face recruitment, flyers explaining the purpose of the research, researcher’s contact information, and the link to the survey were distributed. The researcher’s email was provided in case the study participants encountered issues with the link provided.
**Inclusion and Exclusion Criteria**

Participants were eligible to participate in the study if they were 18 years or older and pursuing a college degree. Graduate students were not eligible to participate in the study.

**Data Entry**

Microsoft Windows Excel 2010 was utilized to enter all data collected from the students. Before data was entered into an Excel spread sheet, each completed survey received a code number (P1, P2,..P215). The participant characteristics section included two continuous variables (height and weight) with the remaining nine questions classified as categorical variables. All categorical variables were coded with numerical values (1, 2, 3, etc.) and a zero was assigned when participants selected *prefer not to respond, other, not sure, or did not select any health condition*. The survey was coded similarly on the participant characteristics questions. Unlike the participant characteristic section, all questions contained in the survey were characterized as categorical. To score this section, each answer choice was given numerical values (1, 2, 3, etc.). If *not sure* was selected, a zero was assigned. Before entering the codes in the spreadsheet the correct, incorrect, and not sure answer were totaled separately and documented at the top of each survey. The perfect score was 53/53, which was a total of all the questions and table elements. After each survey was, coded, and scored (e.g., correct 30/53, incorrect 20/53, not sure 3/53) the information was transposed to the excel sheet.
Participant Codes:

<table>
<thead>
<tr>
<th>What is your sex/gender?</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Male</td>
<td>1</td>
</tr>
<tr>
<td>b. Female</td>
<td>2</td>
</tr>
<tr>
<td>c. Prefer not to respond</td>
<td>0</td>
</tr>
</tbody>
</table>

How old are you?

<table>
<thead>
<tr>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. 18-30</td>
</tr>
<tr>
<td>b. 31-40</td>
</tr>
<tr>
<td>c. 41-50</td>
</tr>
<tr>
<td>d. 50&lt;</td>
</tr>
</tbody>
</table>

NKAT Codes:

<table>
<thead>
<tr>
<th>Whole fruit and vegetables are considered nutrient dense foods</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. True</td>
<td>1</td>
</tr>
<tr>
<td>b. False</td>
<td>2</td>
</tr>
<tr>
<td>c. Not sure</td>
<td>0</td>
</tr>
</tbody>
</table>

Do you think these food are high or low in Salt/ sodium?

<table>
<thead>
<tr>
<th>High Code (1)</th>
<th>Low Code (2)</th>
<th>Not sure Code (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh mango</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw pepper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tacos made with dry taco seasoning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canned soup</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statistical Analysis

This research included both qualitative and quantitative analyses. Quantitatively, the Cronbach’s alpha test was used to assess the reliability of the NKAT. To assess participant characteristic information, frequency tables were created and later compiled into a single table for comparison purposes. Two-sample t-test and analysis of variance (ANOVA) were used to compare effect of overall scores of each element of the characteristics. A two-sample t-test was used to determine if two populations had equal means of overall score variable. For gender and nutrition class variables, equal means were tested by using the two-sample t-test. ANOVA was used to determine if there were significant differences between means of three or more categorical groups of a variable. Data were handled using Statistical Package for Social Sciences (IBM SPSS Statistics version 22). All statistical analyses were conducted by a group of statisticians. Interpretations of the results were conducted in consultation with the statisticians.
CHAPTER 4: RESULTS

Characteristics of Participants:

Participant information was gathered to adequately describe the study population. Despite the goal of equal gender participation, there were more females (n =129) than males (n =78) with over half being females (62.3%). The age range 18-30 years represented 88.9% of the participants age. As expected the most prominent ethnicity represented in the sample population was Hispanics at 82.6%, followed by Caucasian/non-Hispanic at 9.7%. Based on the requirements of the minimum sample of 121 and target sample of 200, estimated distribution values were calculated for each discipline. These values were calculated by finding the percentage of students enrolled in different disciplines from the total student population. From there, that percentage was converted into values based on the minimum and target samples. The target goal for each disciple were accomplished with the exception of the minimum requirements of participants from business, which was short by two participants (Table 1). A large portion of participants were classified as juniors (36.1%), with freshman representing the smallest amount (15%) of students. BMI was calculated using height and weight values reported by students. Using a BMI calculator available from the CDC website, participant’s weight status was determined. About half (50.8%) of participants were considered overweight (29.5%) and (21.3%) were obese. Nearly half (46.4%) of participants were categorized as having a healthy weight. More than half (54%) of participants stated being physically active multiple times a week. The same percentage of student had a healthy weight with a BMI value between 18.5-24.9 kg/m². A small percentage (18.4%) reported being physically active only once a week. There were a total of 41 different codes developed from different combinations of information
regarding participant characteristics and family health. Participants had the option to select health conditions that applied from the following menu: Type 2 diabetes, hypertension, overweight or obese, any type of cancer, cardiovascular disease, and osteoporosis. For comparison purposes, codes were setup to show the number of health conditions reported by each participant. For example if a participant selected Type 2 diabetes in addition to any type of cancer it was coded as two. If a participant selected all health conditions for question 10 a 6 was assigned and a zero was entered if a participant did not select any of the health conditions. These are the values represented on the left side of Table 4 with the frequency of each value on the right.

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Total students per discipline</th>
<th>Minimum (121)</th>
<th>Target (200)</th>
<th>Total (207)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>2988</td>
<td>19</td>
<td>30</td>
<td>17</td>
</tr>
<tr>
<td>Education</td>
<td>1228</td>
<td>8</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Engineering</td>
<td>3172</td>
<td>20</td>
<td>32</td>
<td>34</td>
</tr>
<tr>
<td>Health Sciences</td>
<td>1885</td>
<td>11</td>
<td>18</td>
<td>21</td>
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<tr>
<td>Liberal Arts</td>
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<td>38</td>
<td>62</td>
<td>72</td>
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<tr>
<td>Nursing</td>
<td>1875</td>
<td>11</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>Science</td>
<td>2547</td>
<td>16</td>
<td>26</td>
<td>28</td>
</tr>
<tr>
<td>Participant Characteristics</td>
<td>N=207</td>
<td>n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------</td>
<td>-------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>129 (62.3)</td>
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<td></td>
</tr>
<tr>
<td>Males</td>
<td>78 (37.7)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-30</td>
<td>184 (88.9)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>31-40</td>
<td>20 (9.7)</td>
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<tr>
<td>41-50</td>
<td>2 (1.0)</td>
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<tr>
<td>&gt;50</td>
<td>1 (.5)</td>
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<tr>
<td>Ethnicity</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>13 (6.3)</td>
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<td></td>
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<tr>
<td>White</td>
<td>20 (9.7)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>3 (1.4)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>171 (82.6)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Discipline</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business</td>
<td>17 (8.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>20 (9.7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering</td>
<td>34 (16.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Sciences</td>
<td>21 (10.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liberal Arts</td>
<td>72 (34.8)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Nursing</td>
<td>15 (7.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td>28 (13.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>31 (15)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Sophomore</td>
<td>41 (19.8)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Junior</td>
<td>75 (36.2)</td>
<td></td>
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</tr>
<tr>
<td>Senior</td>
<td>60 (36.2)</td>
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</tr>
<tr>
<td>College Level Nutrition Class</td>
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<tr>
<td>Yes</td>
<td>23 (11.1)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>184 (88.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight Status (based on BMI)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>6 (2.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>96 (46.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td>61 (29.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td>44 (21.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Family of Health Conditions *</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>22 (10.6)</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>29 (14.0)</td>
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<td>2</td>
<td>55 (26.6)</td>
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<td></td>
</tr>
<tr>
<td>3</td>
<td>53 (25.6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>23 (11.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>19 (9.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6 (2.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Activity</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Multiple times a week</td>
<td>113 (54.6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once a week</td>
<td>38 (18.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple times a month</td>
<td>22 (10.6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not physically active</td>
<td>27 (13.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not sure</td>
<td>7 (3.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Type 2 Diabetes, High Blood Pressure/Hypertension, Overweight or Obesity, Any Type of Cancer, Heart/Cardiovascular Disease, Osteoporosis
Aim 1: Validation of Survey

Overall the feedback obtained from the students who provided information for validation purposes were positive. There were a total of four female students from the disciplines of liberal arts and one student from the discipline of nursing. Their student classification included three seniors, one junior, and one sophomore. Four out of the five females addressed concerns about the content and two of them indicated they were confused by the wording and punctuation. The feedback obtained was taken into consideration and included in a revised NKAT.

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Classification</th>
<th>Number of Correct Answers (overall score)</th>
<th>Number Incorrect Answers (%)</th>
<th>Not sure (%)</th>
<th>Comments</th>
<th>How comments were addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liberal Arts</td>
<td>Senior</td>
<td>33 (67.35)</td>
<td>8 (16.33)</td>
<td>8 (16.33)</td>
<td>1. Question # 8 was confusing because I don’t know a lot about drinking alcohol 2. Participant skip 2 questions</td>
<td>This comment was not addressed because it was related to the content</td>
</tr>
<tr>
<td>Nursing</td>
<td>Junior</td>
<td>41 (80.39)</td>
<td>7 (13.73)</td>
<td>3 (5.88)</td>
<td>Questions# 18 &amp; 19 were a little confusing only because of terms used</td>
<td>This comment was not addressed because it was related to the content</td>
</tr>
<tr>
<td>Liberal Arts</td>
<td>Sophomore</td>
<td>25 (49.02)</td>
<td>18 (35.29)</td>
<td>8 (15.69)</td>
<td>1. 4 made me question what the word depleted meant. I think using a more common word like lacking or insufficient may prevent future confusion 2. Check punctuation</td>
<td></td>
</tr>
<tr>
<td>Liberal Arts</td>
<td>Senior</td>
<td>37 (72.55)</td>
<td>11 (21.57)</td>
<td>3 (5.88)</td>
<td>1. The word depleted was changed to lacking 2. Punctuation was added at the end of each question/statement</td>
<td></td>
</tr>
<tr>
<td>Liberal Arts</td>
<td>Senior</td>
<td>34 (66.67)</td>
<td>12 (23.53)</td>
<td>5 (9.83)</td>
<td>Question 19’s wording was a little confusing until I read it a couple of times to fully understand it better.</td>
<td>The questions were slightly revised to better address the corresponding answers</td>
</tr>
</tbody>
</table>
Compared to their female counterparts, the feedback provided by one of the male participants was very limited. The male participants provided limited feedback on the survey. There were two males from liberal arts, one from engineering, one from science, and one from nursing. Their student classifications included three juniors, one sophomore, and one freshman. Only one of the male participant provided feedback in reference to the wording of one of the questions. The other four males felt the survey was well structured and straightforward. The feedback obtained was taken into consideration for refinement of the NKAT.

Table 6. NKAT Validation Results from Male Participants

<table>
<thead>
<tr>
<th>College</th>
<th>Classification</th>
<th>Overall Score</th>
<th>Number Incorrect n (%)</th>
<th>Not Sure n (%)</th>
<th>Comments</th>
<th>How Comment was Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liberal arts</td>
<td>Freshman</td>
<td>33 (64.71)</td>
<td>15 (29.11)</td>
<td>3 (5.88)</td>
<td>Question # 11 seems to have multiple correct answers. Not sure if there could be more than one right choice</td>
<td>To address this, the order of terms were switched. Instead of the question reading &quot;protein and fiber&quot; it now reads &quot;fiber and protein.&quot;</td>
</tr>
<tr>
<td>Engineering</td>
<td>Sophomore</td>
<td>33 (66)</td>
<td>13 (26)</td>
<td>5 (8)</td>
<td>Participant skip 1 question</td>
<td></td>
</tr>
<tr>
<td>Liberal arts</td>
<td>junior</td>
<td>40 (78.43)</td>
<td>8 (15.69)</td>
<td>3 (5.88)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td>junior</td>
<td>37 (72.55)</td>
<td>13 (25.49)</td>
<td>1 (1.96)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nursing</td>
<td>junior</td>
<td>32(62.76)</td>
<td>15 (29.11)</td>
<td>4 (7.84)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Reliability Results

The Cronbach’s alpha measure, was calculated for internal confidentially purposes. These results revealed that the survey is highly reliable with an alpha value of .837 on a scale of 0 -1. In order for the survey to be highly reliable the alpha value normally falls in the range of 0.7<alpha <0.9 (DeVellis, 1991). The NKAT was developed to evaluate nutrition and disease related knowledge. Both sections rendered alpha values consistent with high reliability. The
alpha value for nutrition knowledge was 0.770 and the value for nutrition and disease related knowledge was 0.781.

**Aim 2: Overall NKAT Score**

There was a total of 215 participants who signed the consent form and was agreed to answer the survey. After identifying missing values, the total sample was reduced to 208. As depicted in Figure 5, the overall percentage of correct answers (overall score) showed to be skewed to the left. After the outlier was removed, the histogram presented close to normal distribution. The overall mean score of the overall sample of 207 participants was 74.39% ±11.129. This new tests revealed that the average score was on the low side, but failed to support the hypothesis that the averages score would be 50% or lower.

**Figure 5. Overall NKAT Scores**

**Aim 3: Gender Difference**

The goal of equal gender participation was not achieved. The number of participants (N=207) that answered the survey were 78 (37.6%) males and 129 (62.3%) females. After excluding those students who reported haven taken a nutrition course before, a total of 184 participants
remained, with 112 (60.8%) females and 72 (39.1%) males. The number of students who reported taking a nutrition course before were removed. This was with the purpose to assess if there was a significant difference between genders. In both cases there was no significant difference between genders therefore the null hypothesis was accepted. Although there was not a significant difference in both situations females scored higher than males participants.

<table>
<thead>
<tr>
<th>Score * Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Score * Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

**Aim 4: Nutrition Class vs Non-Nutrition Class**

Twenty-three participants reported taking a college level nutrition course before, leaving 184 participants who had never taken a nutrition course before. Additional statistical analyses
were conducted with the total sample in addition to and a separate analysis excluding the 23 participants. Students enrolled in health sciences and nursing disciplines are required to take an entry-level nutrition course. These students obtained better score on the NKAT. As expected there was a significant difference (p = 0.007) between the mean overall scores of both groups. Therefore, the null hypothesis was rejected because there was a difference between the group scores.

<table>
<thead>
<tr>
<th>Table 9. Nutrition Class vs No Nutrition Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score * Nutri_class</td>
</tr>
<tr>
<td>Score</td>
</tr>
<tr>
<td>Nutri_class</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Aim 5: Students Enrolled in Different Disciplines

Including the students that reported completing a nutrition course before (n=23), a difference between the following disciplines education and science and health sciences and education was detected. When the 23 students were removed, the significance among disciplines changed. There was a significant difference between education and science and liberal arts and science. In both cases the null hypothesis was rejected.
### Table 6. Students Enrolled in Education vs Students Enrolled in Other Disciplines with Students Who Have Taken a Nutrition Course

<table>
<thead>
<tr>
<th>(I) Discipline</th>
<th>(J) Discipline</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Business</td>
<td>-6.5</td>
<td>3.6</td>
<td>.08</td>
</tr>
<tr>
<td></td>
<td>Engineering</td>
<td>-4.5</td>
<td>3.1</td>
<td>.15</td>
</tr>
<tr>
<td>Health Sciences</td>
<td>Liberal Arts</td>
<td>-7.96*</td>
<td>3.4</td>
<td>.02</td>
</tr>
<tr>
<td></td>
<td>Nursing</td>
<td>-3.9</td>
<td>2.8</td>
<td>.16</td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td>-7.3</td>
<td>3.8</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td>-8.6*</td>
<td>3.2</td>
<td>.01</td>
</tr>
</tbody>
</table>

### Table 7. Student Enrolled in Education vs Student in Other Disciplines with Students Who Have Taken a Nutrition Course

<table>
<thead>
<tr>
<th>(I) Discipline</th>
<th>(J) Discipline</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Business</td>
<td>-6.7</td>
<td>3.8</td>
<td>.08</td>
</tr>
<tr>
<td></td>
<td>Engineering</td>
<td>-4.8</td>
<td>3.3</td>
<td>.15</td>
</tr>
<tr>
<td>Health Sciences</td>
<td>Liberal Arts</td>
<td>-7.2</td>
<td>3.9</td>
<td>.76</td>
</tr>
<tr>
<td></td>
<td>Nursing</td>
<td>-3.4</td>
<td>2.99</td>
<td>.25</td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td>-3.4</td>
<td>4.4</td>
<td>.44</td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td>-8.7*</td>
<td>3.4</td>
<td>.01</td>
</tr>
</tbody>
</table>

### Table 8. Student Enrolled in Liberal Arts vs Students Enrolled in Other Disciplines with Students Who Have Not Taken a Nutrition Course

<table>
<thead>
<tr>
<th>(I) Discipline</th>
<th>(J) Discipline</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liberal Arts</td>
<td>Business</td>
<td>-3.2</td>
<td>3.2</td>
<td>.29</td>
</tr>
<tr>
<td></td>
<td>Education</td>
<td>3.4</td>
<td>2.99</td>
<td>.25</td>
</tr>
<tr>
<td></td>
<td>Engineering</td>
<td>-1.3</td>
<td>2.3</td>
<td>.57</td>
</tr>
<tr>
<td>Health Sciences</td>
<td>Nursing</td>
<td>-3.8</td>
<td>3.1</td>
<td>.23</td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td>.06</td>
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<td>.99</td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td>-5.3*</td>
<td>2.6</td>
<td>.04</td>
</tr>
</tbody>
</table>
CHAPTER 5: DISCUSSION

The overall purpose of this study was to describe the nutrition knowledge of college students, with additional aims to assess nutrition knowledge among gender, students enrolled in seven different disciplines, and students who have taken a nutrition course before versus those who have not taken a nutrition course before. The overall results of this study are consistent with results reported in previous research studies.

Participant Characteristics

As previously reported, a high percentage of the participants (88.6%) were 18-30 years of age, an age range that represents the average age of college students (Brunt et al., 2008; Kolodinsky et al., 2007; Ruhl-Eidem, 2013). Despite the high rates of major health conditions relevant to the U.S. - Mexico border region results are consistent with previous research indicating that 46.6 % of the students had a healthy weight according to BMI values (Racette et al., 2010).

Nutrition Scores

Previous research showed that in general college students have low levels of nutrition knowledge. The results from the current study are consistent with findings reported by Holden et al., 2014; Ruhl-Eidem, 2013; and Zigmont, 2012. The average score of correct answers was 74.4% ± 11.1 in a total of 207 participants who completed the survey. According to the Histogram presented in Figure 5, the lower portion of the scores fell between 40%-50% of correct answers with the higher portion of scores being from 90%-100%. It was determined that students who had completed a college level nutrition course achieved higher scores. According
to the results the average score of students who had taken a nutrition course before, was $80.1\% \pm 10.0$, compared to those students ($n=184$) who had never taken a nutrition course. The mean score for these students was $73.7\% \pm 11.1$. The students who have not taken a nutrition course are closer to the overall mean score of $74.4\% \pm 11.1$. These results are consistent with a study conducted by Davy and et al., 2006, where it was shown that the students who took at nutrition course scored higher on the nutrition knowledge portion of the study.

**Gender Differences**

The results of the current study did not reveal a significant difference between genders, however, the scores from female participants were higher ($74.96\% \pm 11.0$) than those from male participants ($73.5\% \pm 11.3$). Even when students who had taken a nutrition course before were removed from the analysis, there was still not a significant difference (females: $74.3\% \pm 11.0$, males: $72.8\% \pm 11.2$). Results from previous research are inconsistent with regards to determining which gender is more knowledgeable about nutrition. A research study conducted by Kolodinsky et al., 2007, reported no significant difference in nutrition knowledge among genders, but overall males were more knowledgeable when compared to their female counterparts (Kolodinsky et al., 2007). The findings reported Karen Ruhl-Eidem, 2013, indicated similar scores for females and males (Ruhl-Eidem, 2013). There were two studies that did find a significant difference in nutrition knowledge among females and males. A study by Barzegari et al., 2011, showed that males are more knowledgeable, in contrast to the results reported by Davy et al., 2006, showing opposite results (Barzegari et al., 2011; Davy et al., 2006).
Differences Among Disciplines

There were slight differences among nutrition knowledge scores obtained from student enrolled in seven different disciplines. The only significant differences were between students from education and science and education and health sciences. When students that also had taken a nutrition course before were removed, there was a slight difference in the results. These findings are consistent with the studies by El-Sabban et al., 2011 and Barzegari et al., 2011. In both cases student pursing science based disciplines scored higher on nutrition knowledge than those pursing non-science based disciplines. It can be assumed that this is the case since nutrition concepts are usually included in science based.

Strengths and Limitations

Regardless of how well a study is designed there are always limitations. For the current study, one of the limitations is convenient sampling. Therefore, these results cannot be generalized to all colleges (Ruhl-Eidem, 2013). Because the sample size was not completely balanced, this could have affected the results specifically in terms of gender difference (Ruhl-Eidem, 2013). Lastly, some of the strengths of the study were the use of a highly reliable tool and access to a large sample population.

Recommendations

Based on the current findings and past research, college students from all disciplines might benefit from enrolling in a basic nutrition course that addresses the most current USDA-DGA 2015. All students exposed to nutritious concepts might have the opportunity to increase their nutrition knowledge. In the end, it is anticipated that college students will develop better
eating habits that could be practiced while in college and also later in life. Thus, potentially avoiding health related disease at a young age and/or at an older age.

**Future Research**

In general, there is a need for more research studies that looks at the health status of college students. There are a lot of factors that play a role in properly assessing college students’ overall health status and lifestyle factors that play a role. It would be beneficial to look at how the lack of balanced diet affects college students’ overall performance in their daily lives, including intellectual performances. Another topic of interests is to study the best approach of how to encourage college students to adopt a healthy lifestyle (health nutrition, physical activity, etc.) and see how these components directly influence their overall health status.
CHAPTER 6: CONCLUSION

This research aimed at describing the nutrition knowledge of college students attending a public academic institution in the U.S. - Mexico border region. Although the hypotheses of this research study yield significant differences, the overall score of the NKAT score was low, suggesting a need for all college students to enroll in an entry-level nutrition course. It is expected that students enrolled in an entry level nutrition course during their college learning experience will acquire the basic knowledge to provide a strong foundation that would allow them to follow the USDA- DGA. This is why it is vital that college students are educated and understand how to apply the USDA- DGA to their daily lives. Being knowledgeable about the Dietary Guidelines for Americans can help college students make better choices about their dietary intake in order to reduce and prevent this age group from developing poor dietary habits early in life.
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ALIGNMENT OF THIS STUDY TO MASTER OF PUBLIC HEALTH CORE COMPETENCIES

**Biostatistics:** Biostatistics is the development and application of statistical reasoning methods in addressing, analyzing and solving problems in public health; health care and biomedical, clinical and population-based research.

1. Describe the roles biostatistics serves in the discipline of public health.
2. Describe preferred methodological alternative to commonly used statistical methods when assumptions are not met.
3. Distinguish among the different measurement scales and implications for selection of statistical methods to be used based on these distinctions.
4. Apply descriptive techniques commonly used to summarize public health data.
5. Apply common statistical methods for inference
6. Apply descriptive and inferential methodologies according to the type of study design for answering a particular research question.
7. Apply basic informatics techniques with vital statistics and public health records in the description of public health characteristics and in public health research and evaluation.
8. Interpret results of statistical analyses found in public health studies.
9. Develop written and oral presentations based on statistical analyses for both public health professionals and educated lay audiences.

**Environmental:** Environmental health sciences represent the student of environmental factors including biological, physical and chemical factors that affect the health of a community.

1. Specify approaches for assessing, preventing and controlling environmental hazards that pose risks to human health and safety.

**Epidemiology:** Epidemiology is the study of patterns of disease and injury in human populations and the application of this study to control the health problems.

1. Identify key sources of data for epidemiologic purposes.
2. Describe a public health problem in terms of magnitude, person, time and place.
3. Explain the importance of epidemiology for informing scientific, ethical, economic and political discussion of health issues.

4. Draw appropriate inferences from epidemiologic data.

5. Evaluate the strengths and limitations of epidemiologic reports.

Health Policy and Management: Health policy and management is a multidisciplinary field of inquiry and practice concerned with the delivery, quality, and cost of health care for individuals and populations. This definition assumes both a managerial and a policy concern with the structure, process and outcomes of health services including the cost, financing, organization, outcomes and accessibility of care.

1. Demonstrate leadership skills for building partnerships.

Social and Behavioral Sciences: This social and behavioral sciences in public health address the behavioral and cultural factors related to individual and population health and health disparities over the life course. Research and practice in this area contributes to the development, administration and evaluation of programs and policies in public health and health services to promote and sustain healthy environments and healthy lives for individuals and populations.

1. Identify the causes of social and behavioral factors that affect health of individuals and populations.

2. Identify individual, organizational and community concerns, assets, resources and deficits for social and behavioral science interventions.

3. Describe the role of social and community factors in both the onset and solution of public health problems.

Hispanic and Border Health Concentration Competencies:

1. Identify the major chronic, infectious, and other public health challenges that face Hispanic and border communities.

2. Identify and access the major sources of public health data that pertain to Hispanic and border communities (e.g., vital statistics and disease registries, health and nutrition surveillance databases, census data, national surveys).

3. Effectively communicate information to the public and policy makers regarding the special public health challenges and needs of Hispanic and border communities.

4. Act as an effective resource person for Hispanic and border residents, organizations, and communities.
APPENDIX

Appendix 1

Informed Consent Form for Research Involving Human Subjects

Protocol Title: Nutritional Knowledge of College Students
Principal Investigator: Heather Sandford

1. Introduction

You are being asked to take part voluntarily in the research project described below. Please take your time making a decision and feel free to discuss it with your friends and family. Before agreeing to take part in this research study, it is important that you read the consent form that describes the study. Please ask the study researcher or the study staff to explain any words or information that you do not clearly understand.

2. Why is this study being done?

You have been asked to take part in a pilot study to validate (authenticate) a nutrition knowledge survey that will be used later on in a larger study. This validation is needed because this is a newly developed survey.

Approximately, 10 students (5 males and 5 females) will be asked to complete the survey follow by an interview consisting of three questions, as presented below. If you agree to participate, the feedback provided by you and other 9 students will be used to refine the survey to make it clear and understandable when implemented with a larger number of students.

You are being asked to take part in this study because you currently completing an undergraduate degree at UTEP and are 18 years or older.

If you decide to enroll in this study, your involvement will last about 20-30 minutes of your time.

3. What is involved in the study?

By signing this consent form, you are agreeing to:

1. Provide the following information:
   a. Class classification (freshman, sophomore, junior, senior)
   b. College you are currently a part of
   c. Gender (optional).

2. Answer the nutrition knowledge survey

3. Answer the three interview questions below:
   a. Were there any question(s) that you did not understand? If so which question(s) and what made it confusing?
b. Were all the questions clear and straightforward? If not which question(s) and what
made them unclear and not straightforward?
c. Do you feel the survey fully measures your nutrition knowledge and nutrition as it
relates to health? If not what suggestions do you have to make it address these
components?

4. What are the risks and discomforts of the study?

There may be a few risks participants may experience during the completion of the survey. Possible risks
include: 1) feeling anxiety or nervous while answering the nutritional knowledge survey; 2) feeling
fatigued when completing the survey; 3) become upset if the participant learns the behaviors he/she has
been engaging may increase risk of future health conditions

5. What will happen if I am injured in this study?

Affiliates do not offer to pay for or cover the cost of medical treatment for research related illness or
injury. No funds have been set aside to pay or reimburse you in the event of such injury or illness. You
will not give up any of your legal rights by signing this consent form. You should report any such injury
to and to the Institutional Review Board (IRB).

6. Are there benefits to taking part in this study?

There will be no direct benefits to you if chose to partake in this study. This research will help the
researcher to gain a better look at the college student’s nutritional knowledge, and help validate a newly
developed survey.

7. What other options are there?

You have the option to take part in this study or not. There will be no penalties involved if you choose not
to take part in this study.

8. Who is paying for this study?

There is no internal or external funding associated with this research study.

9. What are my costs?

There are no direct costs. You will be responsible for travel to and from the research site and any other
incidental expenses.

10. Will I be paid to participate in this study?
You will not be paid for taking part in this research

11. What if I want to withdraw, or am asked to withdraw from this study?

Taking part in this study is voluntary. You have the right to choose not to take part in this study. If you do not take part in the study, there will be no penalty.

If you choose to take part, you have the right to stop at any time. However, we encourage you to talk to a member of the research group so that they know why you are leaving the study. If there are any new findings during the study that may affect whether you want to continue to take part, you will be told about them.

The researcher may decide to stop your participation without your permission, if he or she thinks that being in the study may cause you harm or your data is not needed due to enough participants or incomplete survey.

12. Who do I call if I have questions or problems?

You may ask any questions you have now. If you have questions later, you may call insert

If you have questions or concerns about your participation as a research participant, please contact the Institutional Review Board (IRB).

13. What about confidentiality?

It is the goal of the researcher to maintain complete confidentiality of all participants. As a part of the validation process basic demographic information will be gathered to describe the individuals who have chosen to partake in the current study. The demographic questions will not ask any single identifying questions such as your name or social security number. More specifically the questions will ask about gender, college, and student classification. There will only be two researchers that will look through and sort all the data collected. All hard copies of the survey and this consent form will be stored in a locked file cabinet.

15. Authorization Statement

I have read each page of this paper about the study (or it was read to me). I know that being in this study is voluntary and I choose to be in this study. I know I can stop participating in this study without penalty. I will get a copy of this consent form and can get information on results of the study later if I wish.

Student initials                                      Date
Appendix 2

Participant Characteristics:

1. What is your sex/gender?
   a. Male
   b. Female
   c. Prefer not to respond

2. How old are you
   a. 18-30
   b. 31-40
   c. 41-50
   d. 50<

3. What is your ethnic origin?
   a. Caucasian/ non-Hispanic
   b. Hispanic
   c. African American
   d. Hispanic/ Caucasian
   e. Other

4. What is your major?

5. Discipline:
   Business Administration
   Education
   Engineering
   Health Sciences
   Liberal Arts
   Nursing
   Science

6. What is your class status?
   a. Freshman
   b. Sophomore
   c. Junior
   d. Senior

7. Have you taken a college level nutrition class?
   a. Yes
   b. No

8. What is your height? ________ ft. _______in
   Or
   _________m _________cm
9. How much do you weight? __________pounds

    Or

    _______kilograms

10. Has anyone in your family ever suffered from (select all that apply):
    a. Type 2 diabetes    b. High Blood pressure/ Hypertension
    c. Overweight or obesity    d. Any type of cancer
    e. Heart/ cardiovascular disease (heart attack, stroke)    f. Osteoporosis (low bone density)

11. How often are you physically active?
    a. Multiple times a week    b. Once a week
    c. Multiple times a month    d. I am not physically active
    e. Not sure
Appendix 3

Nutrition Knowledge Assessment Tool (NKAT)

The following questions align with the key recommendation from the United States Department of Agriculture (USDA) Dietary Guidelines for Americans 2010 & 2015.

1. Whole fruits and vegetables are considered nutrient dense foods.
   a. True
   b. False
   c. Not sure

2. The USDA dietary guidelines for Americans recommends that the general population eat a variety of vegetables, especially dark-green, red, and orange vegetables, beans, and peas.
   a. True
   b. False
   c. Not sure

3. Which of the following is not considered a basic food group?
   a. Vegetables
   b. Fruit
   c. Protein
   d. Grains
   e. Dairy
   f. Oils
   g. Not sure

4. Which of the following nutrient(s) is/are lacking in the American diet?
   a. Potassium
   b. Dietary fiber
   c. Calcium
   d. Vitamin D
   e. All of the above
   f. Not Sure

5. Do you think these foods are high or low in saturated fat?

<table>
<thead>
<tr>
<th>Food</th>
<th>High</th>
<th>Low</th>
<th>Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheddar cheese</td>
<td>✓</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Traditional cheese enchiladas</td>
<td>✓</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Canola oil</td>
<td>□</td>
<td>✓</td>
<td>□</td>
</tr>
<tr>
<td>Cheeseburger</td>
<td>✓</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Pecan Pie</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td>High</td>
<td>Low</td>
<td>Not sure</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>------</td>
<td>-----</td>
<td>----------</td>
</tr>
<tr>
<td>Refried beans made with lard</td>
<td>☑</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. **Do you think these foods are high or low in trans fat?**

<table>
<thead>
<tr>
<th>Food</th>
<th>High</th>
<th>Low</th>
<th>Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Popcorn with regular butter flavor</td>
<td>☑</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canned Baked Beans</td>
<td></td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Wheat bagel</td>
<td></td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Some margarines</td>
<td>☑</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greek Yogurt</td>
<td></td>
<td>☑</td>
<td></td>
</tr>
</tbody>
</table>

7. **Do you think these foods are high or low in salt/sodium?**

<table>
<thead>
<tr>
<th>Food</th>
<th>High</th>
<th>Low</th>
<th>Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh mango</td>
<td></td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Raw peppers</td>
<td></td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Tacos made with dry taco seasoning</td>
<td>☑</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canned Soup</td>
<td>☑</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. **What is considered moderate alcohol consumption?**
   a. More than 3 drinks on any day or more than 7 per week for women. More than 4 drinks on any day or more than 14 per week for men
   b. **1 drink per day for women and up to 2 drinks per day for men**
   c. Consumption of 4 or more drinks within a 2 hour period for women and 5 or more drinks within a 2 hour period for men
   d. Not sure

9. Other than drinking water and other water based beverages how can water be incorporated into the diet?
   a. **Consuming fruits and vegetables**
   b. Consuming meat
   c. Consuming grains
   d. Not sure
Consume more dark green and orange vegetables, legumes, fruits, whole grains and low-fat milk and milk products.

10. Which of the following foods are considered low fat dairy products?
   a. Skim Milk
   b. Cheddar cheese
   c. Whole milk
   d. Not sure

11. Processed meat differs from red meat?
   a. True
   b. False
   c. Not sure

12. Which of the following food(s) is/are considered a good source of fiber and protein?
   a. Rice
   b. Soy, chickpeas, lentil
   c. Oatmeal
   d. Fish, Chicken, Beef
   e. Not sure

13. Old Fashion Oatmeal considered to be a whole grain.
   a. True
   b. False
   c. Not sure

Eat fewer calories, refined grains, added sugars, and total fats. Eat foods lower in sodium.

14. Are the following foods considered high or low in refined grains?

<table>
<thead>
<tr>
<th></th>
<th>High</th>
<th>Low</th>
<th>Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole wheat bagel</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
</tr>
<tr>
<td>Donuts</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Whole wheat bread</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
</tr>
<tr>
<td>Sugar Cookies</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Flour tortillas</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

15. Do you think these foods are high or low in added sugars?

<table>
<thead>
<tr>
<th></th>
<th>High</th>
<th>Low</th>
<th>Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweetened Carbonated Soda</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Fruit Drinks</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Apples</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
</tr>
</tbody>
</table>
16. Which of the following types of fat(s) are considered a healthier choice?
   a. Saturated fats
   b. Trans fats
   c. Monounsaturated fats
   d. Not sure

Build healthy eating patterns during each stage of life - childhood, adolescence, adulthood, pregnancy and breastfeeding and older age - to meet nutrient needs and appropriate calorie amounts.

17. Which of the following is a vital nutrient that women of childbearing age need to consume on a daily basis?
   a. Vitamin K
   b. Vitamin E
   c. Vitamin A
   d. Folate
   e. Not sure

18. Compared to adults, children and adolescents need to consume more of this nutrient?
   a. Vitamin B12
   b. Calcium
   c. Vitamin D
   d. Not sure

This next section looks at health related problems or diseases

19. Select a disease(s) or health problem(s) that is/are related to low intake of fresh fruit and vegetable.
   a. Diabetes, Cardiovascular disease, Cancer
   b. Anorexia, Bulimia (type of eating disorders)
   c. Tuberculosis
   d. All of the above
   e. Not sure

20. Select a disease(s) or health problem(s) that is/are related to a low intake of fiber.
   a. Constipation
   b. Colon Cancer
   c. Diverticulitis (small pockets that project outward in the intestines)
   d. All of the above
   e. Not sure
21. Select a disease(s) or health problem(s) associated with a large consumption of sugar.
   a. Overweight or obesity
   b. Increase risk of diabetes
   c. Increase risk of cardiovascular disease
   d. All of the above
   e. Not sure

22. Select a disease(s) or health problem(s) that is related to high intake of fat.
   a. Atherosclerosis, Heart attack, Obesity
   b. Malaria
   c. Chicken pox, Shingles
   d. All of the above
   e. Not sure

23. Which of the following dietary factors are associated with increasing blood pressure?
   a. Excessive sodium consumption
   b. Being overweight or obese
   c. Low intake of potassium
   d. All of the above
   e. Not sure

24. Do you think these eating behaviors will help people reduce the chance of getting certain kinds of cancer?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating more fiber</td>
<td>✔️</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Eating less fruit</td>
<td>☐</td>
<td>✔️</td>
<td>☐</td>
</tr>
<tr>
<td>Eating more vegetables</td>
<td>✔️</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Eating more foods containing preservatives/additives</td>
<td>☐</td>
<td>✔️</td>
<td>☐</td>
</tr>
</tbody>
</table>

25. Do you think these eating behaviors help prevent heart disease?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating less fiber</td>
<td>☐</td>
<td>✔️</td>
<td>☐</td>
</tr>
<tr>
<td>Eating more sugar</td>
<td>☐</td>
<td>✔️</td>
<td>☐</td>
</tr>
<tr>
<td>Eating less salt</td>
<td>✔️</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Eating more fruit</td>
<td>✔️</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Eating more foods containing preservatives/additives</td>
<td>☐</td>
<td>✔️</td>
<td>☐</td>
</tr>
</tbody>
</table>
VITA

Before beginning the journey of my Master’s Degree in Public Health, I obtained a Bachelor’s of Science in Athletic Training from The University of Texas at Arlington (UTA). As I was completing my BS, I obtained my National Athletic Training Certification (ATC), Texas Athletic Training License (LAT), and K-12 Physical Education Teaching Certification. Soon after graduation, I received the opportunity to be a Graduate Assistant Athletic Trainer and work on Master’s Degree. During the last year of my Master’s degree I worked as a Teaching Assistant.

It was during my educational adventure at UTA that my love for nutrition developed and is presently growing. Nutrition has such an impact on an individual’s life whether they realize it or not. I believe it is vital to educate the young about why a healthy life is critical and how to apply it to their daily lives. It is hoped that the current research will decrease the gap present in the area of college students, and be of interests to many. For specific questions regarding the document please feel free to contact me with the information provided below.

This thesis was typed by Heather Sandford, BS, ATC, LAT