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# Body Mass Index Trends and Nutrition Goals of College Students between 2007-2011

Alison L. Lynn

University of Nebraska-Lincoln, [alison.metzger@gmail.com](mailto:alison.metzger@gmail.com)

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BODY MASS INDEX TRENDS AND NUTRITION GOALS OF COLLEGE  
STUDENTS BETWEEN 2007-2011

by

Alison L. Lynn

A THESIS

Presented to the Faculty of

The Graduate College at the University of Nebraska

In Partial Fulfillment of Requirements

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Major: Nutrition & Health Sciences

Under the Supervision of Professor Wanda Koszewski

Lincoln, Nebraska

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BODY MASS INDEX TRENDS AND NUTRITION GOALS OF COLLEGE  
STUDENTS BETWEEN 2007-2011

Alison Leigh Lynn, M.S.

University of Nebraska, 2012

Adviser: Wanda M. Koszewski

The incidence of overweight and obesity has become a major public health concern in the United States. The college years are a time during which many dietary and physical activity habits are formed. Health professionals on college campuses have the ability to reach large numbers of people and provide nutrition education to help reduce the rising rates of obesity. The purpose of this study is to examine the body mass index (BMI) trends of college students at the University of Nebraska-Lincoln, between the years 2007-2011 and to determine the nutrition-related goals of these students. Data was previously collected from NUTR 100 students (n=2353) as part of a class assignment. This data revealed increasing body mass index with increasing age for both males and females. Sixteen themes emerged from the nutrition goals including decreasing a specific food or type of food, increasing a specific food or type of food, physical activity, healthier eating habits, healthy lifestyle/being healthy, weight goals, balanced and varied diets, increasing muscle mass or strength, snacking, body composition, health conditions, mental or emotional-related goals, appearance, and having no goal.

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## Chapter 1: Introduction

College can be an exciting time filled with new-found independence and self-discovery; however, there also comes increased responsibility, including making one's own health decisions that may have lasting impacts on health. While this is an important time it can also be difficult for many college students.<sup>1</sup>

Dr. Jeffrey Jensen Arnett<sup>2</sup> classifies the ages of 18-25 as “emerging adulthood.” He describes this period as a time where young people transition from adolescence to adulthood and begin developing views and behaviors, which will carry into adulthood.<sup>2</sup> During this time the development of self-identity, changing support systems, and the shifting of interpersonal influences occur and set this life stage apart from adolescence and adulthood.<sup>3</sup>

Nelson et al. suggest that the college years have traditionally been considered a time of “optimal health and well-being”,<sup>3</sup> however, dietary and physical activity habits, which may be developed during the college years, can affect the development of chronic disease. In fact, the Centers for Disease Control and Prevention (CDC)<sup>4</sup> has highlighted poor nutrition and lack of physical activity as two modifiable risk factors that contribute to the development of chronic disease. In addition, other factors such as alcohol use, unhealthy weight practices, stress, and sleep loss may affect health.<sup>3</sup> Rates of overweight and obesity have been found to be near 40% in college students, however only 51% believed they were overweight.<sup>5</sup> This suggests that overweight and obese college students may not be aware of the increased health risk associated with overweight and obesity.<sup>5</sup>



Only 8.5% of college students were found to consume the recommended amount of fruits and vegetables<sup>6</sup> and on average, consumed 18 grams of fiber per day,<sup>7</sup> below the recommendations. Many college students also do not have variety in their diets and report eating similar types of foods everyday.<sup>8</sup> There are many factors influencing dietary habits, including food and beverage marketing which often targets college students and promotes late-night eating and inexpensive options to appeal to this audience.<sup>3</sup> College students participate in aerobic exercise an average of 2.8 days per week, and time spent exercising tends to decrease in older students.<sup>7</sup> In addition, sedentary activities, such as watching television, prevent college students from participating in physical activity more often.<sup>9</sup>

Colleges and universities can impact the health behaviors of young adults through nutrition education and programming at this critical age. Many colleges and universities have health services and campus recreation centers which are a prime setting for nutrition education to occur. However, due to the many factors affecting dietary and physical activity habits of college students, these programs should be developed with the goals of college students in mind. Currently, there is limited available research on the nutrition and physical activity goals of college students. Therefore, the purpose of this study is to examine the body mass index (BMI) trends and determine the nutrition-related goals of college students at the University of Nebraska-Lincoln.

## Chapter 2. Review of Literature

### Obesity

Obesity is a growing health concern in the United States, as rates have continued to rise over the past twenty years.<sup>10</sup> In 1994, all fifty states had obesity prevalence rates of less than 19%, but by 2010 no state had rates less than 20%, with many higher than 30%.<sup>10</sup> The CDC defines overweight and obesity as “ranges of weight that are greater than what is generally considered healthy for a given height” and which may “increase the likelihood of certain diseases and other health problems.”<sup>11</sup> Body mass index (BMI) is commonly used to determine overweight and obesity. It is calculated as weight in  $\text{kg/m}^2$  or  $\text{lb/in}^2$  using the following equation<sup>11</sup>:

$$\text{BMI} = \frac{\text{weight (kg)}}{\text{height (m)}^2}$$

To interpret BMI, ranges have been associated with weight status as follows<sup>12</sup>:

- Underweight:  $<18.50 \text{ kg/m}^2$
- Normal range:  $18.50\text{-}24.99 \text{ kg/m}^2$
- Overweight:  $25.00\text{-}29.99 \text{ kg/m}^2$
- Obese:  $\geq 30.00 \text{ kg/m}^2$ 
  - Obese class I:  $30.00\text{-}34.99 \text{ kg/m}^2$
  - Obese class II:  $35.00\text{-}39.99 \text{ kg/m}^2$
  - Obese class III:  $\geq 40.00 \text{ kg/m}^2$

### Chronic Disease and Obesity

As stated in the Surgeon General’s call to action to prevent and decrease overweight and obesity,<sup>13</sup> “the primary concern of overweight and obesity is one of

health and not appearance.” A major concern related to obesity is its relationship with chronic disease development. Most notably, overweight and obesity have been associated with an increased risk of the development of hypertension, dyslipidemia, type 2 diabetes, coronary heart disease, stroke, and cancer, specifically colon, breast, endometrial, and gallbladder cancers.<sup>14</sup> This is of particular concern to the college student population because, as will be seen, habits developed during the college years have been shown to impact chronic disease development later in life.

Metabolic syndrome is defined by the National Heart, Lung, and Blood Institute as a “group of risk factors that raise your risk for heart disease and other health problems, such as diabetes and stroke” and is on the rise as the prevalence of obesity continues to increase.<sup>15</sup> To be diagnosed with metabolic syndrome, one must present with at least 3 of the following risk factors: a waist circumference greater than 35 inches for women and 40 inches for men, triglyceride levels greater than 150 mg/dL, high-density lipoprotein (HDL) cholesterol levels below 40 mg/dL for men, or below 50 mg/dL for women, blood pressure greater than 130/85 mm Hg, and blood glucose levels greater than 100 mg/dL.<sup>16</sup> Almost one third of college students have been seen to have at least one risk factor for metabolic syndrome.<sup>17,18</sup> Morrell, Lofgren, Burke, and Reilly<sup>13</sup> found that college students with BMIs of 30 kg/m<sup>2</sup> or greater exhibited significantly more metabolic syndrome risk factors than did those with BMIs between 18.5 kg/m<sup>2</sup> and 29.9 kg/m<sup>2</sup>. In addition, the number of risk factors was seen to increase as BMI increased.<sup>19</sup> These findings reinforce that chronic disease risk is high in obese individuals, even in those as young as 18 to 24 year olds, thus increasing risk for chronic disease development.

In a study of the BMIs and lipid profiles of college students with a mean age of 21.85 years, many overweight and obese students were found to already have elevated blood pressure, low-density lipoproteins (LDL), total cholesterol to HDL ratio, suggesting an increased risk of cardiovascular disease.<sup>20</sup> Although this is expected in overweight and obese adults, it is notable that these risks are occurring in the college population.

Similarly, the Coronary Artery Risk Development in Young Adults (CARDIA) study<sup>21</sup> followed a cohort of men and women ages 18 to 30 years for twenty years to determine if lipid levels at younger ages would have consequences later in life, such as atherosclerosis. Researchers found a strong correlation between LDL cholesterol levels during young adulthood and coronary calcium, a measure of coronary artery disease, 15 to 20 years later.<sup>21</sup> These results suggest that “atherosclerotic changes begin during young adulthood as a result of commonly observed nonoptimal lipid levels, that these changes persist into middle age, and that maintaining optimal levels of lipids (particularly LDL cholesterol) throughout young adulthood could provide substantial benefits in terms of lifetime CHD (coronary heart disease) prevention”.<sup>21</sup> Once again, this study reinforces the impact that dietary and physical activity habits in young adulthood have on health later in life.

### **College Students and Obesity**

Data from the National Longitudinal Study of Adolescent Health (Add Health)<sup>22</sup> showed that obesity rates were increasing as participants moved from adolescence to adulthood, while only a small percentage moved from being classified as obese to not

obese. In an effort to improve the health of college students, the American College Health Association created the Healthy Campus 2010 objectives, including nutrition and overweight as a focus area along with physical activity and fitness.<sup>23,24</sup> Yet, a study<sup>25</sup> performed in 2008 found that the BMIs and physical activity levels of a sample of college students were still not meeting, or even close to, the objectives. Twenty-six percent of students participated in moderate physical activity and 17.5% in vigorous physical activity at least three times per week as was suggested by the physical activity objective, falling short of the 55% goal.<sup>25</sup> Similarly, 25.6% of students had BMIs which fell into the overweight and obese range, above the objective's goal of 16%.<sup>25</sup> Similar rates of overweight and obesity have been found in other research,<sup>1,26-29</sup> as well as an increase in overweight and obesity between freshman and senior years of college.<sup>30</sup> Males have been seen to be more likely to be overweight or obese compared to females.<sup>31</sup>

The idea of weight gain during the college years is not a new phenomenon. The infamous "Freshman 15" is the idea that students will gain fifteen pounds during their first year of college.<sup>32</sup> However, research does not support the notion that college students will gain fifteen pounds in the first year of college, but has shown more modest weight gains<sup>33-37</sup> A meta-analysis by Vella-Zarb and Elgar<sup>32</sup> found mean weight gains to range from 1.6 pounds to 8.8 pounds during freshman year, with a mean weight gain of 3.86 pounds. Although this weight is significantly less than the mythical "freshman 15", it should still be considered a notable weight gain. A weight gain of this size, if continued throughout college, could result in a significant weight gain and increased BMI.

The “Freshman 15” appears to be a widely known idea; however, Smith-Jackson and Reel<sup>38</sup> found that most college women realized that the typical weight gain is less than fifteen pounds. They also found that attitudes about the “Freshman 15” ranged from believing it to be a joke to being extremely preoccupied and fearful of weight gain.<sup>38</sup> This implies the importance of education about healthy weight management strategies in the college setting.

### **Dietary and Physical Activity Behaviors of College Students**

The big question remains: What is causing college students to gain weight? Many factors contribute to weight gain. Dietary and physical activity behaviors will be the focus here.

During the transition from childhood to young adulthood, changes in diet have been documented which show a decrease in quality and consumption of nutrient-dense foods.<sup>39</sup> The diets of college students are not meeting government recommendations<sup>26,29</sup> and nutrition is an area which proves difficult for many college students.<sup>40</sup> Particularly, fruit and milk intake were seen to decrease.<sup>41</sup>

Anding, Suminski, and Boss<sup>26</sup> found that most college women met the recommendations for at least one food group but none met recommendations for all food groups. Specifically, recommendations for meat were being met, but not recommendations for grains, fruits, vegetables, and dairy.<sup>26</sup> The American College Health Association-National College Health Assessment (ACHA-NCHA)<sup>6</sup> data from spring 2008 found that only 8.5% of students consumed five or more servings of fruits and vegetables per day. Li et al.<sup>42</sup> found that while females tended to have healthier overall

diets than males, they were lacking in fiber, fruit, and vegetable consumption, while males had higher fat intakes. DeBate, Topping, and Sargent saw significantly higher intakes of dairy and meat in males compared to females.<sup>43</sup>

Another study found that males did not meet the recommendations for fruits and milk while females did not meet recommendations for vegetables, fruits, and meat.<sup>44</sup> All students, regardless of age, were found to consume below the recommendations of fruits, milk, and meat, however older student consumed fewer servings of these foods per day compared to younger students.<sup>44</sup> With regard to specific nutrients, both males and females consumed sufficient amounts of vitamins A, C, and B<sub>6</sub>, folate, and iron.<sup>44</sup> Females tended to have low intakes of calcium.<sup>44</sup>

African-American students were less likely than white students to meet recommendations for fruits, vegetables, grains, and dairy, however were more likely to meet recommendations for meat.<sup>43</sup> Fast food consumption is high in college students with 32% of students reporting they eat fast food often, 42% sometimes, and only 27% eating fast food rarely or never.<sup>43</sup> African-Americans were seen to eat fast food more frequently than white students.<sup>43</sup>

Differences in dietary habits exist between students with different BMIs. Students with higher BMI scores tended to eat more meat, specifically pork, lamb, veal, and game.<sup>45</sup> Those with lower BMI scores tended to consume higher amounts of vegetables, specifically green leafy vegetables.<sup>45</sup>

Whole grain intake was also seen to differ between BMI classifications. On average, college students were found to consume 5.4 servings of grains per day with 13% of grain intake made up of whole grains, mainly coming from ready-to-eat cereals and

wheat bread.<sup>46</sup> Overall grain intake was not different across BMI classifications, however normal weight students had significantly higher intakes of whole grains than overweight or obese students. Similarly, fiber intake was significantly higher in normal weight students compared to overweight and obese students.<sup>46</sup>

There are often many options for purchasing food on college campuses. Boek et al.<sup>47</sup> found that the majority of students preferred purchasing food from on-campus food courts over other options, followed by on-campus convenience stores, cafes, and buffet-style dining halls. Males and those of races other than white more often preferred eating at on-campus dining halls more often, while females were more likely to prefer on-campus cafes.<sup>47</sup> Even with many food options, 76% of college students reported that they ate the same types of foods every day.<sup>48</sup> This was seen especially in students living on-campus.<sup>48</sup>

Sugar-sweetened beverages often contain high amounts of calories and are popular drinks. 65% of undergraduate students reported consuming sugar-sweetened beverages every day, including soda, fruit drinks, energy drinks, sport drinks and sweet tea.<sup>49</sup> Researchers estimated this contributed an average of 542 calories per day.<sup>49</sup> Soda was the most commonly reported sweetened beverage consumed, however on occasions when fruit juice was consumed, students tended to take in higher amounts.<sup>49</sup> Gender and age were associated with sugar-sweetened beverage intake. Males and students over 21 years consumed more calories from sugar-sweetened beverages than females and students younger than 21 years.<sup>49</sup>

Only 36.6% of college students reported consuming breakfast always or often.<sup>43</sup> 44.25% ate breakfast rarely or never.<sup>43</sup> Dinner and lunch appear to be consumed most



regularly, being eaten 90.2% and 81% of the time, respectively.<sup>43</sup> Breakfast and dinner were more often prepared and eaten at home compared to lunch, which was more likely to be eaten on campus.<sup>43</sup>

Alcohol consumption may also increase during college, as it is a common part of social gatherings and interactions for many students. Zakletskaï, Wilson, and Fleming<sup>50</sup> found that 57% of students participated in “at-risk” drinking behaviors, defined by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) as seven or more drinks per week for women or fourteen or more for men, or five drinks in a row on a single occasion.

Many students report consuming increased amounts of food when consuming alcohol.<sup>44</sup> In response to increased calorie intake through alcohol consumption, students may take action to try and make up for these additional calories in the days following alcohol consumption.<sup>51</sup> These include eating low-calorie or low-fat foods, exercising, eating less, skipping meals, and less commonly, skipping a full day of eating, vomiting, use of diet pills, diuretic and laxative use.<sup>51</sup>

Physical activity behaviors of college students have also been an area of interest for researchers, and for good reason. Sparling and Snow<sup>52</sup> found that there was a correlation between physical activity habits of participants during their senior year of college and habits six years after graduation. Most who participated in physical activity regularly during their senior year continued after graduation, while those who were not physically active during their senior year remained inactive, suggesting that these behaviors developed during college can influence habits throughout life.<sup>52</sup>

Differences exist between aerobic and strength training exercise as well. Huang et al.<sup>7</sup> found that college students participated in aerobic exercise 2.8 days per week, with males being more likely to take part in aerobic exercise. Students 20 years of age or older were less likely to participate in aerobic activity.<sup>7</sup> The average days per week that college students participated in strength training was found to be 2.2, with students 20 years of age or older being less likely to engage in strength training activities.<sup>7</sup>

Overall, physical activity levels tend to decrease between high school and college, while sedentary activities such as studying, using the computer, and watching television increased.<sup>41</sup> Those who gained weight during the first six months of college reported having decreased levels of physical activity during the first 3 months of college compared to when in high school.<sup>53</sup> Students reported an average of thirty hours a week of sedentary behaviors.<sup>9</sup> Older students tended to spend more time using the computer while younger students reported participating in more days of physical activity.<sup>9</sup> Watching television was seen to compete with physical activity as students who watched more television were less likely to have spent time doing physical activity.<sup>9</sup>

Decreased physical activity plays an important role in weight gain. A study aimed at tracking behavior changes related to weight gain in freshmen women found that women who both gained and lost weight during their freshman year of college both reduced their caloric intake during that year.<sup>54</sup> However, differences in physical activity behaviors between those who gained and those who lost weight were seen.<sup>54</sup> Those who gained weight decreased caloric intake as well as physical activity. Those who lost weight decreased caloric intake and initially decreased physical activity, however, increased their physical activity part way through their freshman year.<sup>54</sup> These findings

suggest that physical activity is playing an important role in weight gain during the first year of college.<sup>54</sup> A different study showed that 80% of college student participants reported using physical activity as a means for controlling weight, however, 32% of these participants did not regularly participate in physical activity as needed for weight loss or maintenance.<sup>55</sup>

Lowry et al.<sup>29</sup> found that 37.6% of undergraduate college students surveyed participated in vigorous physical activity at least three times per week and 29.9% participated in strength training or moderate physical activity five or more times per week. These numbers show that the majority of college students are not meeting recommendations for physical activity, which currently state that adults ages 18-64 need at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity physical activity in combination with strength exercises each week.<sup>56</sup> Females were less likely than males to participate in physical activity<sup>29</sup> and those with a BMI 25 or more were less likely than those with a BMI of less than 25 to participate in physical activity.<sup>34</sup> Physical activity also seems to decrease with increasing age.<sup>7</sup> Alarming, the trend seems to be that physical activity is decreasing, while BMI increasing.

### **Factors Affecting Dietary and Physical Activity Behaviors of College Students**

Nutrition and physical activity-related goals are common among college students, suggesting that the desire for improvement exists.<sup>57</sup> Qualitative studies have investigated students' perceived influences of dietary and physical activity behaviors. Busy schedules, lack of time, struggles with time management, and social eating have been identified as common factors.<sup>57</sup> In addition, anxiety about the transition from living with

one's family to being independent, as well as boredom, loneliness, and stress also influence behavior.<sup>57-59</sup>

The fear of gaining weight in college, possibly stemming from seeing weight gain in other college students, may negatively affect behaviors.<sup>59</sup> Some students reported weight gain as “inevitable” and felt they should “relish in it” or “live it up”.<sup>38</sup> Smith-Jackson and Reel<sup>38</sup> suggest this may be due to popular media coverage, which often fails to diminish the validity of the “Freshman 15” myth.<sup>60</sup>

Factors which influence students to eat a food were found to be, most strongly, taste, followed by convenience and low cost.<sup>47</sup> Factors which influence students to dislike a food were found to be, most strongly, poor taste, followed by poor quality, poor nutrition, and high cost.<sup>47</sup> Racial differences were found, showing that white students were more likely to consider poor nutrition a negative influence compared to students of races other than white who were more strongly influenced by poor taste, high cost, and poor quality.<sup>47</sup>

Living arrangements may also play a role. In a study by Boyle & LaRose,<sup>5</sup> overweight and obese students were found to be more likely to live off campus. Brunt, Rhee, and Zhong also found that students who lived off-campus were more often overweight or obese compared to those who lived on-campus or with parents.<sup>45</sup> For students living in on-campus housing, food is readily available and cafeterias may include all-you-can-eat buffets.<sup>1,59</sup> Some students see university dining services as a barrier to eating healthy, while others felt that this helped promote healthy eating.<sup>57</sup> This suggests the need for and importance of nutrition education to give knowledge and empower students to make healthful food choices. Ease of access and social outings can

lead to increased fast-food consumption,<sup>38,59</sup> while limited budgets prevent students from purchasing more healthful foods.<sup>57</sup>

Marketing strategies of food and beverages often target young adults. Nelson et al.<sup>3</sup> report that many fast food restaurants have specifically geared their marketing toward promoting late-night eating and inexpensive options, such as Taco Bell's "Fourth Meal" which promotes late night eating, to appeal to young adults including college-aged individuals.

Students attending 4-year colleges were seen to have better dietary habits than students attending 2-year colleges and nonstudents, however they still were not meeting dietary recommendations.<sup>61</sup> While this group reported higher accessibility to healthful foods, they also reported the higher accessibility to unhealthy foods than students attending 20-year college students and nonstudents.<sup>61</sup> This suggests that while student status seems to play a role, there is still a need for education in all groups.<sup>61</sup>

Greene et al.<sup>62</sup> identified three clusters of college students who were at increased disease risk. The first cluster included students who had few weight-related concerns, low presence of emotional and uncontrolled eating, and high eating competence. This group had the lowest BMI and waist circumferences however, also had the lowest intakes of fruits and vegetables and the least vigorous physical activity of the three clusters. These students were considered to be psychologically secure but still in need of health education.<sup>62</sup> The second cluster was deemed behaviorally competent, having the highest fruit and vegetable intake and more vigorous physical activity of the three groups. However, females in this cluster were likely to have weight loss goals despite having BMI scores in the normal range, which may have motivated their diet and physical

activity habits.<sup>62</sup> The third cluster was considered high risk and had the highest BMI and waist circumferences along with low fruit and vegetable intake, putting them at higher risks of disease. This group had higher weight loss goals than the other clusters and was also seen to be more susceptible to emotional eating and psychological/emotional distress.<sup>62</sup> Similarly, different influences also exist between normal weight and overweight students. Boyle and LaRose<sup>5</sup> found that dietary and physical activity habits of overweight students were influenced by the environment and support systems within that environment while normal weight students were affected more strongly by personal beliefs, such as their confidence to make healthy food and physical activity decisions.<sup>5</sup> These findings suggest that the many factors are influencing dietary and physical activity habits and educational programs may need to be designed with this in mind.

Negative experiences at campus recreation facilities can discourage physical activity. Students refrain from using campus recreation facilities due to them being overcrowded, seeing them as intimidating, and confusion about how to become involved with campus recreation activities such as intramurals.<sup>59</sup> Unfavorable weather is also a barrier to physical activity, and when combined with a lack of use of campus recreation facilities, physical activity options are few.<sup>59</sup>

### **Campus-Based Nutrition Education Programs**

A semester long general nutrition class was seen to increase fruit and vegetable intake in college students, which prior to the class had been measured to be less than optimal.<sup>63</sup> Although intake was still less than the current recommendations, consumption of fruits and vegetables increased significantly over the fifteen-week period during which

the class took place.<sup>63</sup> Additionally, these results were seen across all majors, living arrangements, gender, and year in college.<sup>63</sup> Another class-based intervention was shown to increase both the amount of whole grains consumed by students and the proportion of students who consumed some whole grains.<sup>64</sup> Thus, nutrition classes may be an effective way to deliver nutrition education.<sup>63</sup>

Internet-based interventions have also been studied. Gow, Trace, and Mazzeo<sup>65</sup> implemented an internet intervention to prevent weight gain in freshmen students. Three treatments were administered. The first group was weighed weekly and given a graph showing their changes in weight. The second group took part in six intervention sessions delivered over the internet including self-assessments, group discussions, and homework assignments. The third group received both of these treatments. At the end of the intervention, students who had received both treatments had significantly lower BMI scores than those who received only one intervention or were part of the control group.<sup>65</sup> This suggests that interventions should use multiple components to improve success.<sup>65</sup>

Improving a students' confidence to make healthy choices was the focus of a nutrition education intervention for college female athletes.<sup>66</sup> This study found that following the intervention, consisting of 8 educational sessions, students had not only increased knowledge but an increase in their confidence to make healthy food choices.<sup>66</sup> Similarly, Poddar, Hosig, Anderson, and Nickols-Richardson<sup>67</sup> showed increased self-efficacy for dairy intake in college students following a 5-week web-based intervention. This is important because not only do students need to know what choices to make, but also feel that they have the ability to make these healthy dietary choices.

Peer educators also have been seen to have a positive impact on college students.<sup>68</sup> White et al.<sup>68</sup> found that those who met with peer educators decreased unhealthy weight management behaviors.

As can be seen, many approaches can be taken regarding nutrition education for college students. Class-based, web-based, and peer education have been seen to be successful. In addition, using multiple intervention techniques may be beneficial. Improving nutrition knowledge, behavior, and self-efficacy have previously been included in interventions with positive results.

## **Conclusion**

While many barriers exist for college students, they are not impossible to overcome. Students with increased nutrition knowledge have been seen to have more healthful eating habits.<sup>59</sup> By learning what college students desire to learn about and what their goals are, colleges and universities can better create and promote activities, programs, and educational opportunities. The U.S. Census Bureau<sup>69</sup> estimated 19.7 million students to be enrolled in colleges and universities during the 2011-2012 school year. In 2009, 50% of all 18- and 19-year olds were enrolled in colleges or universities.<sup>69</sup> This provides a huge opportunity to reach a large portion of the United States' population. By educating college students on the health risks of overweight and obesity, how lifestyle habits at this age can affect health later in life, and skills for making appropriate health decisions, an enormous impact could be made on the health of the United States. Therefore, the purpose of this study was to examine the BMI trends of college students at the University of Nebraska-Lincoln, over the years 2007-2011, by sex and age and to



determine the nutrition-related goals of these students. Three research questions were developed for this study:

1. What are the BMI trends between 2007-2011 based on age and sex?
2. What were the nutrition-related goals of college students during these years?
3. Is there a relationship between BMI and nutrition-related goals?

## Chapter 3: Methods

### Data Collection

Data from previously administered questionnaires which had been given to students at the University of Nebraska-Lincoln was used for this study. The information used includes self-reported age, height, weight, and answers to the question “Do you have any nutrition related goals? Explain.”

Participants for this study were taken from male and female students attending the University of Nebraska-Lincoln who completed the Weight History Questionnaire (Appendix A) between 2007 and 2011. These students were enrolled in the class NUTR 100: Nutrition, Exercise and Health. NUTR 100 is open to students of any major and class standing at the University of Nebraska-Lincoln, but is a required course for many majors in the College of Education and Human Sciences. It is taught by professors in the Department of Nutrition and Health Sciences each semester. The questionnaire, assigned at the beginning of the semester, was given to students in class, completed at home, and returned to the professor during a later class period. This was a required assignment and students were awarded points for returning the completed questionnaire. This sample includes 1,474 females and 879 males.

Approval by the Institutional Review Board (IRB) at the University of Nebraska was obtained (Appendix B). Information from the Weight History Questionnaire had previously been entered into a Microsoft Excel spreadsheet and separated by gender, year data was collected, and sorted by ascending age. The information in these spreadsheets was used for analysis in this study. No identifying information is included in the spreadsheets.

## Data Analysis

### *Quantitative*

Body Mass Index (BMI) was calculated using the formula  $\frac{\text{Body weight (lbs.)}}{\text{Height (in.)}^2} \times 703$ , using self-reported height and weight from the Weight History Questionnaire. Participants were placed into one of five groups based on BMI classification from the World Health Organization (WHO)<sup>12</sup> Table 3.1 further shows the breakdown of BMI requirements for each group. The Nebraska Evaluation and Research (NEAR) Center was consulted to determine trends in the data. SPSS version 20 was used to conduct the analysis of variance (ANOVA).

**Table 3.1: BMI Classification Groups**

Group	BMI (kg/m <sup>2</sup> )
Underweight	<18.50
Normal Weight	18.50-24.99
Overweight	25.00-29.99
Obese I	30.00-34.99
Obese II	≥35.00

### *Qualitative*

The Microsoft Excel spreadsheets containing the data were converted into Adobe Acrobat Portable Document Format (PDF) files and imported into ATLAS.ti 7. Nutrition goals were coded using ATLAS.ti 7 to determine emerging themes. Another graduate student from the Nutrition & Health Sciences department at the University of Nebraska-

Lincoln coded 247 (10%) of the nutrition goals to reduce bias and validate the results. Codes were then grouped into themes which described the nutrition goals that were found in the data. The researcher analyzed these codes based on gender (male and female), age ( $\leq 18$ , 19, 20, 21, and  $\geq 22$  years), and BMI classification (underweight, normal weight, overweight, obese I, and obese II) to determine if participants in each of these groups made certain nutrition goals. The total number of participants in each group, as well as the total number of times each theme was mentioned was considered when determining trends.

## Chapter 4: Results

### Demographic Data

There were 2,353 total participants. Demographic data was determined for gender, age, and BMI classification. This data is presented in Table 4.1.

**Table 4.1. Demographics**

Demographic	Number of participants (% of total)		
<i>Gender</i>			
Male	879 (37.3%)		
Female	1,474 (62.7%)		
<i>BMI Classification</i>	<i>Total</i>	<i>Male</i>	<i>Female</i>
Underweight	75 (3.2%)	6	69
Normal Weight	1,553 (66.0%)	478	1075
Overweight	534 (22.7%)	310	224
Obese I	129 (5.5%)	60	69
Obese II	55 (2.3%)	20	35
Unknown BMI*	7 (.30%)	3	4
<i>Age</i>	<i>Total</i>	<i>Male</i>	<i>Female</i>
≤18 years	733 (31.2%)	226	507
19 years	671 (28.5%)	269	402
20 years	361 (15.3%)	126	235
21 years	214 (9.1%)	97	117
≥22 years	374 (15.9%)	161	213

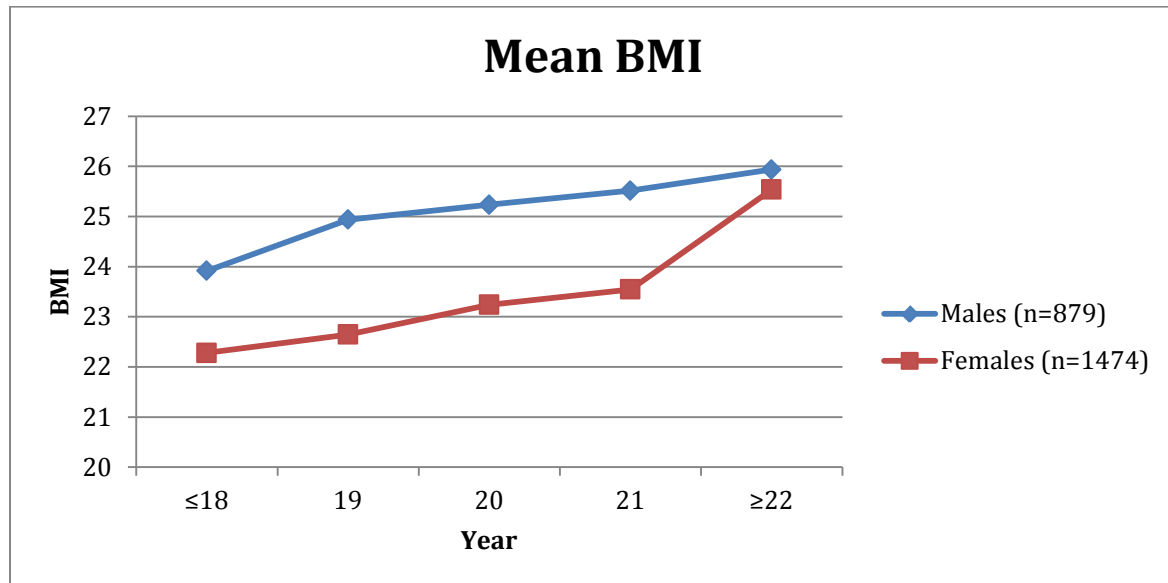
\*BMI was undeterminable because weight was not provided by the participant.

## Quantitative Results

The mean BMI of all males over the five-year period was 24.96 kg/m<sup>2</sup>. The mean BMI of all females over the five-year period was 23.10 kg/m<sup>2</sup>. Overall mean BMI of combined males and females over the five-year period was 23.796 kg/m<sup>2</sup>. BMI for males and females at each age group ( $\leq 18$ , 19, 20, 21, and  $\geq 22$  years) are presented in Table 4.2. Figure 4.1 depicts the trend in mean BMI seen by both males and females at each age group.

**Table 4.2. Mean BMI Based on Age and Gender**

	Mean BMI (kg/m <sup>2</sup> )	Standard Error
<b><i><math>\leq 18</math> years</i></b>		
Males	23.915	0.280
Females	22.279	0.187
<b><i>19 years</i></b>		
Males	24.936	0.257
Females	22.645	0.210
<b><i>20 years</i></b>		
Males	25.235	0.375
Females	23.241	0.275
<b><i>21 years</i></b>		
Males	25.515	0.428
Females	23.546	0.389
<b><i><math>\geq 22</math> years</i></b>		
Males	25.937	0.332
Females	25.538	0.289

**Figure 4.1. Mean of Males and Females BMI by Age**

Males had significantly higher BMI scores in each age group than did females of the same age in every age group except that of  $\geq 22$  years. The mean differences between males and females in each age group are shown in Table 4.3.

**Table 4.3 Mean BMI differences between males and females in each age group**

Age Group	Mean BMI Difference (kg/m <sup>2</sup> ) between males and females
≤18 years	1.637*
19 years	2.290*
20 years	1.993*
21 years	1.969*
≥22 years	.399

\*The mean difference is significant ( $p \leq 0.05$ ).

Males less than 18 years of age had significantly ( $p \leq 0.05$ ) lower BMI scores than all other male age groups. Nineteen-year-old males had lower BMI scores than 20, 21, and  $\geq 22$  year old males, however were only significantly lower than  $\geq 22$  year old males. Twenty-year-old males had lower BMI scores than 21 and  $\geq 22$  year old males, however they were not significantly lower. Twenty-one-year-old males had lower BMI scores than  $\geq 22$  year old males; however they were not significantly lower. This data showed that the only significant ( $p \leq 0.05$ ) increase in BMI between consecutive age groups occurred between 18 and 19 year old males. However, the trend showed increasing BMI with age and a significant ( $p \leq 0.05$ ) increase in BMI between male age groups of  $\leq 18$  years and  $\geq 22$  years. This data can be seen in Table 4.4.

Females less than 18 years of age had significantly ( $p \leq 0.05$ ) lower BMI scores than all other age groups except 19-year-old females. Nineteen-year-old females had lower BMI scores than 20, 21, and  $\geq 22$  year old females, but were significantly ( $p \leq 0.05$ ) lower only for the difference between 19 and 21 years and 19 and  $\geq 22$  years. Twenty-year-old females had lower BMI scores than 21 and  $\geq 22$  year old females but were only significant ( $p \leq 0.05$ ) for the difference between 20 and  $\geq 22$  year old females. Twenty-one-year-old females had significantly lower ( $p \leq 0.05$ ) BMI scores than  $\geq 22$  year old females. This data showed that females did not have a statistically significant increase ( $p \leq 0.05$ ) in BMI between consecutive age groups except between 21 and  $\geq 22$  year olds. As was seen with males, the trend showed increasing BMI with age. Females also had a significant increase ( $p \leq 0.05$ ) in BMI between the age groups of  $\leq 18$  and  $\geq 22$  years. This data can be seen in Table 4.5.



**Table 4.4. Male Mean BMI Differences Between Age Groups**

Age Group	Comparison Age Group	Mean BMI Difference (kg/m <sup>2</sup> )	Level of Significance*
≤18 years	19 years	-1.020*	.007
	20 years	-1.319*	.005
	21 years	-1.600*	.002
	≥22 years	-2.022*	.000
19 years	≤18 years	1.020*	.007
	20 years	-.299	.511
	21 years	-.579	.246
	≥22 years	-1.002*	.017
20 years	≤18 years	1.319*	.005
	19 years	.299	.511
	21 years	-.280	.622
	≥22 years	-.702	.161
21 years	≤18 years	1.600*	.002
	19 years	.579	.246
	20 years	.280	.622
	≥22 years	-.422	.435
≥22 years	≤18 years	2.022*	.000
	19 years	1.002*	.017
	20 years	.702	.161
	21 years	.422	.435

\*The mean difference is significant at  $p \leq 0.05$ .

**Table 4.5. Female Mean BMI Differences Between Age Groups**

Age Group	Comparison Age Group	Mean BMI Difference	Level of Significance*
≤18 years	19 years	-.367	.193
	20 years	-.963*	.004
	21 years	-1.268*	.003
	≥22 years	-3.259*	.000
19 years	≤18 years	.367	.193
	20 years	-.596	.085
	21 years	-.901*	.042
	≥22 years	-2.893*	.000
20 years	≤18 years	.963*	.004
	19 years	.596	.085
	21 years	-.305	.522
	≥22 years	-2.297*	.000
21 years	≤18 years	1.268*	.003
	19 years	.901*	.042
	20 years	.305	.522
	≥22 years	-1.992*	.000
≥22 years	≤18 years	3.259*	.000
	19 years	2.893*	.000
	20 years	2.297*	.000
	21 years	1.992*	.000

\*The mean difference is significant at  $p \leq 0.05$ .

There were no trends seen between BMI and the year the data was collected. Data collected during 2009 was significantly lower ( $p \leq 0.05$ ) than every other year, but no other significant differences existed and there was no upward or downward trends seen.

## Qualitative Results

Participants for the qualitative portion were the same that were examined for the quantitative portion. There was no qualitative data available for 455 participants. Therefore, responses from 1,898 participants were evaluated for the qualitative portion of this study.

Many themes emerged from the qualitative data studied. The question which was explored was “Do you have any nutrition related goals? Explain.” from the Weight History Questionnaire (Appendix A). Participants were not required to provide an answer, so 133 participants left the question blank. 1,765 participants provided one or more answers. Seven themes emerged strongly from this data including goals related to decreasing a specific food or type of food, increasing a specific food or type of food, physical activity, healthier eating habits, healthy lifestyle/be healthy, weight goals, and balanced and varied diets. Seven other themes did not emerge with as many responses as those previously mentioned, but were still notable. These include goals related to increasing muscle mass or strength, snacking, body composition, health conditions, mental or emotional-related goals, appearance, and having no goal. Each theme is described below.

***Decrease a Specific Food or Type of Food.*** Across all genders, age groups, and BMI classifications with the exception of obese I, decreasing a specific food or type of food emerged as a nutrition goal. Foods that were mentioned to be decreased include junk food or sweets/desserts, soda, sugar consumption, fat, eating out or fast food, and carbohydrates. Other less commonly mentioned but notable responses include meat, caffeine, processed foods, and fried foods.

Participants stated their goals in a variety of ways. Some participants wanted to cut out a food altogether, while others stated they would like to eat less of a specific food. For example, one participant stated their goal as “I want to eat less sugar but not cut it out all together,” while another participant had a goal to “Cut out all fatty, sugary foods”.

Yet others had set a specific limit as to how much a certain food they would eat. For example, one participant set a goal to “Only eat fast food once a week,” while another’s was less specific and stated “Less fast food.” Similarly, regarding the goal of drinking less pop, one participant stated their goal as “Cut pop out a lot,” while another student was more specific stating they would like to “Cut back on caffeine intake (1 or fewer cans a day).”

***Increase a Specific Food or Type of Food.*** Similarly, another theme that emerged was foods to increase. This goal was seen across all age groups and BMI classifications with the exception of obese I. It mentioned by both males and females, but it was a seen more as a goal of females. By far, the most commonly mentioned goals were to increase fruits and vegetables. Other goals included increasing water consumption, dairy, protein, fiber, vitamins and minerals.

Some goals simply reflected the desire to increase a food, for example, a goal by one participant was stated as “Increase fruit and vegetable intake during the winter,” and another participant said “I would like to incorporate more calcium and vegetables into my diet”. Others had goals specifically stating the amount of a food they would like to eat such as “Eat at least two servings of fruits and/or vegetables everyday,” or another participant who stated “I want to eat fruits and vegetables at least 3 times a day.” Yet others had goals of replacing a food they would like to decrease with one they would like

to increase. For example, one participant's goals was stated as "To eat more fruits and veggies and less from the bread/fat group."

**Physical Activity.** Although not a nutrition goal, physical activity themes emerged. Physical activity goals were seen in all age groups but were strongest in  $\leq 18$ , 19, and 20 year olds. It was seen in all BMI classifications except obese II. With regard to gender it was seen to be goal of more females than males.

As has been seen with previous themes, some participants were more specific than others in their goals. For example, one participant's goal was to "Exercise regularly," and another's "To be more regular with exercise and do different things besides run and lift." A different participant had a more specific goal of "I would like to exercise at least 30 min., 5 days a week," and another said "Exercise 45+ minutes, 3-4 times/week."

It was also seen that some participants had goals to continue exercising regularly while others had goals to begin exercising regularly. One participant stated their goal was "To keep exercising 5 to 6 days a week," and another's to "I want to continue to work out 3x/wk." Others want to begin exercising regularly, such as one participant who described their goal as to "Start a regular exercise program," and another whose goal was "To get into a consistent exercise routine." Many participants mentioned aerobic exercise and weight lifting as types of physical activity they were interested in doing. Improving one's fitness level was also seen commonly.

There were many reasons stated as to why a participant's goal was to improve fitness. Not feeling tired while exercising or increasing endurance were reasons stated often. One stated "I want to be in better shape so I don't get tired as fast." Others were

less specific, such as this participant who stated “To become more physically fit.” Yet another’s goal was to “Be fit and healthy which will make me feel better/good.”

***Healthier Eating Habits.*** Many participants had the broad goal of “eating healthier” and healthier eating habits emerged as a theme. This was seen across all age groups, genders, and BMI classifications. By far the most common response under this theme was to eat healthier or have a better diet. Other less mentioned but notable responses include being aware of their diet, preparing nutritious foods, not overeating, eating breakfast, eat regularly, and feeling full or not feeling hungry. Many also had goals related to meeting recommendations for food group intakes as well as eating the correct portion sizes.

***Healthy Lifestyle/Be Healthy.*** This theme was seen across all age groups, genders, and BMI classifications but emerged predominately among  $\leq 18$ , 19, and 20 year olds, both males and females, normal weight and overweight participants. Many had goals similar to this participant’s, which stated “I want to maintain a healthy lifestyle throughout all of college,” or another’s which stated “Be healthier than I am currently. There is always room for improvement.” Some had even simpler goals such as another participant’s: “Be healthy.”

A few participants related their goal of being healthy to the benefit it would bring in the future. For example, one participant stated her goal as “I would like to live my life with no health problems when I get older.”

***Weight Goals.*** Goals relating to a participant’s weight were seen across all age groups, genders, and BMI classifications. These weight goals included losing weight,

gaining weight, and maintaining weight. Some participants had set a goal weight they would like to reach.

Appearance was mentioned in some participants' goals as a reason they would like to lose weight. One participant had a goal to "Lose weight so I can look the way I used to," and another stated "I want to lose weight and be happy when I look in the mirror." Yet others mentioned other reasons such as "I hope to lose lots of weight and to make myself healthier so I can enjoy my future," or another participant whose goal was "To lose weight so that I feel more comfortable."

Several participants mentioned the "Freshmen 15" in their goal, such as this participant whose goal is "To not gain the freshman 15!" or another's goal "Just to stay healthy and not gain freshmen 15." Others did not mention the "Freshmen 15" but did mention college as a factor, such as one participant whose goal was to "Remain healthy and don't gain weight while in college," or another who stated "I would like to manage my weight between 115-118 pounds during my college career."

***Balanced and Varied Diet.*** Eating a balanced and varied diet was seen as a goal in all age groups, genders, and BMI classifications, however it emerged most strongly in females over males as well as normal and overweight BMI classifications. The words "balanced", "varied", and "well-rounded" were used in participants' goals. One participant provided reasoning for their goal, stating "I've seen firsthand the difference nutrition can make, and I'm working towards a balanced, whole-foods diet." The addition of fruits and vegetables was mentioned by several participants as a way to make their diet more balanced or varied. Others mentioned the food groups as a guide for eating a balanced and varied diet such as this participant whose goal stated "How to make

a well-rounded meal. I tend to eat 1-2 food groups at a time.” Another participant stated their goal as “Eat a more balanced diet with all 5 food groups.”

***Increase Muscle Mass or Strength.*** The goal to increase muscle mass or strength was seen in many male participants although some females did have these goals. It also was seen more often in the younger age groups ( $\leq 18$ , 19, and 20 year olds) as well as normal weight and overweight participants.

Gaining strength or muscle as well as toning muscles were seen as goals. Some had specific amounts of muscle they wanted to gain, ranging from 5 to 20 pounds of muscle weight. Some had goals to gain weight by adding muscle, such as this participant’s goal, stating, “I hope to gain healthy weight and to grow and tone muscle.” Others hoped to lose weight while gaining muscle as was seen in another participant’s goal which stated “Lose weight but at the same time keep and add muscle mass.”

***Snacking.*** Goals related to snacking emerged across all age groups, with the exception of  $\geq 22$  years. It emerged in both males and females, normal weight, and overweight participants. Many stated their goal was to stop or reduce the amount of snacks eaten. Others wanted to find healthier snack to consume. Snacking or eating at night was also mentioned as a habit to decrease. One participant described their goal as “I would like to get better about snacking less late at night after work.” Another stated, “I want to stop snacking right before I go to bed.”

***Body Composition.*** Goals related to body composition emerged in  $\leq 18$ , 19, 20, and 21 year olds. It was more common in males than females although it was seen in both. With regard to BMI classification, these goals were seen most strongly in normal and overweight participants. Females tended to answer with more broad goals such while



males tended to have more specific body fat percentages to reach. One female's goal stated "Body fat % decrease and lean body mass/muscle mass increase," and another's "I would like to lose fat and gain muscle." Comparatively, a male participant's goal stated "I would like to get my weight above 185 and my body fat % between 5-8% by the end of the school year," while another said "To lower my body fat to the single digits, 8% or 9%." Normal weight and overweight participants both had a mix of broad and specific body composition goals.

***Health Conditions.*** A smaller number of participants had goals related to health conditions and these were seen across all age groups, genders, and most strongly in normal weight, overweight and obese II participants. A wide range of health conditions were seen including controlling blood sugar, Crohn's disease, absence of a colon, upset stomach, hypothyroidism, irritable bowel syndrome, lactose intolerance, breast cancer, osteopenia, high blood pressure, asthma, and most commonly, high cholesterol.

Many of the goals related to using nutrition to treat these health conditions. One participant's goal stated "Finding ways I can eat healthier from all food groups since I no longer have my colon." Another stated, "Figure out a healthy diet that will assist my weight goals and not trigger my Crohns." One participant was thinking to the future with their goal: "I would like to maintain a healthy cholesterol level (issues w/ family cholesterol)."

***Mental or Emotional-Related Goals.*** Goals related to mental and emotional aspects emerged in all age groups, females, as well as normal weight, overweight, and obese I BMI classifications. These goals included reducing eating for reasons other than

hunger, worrying about gaining weight, and having a positive attitude about eating healthy and one's body image.

Stress was mentioned in several goals related to reducing eating for reasons other than hunger. One participant's goal was to "Not let stress change my eating habits," and another's "To not always overeat when I feel stressed out." Emotional eating was also mentioned, such as in this participant's goal: "Food eating would be more intentional and less emotional." Another stated her goal to be "Refrain from emotional eating." Goals related to having a positive attitude about eating and body image include these examples:

"To enjoy food with a positive attitude."

"Stop being so negative about my body."

"I would like to learn how to eat healthier to improve my attitude, energy, and appearance."

"Start eating healthier so I can feel better about myself."

"I want to learn to love to eat healthfully."

**Appearance.** Appearance goals emerged in  $\leq 18$  and 19 year olds, both males and females, and normal and overweight participants. Some had goals to improve appearance that were general in nature. Others had specific aspects of their appearance that they had a goal to change. The stomach was one area often mentioned, such as in this participant's goal "To lose a little belly fat," or another's whose goal was stated as "Get a flat stomach." Similarly, one participant stated, "I want more strength and a flat stomach w/o 'love' handles." Two participants mentioned improving their skin as a goal, one stating, "To maintain healthy and glowing skin," and the other's goal to "Maintain complexion."

**No Goal.** Some participants stated that they had no nutrition-related goals. This group included participants from across all age groups, genders, and BMI classifications.

**Other.** Goals which did not fit into other themes and did not emerge strongly from the data were placed in the “Other” category. This included participants from across all age groups, genders, and BMI classifications although was seen less often in 21 year olds and underweight participants.

**Blank Goal.** If a participant did not respond with a nutrition goal but left the question blank, they were put into the “blank goal” category. This was seen across all age groups, genders, and BMI classifications, although was seen less often in 21 year olds, underweight, obese I and obese II participants.

Tables 4.6, 4.7, and 4.8 include data regarding the number of participants from each group that had goals for each theme.

Table 4.6. Nutrition Goals by Age Group

Theme	Number of participants in each age group (% of total for each age group)				
	≤18 years	19 years	20 years	21 years	≥22 years
<b>Appearance</b>	6 (0.8%)	7 (1.0%)	2 (0.6%)	0 (0.0%)	2 (0.5%)
<b>Balanced and Varied Diet</b>	41 (5.6%)	30 (4.5%)	18 (5.0%)	11 (5.1%)	16 (4.3%)
<b>Body Composition</b>	28 (3.8%)	30 (4.5%)	9 (2.5%)	8 (3.7%)	4 (1.1%)
<b>Decrease a Specific Food or Type of Food</b>	85 (11.6%)	66 (9.8%)	41 (11.4%)	31 (14.5%)	33 (8.8%)
<b>Health Conditions</b>	6 (0.8%)	4 (0.6%)	6 (1.7%)	5 (2.3)	8 (2.1%)
<b>Healthier Eating Habits</b>	223 (30.4%)	186 (27.7%)	89 (24.7%)	52 (24.3%)	86 (23.0%)
<b>Health Lifestyle/Be Healthy</b>	43 (5.9%)	29 (4.3%)	18 (5.0%)	7 (3.3%)	8 (2.1%)
<b>Increase Muscle Mass or Strength</b>	31 (4.2%)	28 (4.2%)	16 (4.4%)	6 (2.8%)	6 (1.6%)
<b>Increase Specific Food or Type of Food</b>	94 (12.8%)	78 (11.6%)	37 (10.2%)	28 (13.1)	47 (12.6%)
<b>Mental or Emotional Related</b>	10 (1.4%)	6 (0.9%)	2 (0.6%)	3 (1.4%)	6 (1.6%)
<b>Blank</b>	33 (4.5%)	25 (3.7%)	16 (4.4%)	9 (4.2%)	47 (12.6%)
<b>No Goal</b>	17 (2.3%)	18 (2.7%)	8 (2.2%)	6 (2.8)	19 (5.1%)
<b>Other</b>	39 (5.2%)	38 (5.7%)	29 (8.0%)	12 (5.6%)	50 (13.4%)
<b>Physical Activity</b>	88 (12.0%)	76 (11.3%)	35 (9.7%)	10 (4.7%)	8 (2.1%)
<b>Snacking</b>	21 (2.9%)	11 (1.6%)	8 (2.2%)	5 (2.3%)	4 (1.1%)
<b>Weight Goals</b>	70 (9.6%)	57 (8.5%)	29 (8.0%)	22 (10.3%)	20 (5.3%)

Table 4.7. Nutrition Goals by Gender

Theme	Number of participants in each gender (% of total for each gender)	
	Female	Male
Appearance	12 (0.8%)	5 (0.6%)
Balanced and Varied Diet	89 (6.0%)	27 (3.1%)
Body Composition	16 (1.1%)	63 (7.2%)
Decrease a Specific Food or Type of Food	188 (12.8%)	69 (7.8%)
Health Conditions	15 (1.0%)	14 (1.6%)
Healthier Eating Habits	452 (30.7%)	185 (12.0%)
Health Lifestyle/Be Healthy	66 (4.5%)	39 (4.4%)
Increase Muscle Mass or Strength	21 (1.4%)	66 (7.5%)
Increase Specific Food or Type of Food	202 (13.7%)	82 (9.3%)
Mental or Emotional Related	23 (1.6%)	4 (0.5%)
Blank	77 (5.2%)	56 (6.4%)
No Goal	33 (2.2%)	35 (4.0%)
Other	94 (6.4%)	75 (8.5%)
Physical Activity	167 (11.3%)	50 (5.7%)
Snacking	43 (2.9%)	6 (0.7%)
Weight Goals	121 (8.2%)	77 (8.8%)

Table 4.8. Nutrition Goals by BMI Classification

Theme	Number of participants in each BMI classification				
	Under-weight	Normal Weight	Overweight	Obese I	Obese II
<b>Appearance</b>	1 (1.4%)	11 (0.7%)	5 (0.9%)	0 (0.0%)	0 (0.0%)
<b>Balanced and Varied Diet</b>	4 (5.5%)	76 (4.9%)	26 (4.9%)	6 (4.7%)	3 (5.5%)
<b>Body Composition</b>	1(1.4%)	41 (2.6%)	32 (6.0%)	4 (3.1%)	0 (0.0%)
<b>Decrease a Specific Food or Type of Food</b>	7 (9.3%)	193 (12.4%)	41 (7.7%)	9 (7.0%)	6 (10.9%)
<b>Health Conditions</b>	1 (1.4%)	13 (0.8%)	10 (1.8%)	2 (1.6%)	3 (5.5%)
<b>Healthier Eating Habits</b>	26 (34.7%)	419 (27.0%)	121 (22.7%)	50 (38.8%)	18 (32.7%)
<b>Health Lifestyle/Be Healthy</b>	6 (8.0%)	61 (3.9%)	26 (4.9%)	9 (7.0%)	3 (5.5%)
<b>Increase Muscle Mass or Strength</b>	3 (4.0%)	68 (4.4%)	15 (2.8%)	0 (0.0%)	1 (1.8%)
<b>Increase Specific Food or Type of Food</b>	8 (10.7%)	203 (13.1%)	53 (9.9%)	10 (7.8%)	10 (18.2%)
<b>Mental or Emotional Related</b>	0 (0.0%)	16 (1.0%)	8 (1.5%)	3 (2.3%)	0 (0.0%)
<b>Blank</b>	4 (5.5%)	85 (5.5%)	34 (6.4%)	5 (3.9%)	2 (3.6%)
<b>No Goal</b>	3 (4.0%)	43 (2.8%)	16 (3.0%)	4 (3.1%)	2 (3.6%)
<b>Other</b>	4 (5.5%)	95 (6.1%)	50 (9.4%)	15 (11.6%)	5 (9.1%)
<b>Physical Activity</b>	13 (17.3%)	160 (10.3%)	34 (6.45%)	7 (5.4%)	0 (0.0%)
<b>Snacking</b>	3 (4.0%)	38 (2.4%)	8 (1.5%)	0 (0.0%)	0 (0.0%)
<b>Weight Goals</b>	7 (9.3%)	108 (7.0%)	57 (10.7%)	17 (13.2%)	7 (5.4%)

## Chapter 5: Discussion

Using both quantitative and qualitative methods gives a wider picture of where college students stand as far as current BMI but also their nutrition goals, which give insight into what college students would like to achieve in the future. Data in this study clearly show increasing BMI in both males and females as age increases. This aligns with the trend seen by Melton, Bodur, & Clouse<sup>28</sup>. They saw that changes between consecutive years were not necessarily significant, however there was an overall trend toward weight gain. Similarly in the present study, significant increases in BMI were only seen between age groups of 21 and  $\geq 22$  years for females and  $\leq 18$  and 19 year olds for males. Although not all differences were significant, the overall trend showed increasing BMI as age increased with significant increases over the five-year time period. If this trend continues past the college years, overweight and obesity will continue to increase in the population. The idea that students are gaining weight during their time in college is helpful in guiding health professionals towards the type of nutrition and physical activity education that should be developed.

Both males and females had overall mean BMI scores in the normal weight range. However, when broken down by age, mean BMI for males jumped into the overweight range for age 20 years and higher. Females also saw a jump into the overweight category, but not until the age group  $\geq 22$  years. Male BMI increases tended to plateau as age increased, whereas female mean BMI increased at older ages. In the age group of  $\geq 22$  years, females no longer have significantly lower BMI scores than males. Weight gain for males and females seems to be occurring at different times during the college years. Reasons for this are unable to be determined from this data. This trend

emphasizes the importance of continuing nutrition and physical activity education throughout the college years, not simply at the beginning.

The percentage of students in each BMI classification in this study was inconsistent with data from McLean-Meynsse, Gager, and Cole.<sup>70</sup> The present study saw a higher percentage of students in the normal weight classification (66% compared to 45%) and a lower percentage in the overweight (22.7% compared to 29%) and total obese (obese I and obese II) classifications (7.8% compared to 23%). This difference may be attributed to the population chosen for this study. Participants were chosen from a nutrition class which may have been more appealing to students majoring in nutrition and health-related majors or to those who are interested in nutrition and physical activity which may lead them to have lower BMI scores. Even so, the percentage of overweight and obese students is still higher than the goal set by the Healthy Campus 2010 Objectives.<sup>24</sup> This goal is to reduce the percentage of overweight and obese college students to 16%. The percentage of overweight and obese college students in this study was found to be 30.5%.

The themes which emerged the most strongly (decreasing a specific food or type of food, increasing a specific food or type of food, physical activity, healthier eating habits, healthy lifestyle/be healthy, weight goals, and balanced and varied diets) were not surprising goals. These goals were similar to those found by Greaney, Less, and White et al.<sup>57</sup> They found goals related to being healthy, increasing physical activity, improving diet, weight goals, increasing fruits and vegetables, and decreasing unhealthy foods. This implies that these goals are common in college students. Another reason these goals emerged so strongly may be that they are common goals and easy to answer on the



survey. This study's survey was given as an assignment for a college class. Because of this, some students may have not put much thought into it and chosen these common goals. Others may have been self-conscious of their goals and so chose to put down one of these common goals. This is not to say, however, that many students do not have these goals as many may have put much thought into answering.

Although many of the goals reported by students were realistic, others seemed more unrealistic. While females tended to have non-specific goals related to body composition, males often had precise percent body fat levels they would like to reach. These ranged up to 15% body fat however many were lower, between 4-6% body fat. These low levels of body fat are very near or below the minimum essential body fat recommendations of 5% for males<sup>71</sup> and are unrealistic in this researcher's opinion. Similarly, males had goals to gain muscle weights of anywhere from five to twenty pounds. While some lower weights may be attainable, these higher weights may be more difficult to obtain.

Students most often had goals to participate in physical activity three to five days per week, with few as high as seven days per week. Times for each exercise session ranged from thirty to sixty minutes per day. These physical activity goals were, in general, realistic in the opinion of this researcher.

A wide range of weight loss goals were seen. These ranged from 3-60 pounds; however, the majority of goals were between five and fifteen pounds of weight loss. It is this researcher's opinion that if these weight losses occur over an appropriate amount of time that they are realistic in those participants in the overweight and obese categories, as the majority of these specific weight loss goals were, if they are reached over an

appropriate time period. Participants did not provide information as to when they hoped to lose this weight, so this factor is not determinable from this data.

Overall, there were no major differences in nutrition goals between the different age groups. There were a low number of 21 and  $\geq 22$  year old participants who had goals of healthy lifestyle/be healthy, increase muscle mass/strength, and physical activity. This could be due to the lower number of participants in these age groups compared with other age groups. The pattern that is seen, however, is that these two oldest age groups had fewer physical activity goals than did the younger age groups. The reasoning for this cannot be determined from this data, however this could provide an area for education. Further investigation into why participants choose certain goals would increase understanding about this pattern.

Males and females differed in only a few areas of their nutrition goals. Of those who had mental or emotional-related goals, more were female. Many factors may have contributed to this. Perhaps females are more likely to have mental or emotional-related goals. Or, in this researcher's opinion, perhaps more females felt comfortable putting these types of goals down on the survey, while males did not.

Participants who had goals related to body composition were more likely to be males. Many of the goals were related to having a specific percent body fat or increasing muscle mass. Females, on the other hand, had goals that were more general in nature regarding increasing physical activity or exercising regularly. These differences are important to note. The types of physical activity that male and females wish to participate in may be different in nature and education programs should be developed with this in mind.

Normal weight and overweight participants were seen to have similar nutrition goals. Decreasing a specific food or type of food, healthier eating habits, increasing a specific food or type of food, and weight goals were common across all BMI classifications. Obese I and II participants were unlikely to have physical activity related goals but had goals related to eating habits such as decreasing or increasing a specific food or type of food, having healthier eating habits, as well as weight goals. Underweight participants did have goals related to physical activity but were less likely to have goals to increase muscle mass or strength. Their goals tended to fall into the seven strongest themes found, as did obese I and obese II participants. This could be due to the lower number of participants who were underweight, obese I, and obese II compared to normal weight and overweight participants.

### **Limitations**

Self-reported height and weight were used in this study. It was previously shown by Graves and Adams II<sup>72</sup> that college-aged males and females tend to over-report heights. College-aged females tend to under-report weights.<sup>72</sup> Because BMI is based off of height and weight measurements, inaccuracies can affect BMI calculations.

Another limitation is the use of BMI. BMI may not be accurate for people with muscle wasting or those with high amounts of muscle.<sup>73</sup> Thus, BMI may over- or underestimate overweight or obesity in these types of people.<sup>73</sup>

The population used in this study was not randomly selected. Participants took part in a college nutrition class. Because of this, the population may have been composed

of students who are either majoring in a nutrition-related major or who are interested in nutrition and physical activity.

## Chapter 6: Conclusion

It is clear that a positive correlation exists between BMI and age. Although not all changes between consecutive age groups were statistically significant, the trend showed increasing BMI scores as age increased with a statistically significant difference between the youngest age group ( $\leq 18$  years) and the oldest age group ( $\geq 22$  years). Males had significantly higher BMI scores than females at all ages except  $\geq 22$  years. BMI scores were within the normal range until age 20 years for male and 22 years for female, however rates of overweight and obesity were still higher than the goals set by the American College Health Association.<sup>18</sup>

In addition, there were a wide variety of nutrition and physical activity related goals that were reported by college students. These goals combined with the knowledge of college students' weight status can aid health professionals on college campuses to develop appropriate nutrition and physical activity education and programming to fit the needs of college students. Targeting college students allows health educators to reach a large group of the population to aid in improved nutrition and physical activity practices and improved health status.

While these results cannot be applied to the entire population, it is clear that there is a need for nutrition and physical activity education programs due to the percentage of overweight and obese students in this study. Specific themes also emerged which can be used to target this population and better help college students at the University of Nebraska-Lincoln to achieve their goals.

More research is needed in this area. A continued analysis of the BMI trends of college student is needed to determine the health risks of the population. . A comparison

of college students to non-college students of the same ages would also give insight into the influence, if any, that the student lifestyle has on overweight and obesity. .In addition, a more in depth look into how and why students set their nutrition and physical activity goals would give greater insight into the types of programs that could be developed

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**Appendix A**  
**Weight History Questionnaire**

**University of Nebraska, Lincoln**  
**Campus Recreation**  
**Fitness & Wellness Services**  
**Weight History**

Name: \_\_\_\_\_ UNL ID #: \_\_\_\_\_

Daytime Phone: \_\_\_\_\_ Home Phone: \_\_\_\_\_

Email Address: \_\_\_\_\_

Gender: \_\_\_\_\_ Age: \_\_\_\_\_ Height: \_\_\_\_\_

Weight History:

Current Weight: \_\_\_\_\_ Goal Weight: \_\_\_\_\_

Women Only: Do you menstruate monthly?      Yes      No

Highest weight as an adult and at what age? (18 years or older) \_\_\_\_\_

\_\_\_\_\_

Lowest weight as an adult and at what age? (18 years or older) \_\_\_\_\_

\_\_\_\_\_

Have you ever been at your goal weight? \_\_\_\_\_ If yes, when and for how long?

\_\_\_\_\_

Please list any pertinent family or personal weight management history or issues.

\_\_\_\_\_

Medication/Supplements: \_\_\_\_\_

Identify one question you would like answered or one subject you would like to discuss in your nutrition consultation. \_\_\_\_\_

\_\_\_\_\_

Do you have any nutrition related goals? Explain \_\_\_\_\_

\_\_\_\_\_

How did you hear about us? \_\_\_\_\_

**Appendix B**  
**Institutional Review Board Approval**

February 6, 2012

Emily Estes  
Department of Nutrition and Health Sciences  
6401 Vine Street #154 Lincoln, NE 68505

Wanda Koszewski  
Department of Nutrition and Health Sciences  
120C LEV, UNL, 68583-0806

IRB Number: 20121212192EP  
Project ID: 12192  
Project Title: College Student BMI's and Goal Weights

Dear Emily:

This letter is to officially notify you of the approval of your project by the Institutional Review Board (IRB) for the Protection of Human Subjects. It is the Board's opinion that you have provided adequate safeguards for the rights and welfare of the participants in this study based on the information provided. Your proposal is in compliance with this institution's Federal Wide Assurance 00002258 and the DHHS Regulations for the Protection of Human Subjects (45 CFR 46). Your project was reviewed as an Expedited protocol, category 5.

Dates of EP Review: 01/02/2012 & 01/23/2012

You are authorized to implement this study as of the Date of Final Approval: 02/06/2012. This approval is Valid Until: 02/05/2013.

We wish to remind you that the principal investigator is responsible for reporting to this Board any of the following events within 48 hours of the event:

- \* Any serious event (including on-site and off-site adverse events, injuries, side effects, deaths, or other problems) which in the opinion of the local investigator was unanticipated, involved risk to subjects or others, and was possibly related to the research procedures;
- \* Any serious accidental or unintentional change to the IRB-approved protocol that involves risk or has the potential to recur;
- \* Any publication in the literature, safety monitoring report, interim result or other finding that indicates an unexpected change to the risk/benefit ratio of the research;

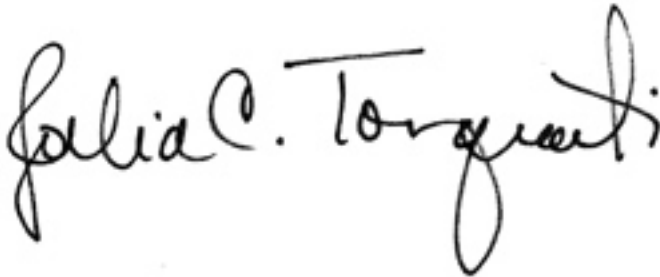


- \* Any breach in confidentiality or compromise in data privacy related to the subject or others; or
- \* Any complaint of a subject that indicates an unanticipated risk or that cannot be resolved by the research staff.

For projects which continue beyond one year from the starting date, the IRB will request continuing review and update of the research project. Your study will be due for continuing review as indicated above. The investigator must also advise the Board when this study is finished or discontinued by completing the enclosed Protocol Final Report form and returning it to the Institutional Review Board.

If you have any questions, please contact the IRB office at 472-6965.

Sincerely,



Julia Torquati, Ph.D.  
Chair for the IRB

