DIFFERENCES IN DIETARY INTAKE AND PHYSICAL ACTIVITY PATTERNS AMONG YOUNG ADULTS

A Thesis

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By

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ABSTRACT

Poor dietary choices as well as declining levels of physical activity have been observed in young adults. The greatest increases in overweight and obesity have been reported in this population and is likely due to the lifestyle and environmental influences on these individuals. Data from the 1999-2002 National Health and Nutrition Examination Survey (NHANES) were examined including young adults age 18-24 years (n= 1,968). Dietary intake and physical activity patterns among young adults, 18-24 years of age in both the college and non-college settings were examined. A 24-hour recall, physical activity questionnaire, and health examinations were used to collect pertinent data. College students consumed significantly more protein (p=0.009), servings of fruit (p=0.002), and several nutrients including vitamin A, thiamin, riboflavin, niacin, vitamin B6, calcium, phosphorus, magnesium, iron, sodium, and potassium. The non-college group consumed significantly more added sugars than college students (p=0.003). College students engaged in significantly more vigorous and total physical activity than non-college individuals. Interventions are needed to provide nutrition education to young adults focusing on making healthy choices at dining halls and restaurants, food preparation skills and techniques, and consumption of a balanced diet consisting of all food groups. Participation in daily physical activity should be encouraged in young adults due to the decrease in activity seen in young adulthood.
DEDICATION

Dedicated to my husband, parents, and mentors.
ACKNOWLEDGMENTS

I would like to thank my thesis committee, Dr. Clutter, Dr. Taylor, and Dr. Geraghty, for their continuing guidance throughout my coursework at The Ohio State University. Your support, expertise, and assistance throughout my journey to complete this thesis has been much appreciated.

I would also like to thank my husband, Aaron, who has always been there for me when I was overwhelmed with work, school, and other obligations. Not only was Aaron there for me when I was stressed, but he also surrendered the computer to me nightly and stayed in with me on countless weekends. I would last like to thank my parents for their continuing support throughout my education. It is the sacrifices you have made for me that have made my education and this thesis possible.
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CHAPTER 1

INTRODUCTION

The increasing prevalence of obesity remains a health concern in the United States (U.S.), a problem that is not improving. Obesity in the U.S. has nearly doubled over the past decade. It is estimated that as many as 400,000 Americans died in 2000 due to poor diet and physical inactivity and obesity is on track to surpass tobacco as the number one killer of Americans.\(^1\) Results from the National Health and Nutrition Examination Survey (NHANES) indicate that from 2001-2002, 65.7% of adults were either overweight or obese.\(^2\) The increase in overweight and obesity in the U.S. has been on the rise for a quarter century and is still climbing. The most current NHANES data reports obesity among adult men was 33.3% in 2005-2006, a minimal and not statistically significant rise from the previous 31.1% in 2003-2004.\(^2\) Among adult women there was also a small increase in obesity from 2003-2004 to 2005-2006 with an increase from 33.2% to 35.3%.\(^2\) Although the rate of overweight and obesity continues to rise, it appears that the rate in which obesity is increasing has decreased over the past few years.

The greatest increases in overweight and obesity appears to occur in individuals between the ages of 18-29 years.\(^3\) With more than 10 million full-time college students in the U.S. between the ages of 19-29, the link between the college lifestyle and weight gain
has received much attention. Rates of overweight and obesity among college-aged people were 12% in 1991, and have increased to rates as high as 36% in 2003, a 24% increase in just 12 years. In 2008, based on self-reported height and weight, the National College Health Assessment (NCHA) and the College Health Risk Behavior Survey (NCHRBS) reported that 29.9% of college students are overweight or obese. Obesity in adolescence is the leading predictor of obesity in adulthood and those who develop obesity as adolescents rarely lower their body mass index (BMI) out of the obese range. In addition, other young adults may also be at risk for obesity and co-morbidities due to the high prevalence of sedentary jobs and lifestyles. Healthcare costs have seen a dramatic increase due to obesity and chronic disease with an estimated $117 billion dollars spent on obesity related illnesses in 2000.

The social cognitive theory (SCT) is a theory of learning based on the belief that behavioral, environmental, and personal factors are interrelated. The environments in which young adults live, work, and socialize undoubtedly influence the lifestyle choices, personal experiences, and personal characteristics of these individuals. Health-related behaviors such as diet and physical activity are among the lifestyle factors influenced by environment. A better understanding of the behavioral, environmental, and personal factors of these young adults may provide insight into the resultant lifestyles of this population.

Young adulthood often represents a person's first time living away from home in which they are required to make their own choices about the lifestyle in which they live. Poor dietary choices often lead to diets high in calories, fat, sodium, and sugar while lacking in essential food groups such as fruits, vegetables, dairy products, and whole
grains. In addition, many young adults also face challenges to maintaining a healthy lifestyle as the environment in which individuals work undoubtedly impacts multiple health-related behaviors. Work-related factors including stress, sedentary occupations, time constraints, extended work hours, among others have been thought to promote weight gain. The risky health behaviors seen in college students as well as non-collegiate young adults have made significant contributions to the obesity epidemic in the U.S.

Environmental as well as food and nutrition-related factors including nutrition knowledge, food preparation skills, dining out, and dining halls have a profound impact on one’s health. Results from the 2004 Shopping for Heath Survey indicate that only 10.5% of students can correctly describe a serving size as the amount of food eaten at one time. The limited use of nutrition labels among young adults may be due to the lack of nutrition knowledge in this population, making these individuals a target for nutrition education. In addition, college students often reside in environments which are not conducive to preparing nutritious home-cooked meals. Limited cooking equipment, skills, space, time, money, and other factors commonly prevent young adults from preparing their own food. Many young adults resort to purchasing a campus meal plan, convenience foods, dining out at fast food restaurants, or ordering take-out on a regular basis. Home prepared meals are higher in many nutrients including fiber, calcium, folic acid, iron, vitamins B6 and B12, vitamin C, and vitamin E and lower in cholesterol and saturated and trans fats than restaurant meals making the traditional home-cooked meal the healthier option.

With the number of fast food restaurants in the U.S. now exceeding 280,000, it is no surprise that fast food sales have skyrocketed over the past few decades. The fast
food industry is targeting children, adolescents, and young adults now more than ever. Between 1977 and 1995, fast food consumption by individuals between the ages of 2 and 18 years saw a 5-fold increase and currently one-third of all children consume fast food daily.\(^9\) This may be due to the strategic clustering of fast food chains within walking distance of elementary and high schools as well as within college campuses and within close proximity to many businesses. On days when fast food is consumed, individuals consume more calories, fat, added sugar, and sugar-sweetened beverages and less fruits and vegetables.\(^7\) Another study found a 0.2 unit increase in body mass index in those who consume fast food.\(^9\)

In addition to restaurants, dining halls and workplace cafeterias are frequented by thousands of hungry young adults every day, many of which serve over 3,500 different foods daily.\(^10\) The typical dining hall and cafeteria offers buffet-style meals with multiple dining options including selections from the grill, deli, salad bar, fast food, ethnic foods, dessert bars and more. The traditional sit-down dining hall provides students with the opportunity to eat large quantities in endless helpings of many of their favorite foods. While many colleges, universities, and businesses are taking action to improve meals and promote healthy eating in the campus dining halls and workplace cafeterias much improvement is necessary to improve the health of these young adults.

Engaging in regular physical activity is one of the most effective ways to maintain a healthy lifestyle. It is apparent that physical activity among adolescents reduces throughout the teenage years and into young adulthood. The Center for Disease Control and Prevention (CDC) estimates that only 25% of individuals engage in the recommended level of physical activity.\(^11\) Data from the National Health Interview
Survey suggest that the greatest reductions in physical activity have been seen in individuals between the ages of 15 and 19 years with a continuous decline until the age of 29.\textsuperscript{12} The sedentary lifestyle of many young adults may be the result of the high prevalence of low activity occupations and course schedules. In many occupations most employees are deskbound for most hours of the work day. Many businesses and corporations have made efforts to increase physical activity and wellness by offering recreation facilities and wellness programs to their employees. Offering incentives to employees such as maintaining a healthy BMI and participating in physical activity in order to prevent chronic illness is of growing interest among many employers. Colleges often provide recreational facilities and recreational sports activities to students in order to increase physical activity and involvement within campus. While young adults are commonly offered access to these facilities at no additional cost, the actual number of people taking advantage of these facilities may be lower than desired.

Obesity commonly leads to serious chronic health conditions such as type 2 diabetes, heart disease, hypertension, stroke, and cancer. Unhealthy lifestyle behaviors such as poor diet, physical inactivity, stress and depression and the use of tobacco, drugs and alcohol have been identified as the primary contributors to the chronic disease epidemic among Americans. Many young adults are pre-maturely suffering from many of these chronic diseases as a result of obesity. The purpose of this study is to further investigate the health behaviors adopted by young adults in both college and non-college settings and to better understand the behavioral, environmental and personal factors of this population. Objectives include: 1) to describe the dietary patterns including energy intake, macronutrient intake, and consumption from the various food groups of both
college students and non-college young adults 18-24 years of age; 2) to describe the physical activity patterns of both college students and non-college young adults 18-24 years of age.
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<td><strong>Added sugar</strong></td>
<td>Sugars and syrups that are added to foods or beverages during processing or preparation not including naturally occurring sugars such as those that occur in milk and fruits.</td>
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<td><strong>Body Mass Index (BMI)</strong></td>
<td>A measure for estimating a healthy body weight based on weight in relation to height.</td>
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<td><strong>Dietary Guidelines for Americans</strong></td>
<td>Advice for adults on dietary habits and reducing the risk for major chronic diseases.</td>
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<td><strong>Discretionary Fats</strong></td>
<td>Fat in a food above the amount that would be found in a lean, low-fat, or fat-free form of the food.</td>
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<td><strong>Discretionary Oils</strong></td>
<td>Discretionary oils that are counted as discretionary calories if they exceed recommendations for oil consumption.</td>
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<td><strong>Fruit food group</strong></td>
<td>Any fruit or 100% fruit juice.</td>
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<tr>
<td><strong>Grain food group</strong></td>
<td>Any food made from wheat, rice, oats, cornmeal, barley or another cereal grain.</td>
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<td><strong>MyPyramid</strong></td>
<td>Recommendations set by the USDA for Americans on food groups, portion sizes, nutrients, and physical activity in order to maintain a healthy lifestyle.</td>
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<td><strong>Meat &amp; Beans food group</strong></td>
<td>All foods made from meat, poultry, fish, dry beans or peas, eggs, nuts, and seeds.</td>
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<td><strong>Milk food group</strong></td>
<td>All fluid milk products and many foods made from milk, cheese, and yogurt.</td>
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<td><strong>NHANES</strong></td>
<td>A program of studies designed to assess the health and nutritional status of adults and children in the United States. The survey is unique in that it combines interviews and physical examinations.</td>
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<td><strong>Obesity</strong></td>
<td>An adult with a BMI of 30 or higher.</td>
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<tr>
<td><strong>Overweight</strong></td>
<td>An adult with a BMI between 25 and 29.9.</td>
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<td><strong>Vegetable food group</strong></td>
<td>Any vegetable or 100% vegetable juice. Organized into 5 subgroups, based on their nutrient content: dark green, orange, dry beans and peas, starchy, and other.</td>
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<td><strong>Whole grains</strong></td>
<td>Foods made from the entire grain seed which consists of the bran, germ, and endosperm. Whole grains are a subgroup within the grain group in MyPyramid.</td>
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<td>Abbreviation</td>
<td>Description</td>
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<td>AMDR</td>
<td>Acceptable Macronutrient Distribution Range</td>
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<tr>
<td>BMI</td>
<td>Body Mass Index</td>
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<td>CDC</td>
<td>Center for Disease Control and Prevention</td>
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<td>FNDDS</td>
<td>Food and Nutrition Database for Dietary Studies</td>
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<td>National Center for Health Statistics</td>
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<td>NCHRBS</td>
<td>National College Health Risk Behavior Survey</td>
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<tr>
<td>NHANES</td>
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<td>USDA</td>
<td>United States Department of Agriculture</td>
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CHAPTER 2

REVIEW OF LITERATURE

The behaviors which individuals develop over time are most commonly the result of the environment in which they live, work, and socialize. The social cognitive theory (SCT) is based on the belief that behavioral, environmental, and personal factors are interrelated. The environments in which young adults live, work, and socialize undoubtedly influence lifestyle choices, personal experiences, and personal characteristics. Differences in environment between young adults both in college and not in college are likely to differ. College students often reside within college campuses, predisposing these individuals to many of the unhealthy lifestyle behaviors of this population. Non-college attending young adults however, may face much different challenges to maintaining a healthy lifestyle due other factors including sedentary workplace environments and social influences. Health-related behaviors such as diet and physical activity are among the lifestyle factors that may be influenced by environment.

Nutritional Implications

Young adulthood often represents a student’s first time living away from home in which they are required to make their own choices about the lifestyle in which they live. Poor dietary choices often lead to diets high in calories, fat, sodium, and sugar while
lacking in essential food groups such as fruits, vegetables, dairy products, and whole grains. Brunt et al\textsuperscript{4} reports that college students frequently consume diets lacking in variety with an increased consumption of fast food and snacking throughout the day. The poor health choices individuals make as young adults often leads to obesity and the development of multiple chronic health complications later in life.

In addition, non-college individuals also face challenges to maintaining a healthy lifestyle as environmental factors, particularly in the workplace are likely to impact health behaviors. Work-related factors including stress, sedentary occupations, time constraints, extended work hours, among others have been thought to promote weight gain as well as abdominal fat accumulation.\textsuperscript{13} These risky health behaviors often seen in young adults have had a significant impact on the current obesity epidemic in the U.S.

\textit{Caloric Intake}

The development of obesity is commonly the result of a combination between the consumption of high caloric foods and lack of physical activity. An individual’s daily caloric need is based on height, weight, gender, age, and level of activity. Consumption of excess energy over one's metabolic rate most often leads to weight gain and ultimately obesity. Although many studies have investigated the various components of the diet in the college population, there are few studies reporting the actual caloric intake of these individuals compared with non-collegiate young adults. In a study of students enrolled at a Los Angeles (LA) university and students at a university in Taiwan (TW), LA students consumed an average of 1,720.9 (±624.8) calories while TW students consumed 1,306.9...
LA students consumed over 400 calories more than TW students; a difference of 0.8 pounds per week. This difference represents the impact of environmental and cultural differences in lifestyle choices among individuals.

**Lipids**

Dietary fat intake is associated with the risk for the development of cardiovascular disease among other chronic diseases. The Acceptable Macronutrient Distribution Range (AMDR), set forth by the USDA recommends consuming a diet with less than 35% of calories from fat with no more than 10% of calories from saturated fat. In addition, it is recommended that cholesterol intake should not exceed 300 milligrams per day. Numerous studies suggest that the average American consumes a diet exceeding these recommendations for total fat, saturated fat, and cholesterol. Anding et al reports a mean total fat intake of 37% (±4%) per day with saturated fat accounting for 11% (±4%) of calories among college students, both if which exceed the AMDR. In addition, approximately two-thirds of students consumed more than the recommended levels for saturated fat and 20% of students exceeded recommendations for cholesterol. There may also be differences found between dietary fat intakes in individuals living on campus versus off campus. Brevard et al found that while serum lipid levels for students living on and off campus were similar, triglyceride levels were significantly higher in those who lived off campus.

Non-college young adults are also susceptible to a high fat diet as many workplace break rooms, conferences, and special events include high fat, high caloric foods. Stressed workers may also be more vulnerable to over-consumption of high
caloric, high fat comfort foods in the evenings due skipping breakfast and even lunch on busy work days. It is unclear as to the differences in serum lipid levels and fat consumption among college students and non-college individuals.

**Sodium**

The USDA recommends no more than 2,300 milligrams of sodium per day. A diet high in sodium often leads to the development of hypertension along with numerous cardiovascular complications. Many young adults commonly consume pre-packaged convenience foods and salty snacks which often contain high levels of sodium. Anding et al found that college students average 3,204 (±1,941) milligrams of sodium per day with more than half of students exceeding 2,400 milligrams daily. This finding is not surprising due to the unhealthful eating habits of many young adults and the low consumption of fruits and vegetables among this population. While few studies have investigated the sodium intake among non-college young adults, it is likely sodium intakes are comparable with the general population as rates of hypertension in the adult population continues to rise. The replacement of processed foods such as salty snack items and frozen meals with fresh fruits and vegetables is a good strategy for lowering sodium consumption.

**Sugar**

The Dietary Guidelines for Americans recommends a diet moderate in sugar with no more than 10% of calories coming from sugar. Added sugars are commonly found in foods such as candy, baked goods, sweetened breakfast cereals, soda, sweetened tea, and many fruit juices. Not only do these foods provide a substantial amount of sugar and thus increasing the risk for the development of obesity and insulin resistance, but they also
supply the body with large quantities of empty calories. Anding et al\textsuperscript{16} found that in a sample of 60 college students, daily sugar intake averaged 19.7\% (±7.7\%) of total calories; 9.7\% higher than recommended. In addition, this study found that only 5 of these students consumed less than 10\% of their total calories from sugar.\textsuperscript{16} Brunt et al\textsuperscript{4} found similar results in which 95\% of students consumed at least 2 servings of high fat, high sugar, discretionary calories per day. There is little research done on the consumption of sugar in the non-college young adult population although the consumption of added sugars in the general population has been identified as a contributing factor to the growing number of overweight and obese individuals in the U.S.

**Food Groups**

The USDA provides dietary recommendations in regards to the 5 food groups that should be consumed everyday in order to promote the consumption of a balanced diet. The 5 food groups consist of grains, vegetables, fruits, milk, and meat and beans with oils and discretionary calories not included as part of a balanced diet. The MyPyramid plan is designed to make individuals more aware of the food groups and how much they need from each daily. A diet abundant in fruits, vegetables, whole grains, and low-fat dairy has been shown to significantly reduce the risk of diet-related chronic diseases. Numerous studies have shown the impact of consuming 5 or more servings of fruits and vegetables a day on the reduction of heart disease, cancer, and stroke; the leading causes of death in the U.S.\textsuperscript{18} Certain lung diseases, gastrointestinal complications, obesity and diabetes
have been associated with a diet low in fruits and vegetables.\textsuperscript{18} A balanced diet including foods from all 5 food groups with an emphasis on fruits, vegetables and whole grains is the key to preventing the occurrence of many diet-related chronic conditions.

\textit{Fruits & Vegetables}

The USDA recommends the consumption of at least 5 servings of fruits and vegetables daily.\textsuperscript{19} \textit{Healthy People 2010} found a slight increase in fruit consumption from 1994-1996 to 2004, with an increase from 39\% to 40\% of Americans eating 2 servings of fruit daily.\textsuperscript{19} In addition, vegetable intake stayed constant with only 4\% of individuals consuming the recommended number of servings from 1994-1996 to 2004.\textsuperscript{19} These results indicate the lack of consumption of fruits and vegetables, putting Americans at greater risk for the development chronic health conditions. Adams et al\textsuperscript{20} reports that between 1990 and 2000, the average servings of fruits and vegetables increased. Unfortunately, more recent data has shown no improvement. There is a substantial difference between recommendations and actual consumption of fruit and vegetables among Americans.

The majority of young adults also do not meet recommendations for daily fruit and vegetable intake. A 1995 survey found that approximately 25\% of college students age 18-24 years old consume 5 or more servings of fruits and vegetables each day.\textsuperscript{20} In addition, consumption of fruits and vegetables among college students was 3 percentage points lower than that of the general population.\textsuperscript{20} Adams et al\textsuperscript{20} found that students living in residence halls, sorority and fraternity housing reported greater fruit and vegetable consumption than those living in other campus housing, off campus, or with parents. While little research has investigated the consumption of fruit and vegetable
intake among non-college individuals, low consumption of these food groups over time may be a contributing factor to high obesity rates, heart disease, and other illnesses among later in life.

**Whole Grains**

The consumption of whole grains may also reduce the risk of chronic disease and assist with weight maintenance. The 2005 Dietary Guidelines for Americans recommend that adults consume at least 3 servings of whole grains daily. Unfortunately, it appears that 90% of American adults and adolescents do not meet these recommendations. Studies show that adults who consume more than 1 serving of whole grains daily have a lower BMI and waist circumference than those that consume less. Whole grain products contain high levels of fiber which may increase satiety, help with weight loss and maintenance, and reduce the risk of colorectal cancer. The accessibility of foods rich in fiber to the college population may be limited due to reliance on dining halls, limited food preparation skills and space, and monetary issues. Many dining halls as well as restaurants and workplace cafeterias do not serve whole grain versions of foods; therefore limiting the opportunity for a high fiber diet. Rose et al found that in a sample of 164 college students, students consumed an average of 0.7 servings of whole grains per day, providing minimal fiber in the diet. Grain-based food items including pizza, sandwiches, and snacks are popular among many young adults; unfortunately, these items are not commonly made with whole-grain products and therefore lack in nutritional value. There is little data available as to the consumption of fiber among non-college young adults.
Nutrition Knowledge & Skills

The consumption patterns seen in this population may be low due to a lack in nutrition education, knowledge, skill or lack of application of these factors among young adults. Knowledge of nutrition labels appears to be low in this population. Nutrition labels are designed to provide consumers with the information necessary to make informed dietary decisions. While the inclusion of nutrition labels is optional in dining halls and workplace cafeterias, nutrition labels are mandatory for most packaged foods purchased in stores. In a study of undergraduate college students at 2 Midwestern universities, 90% of students indicated food labels as being useful and 70% said labels were easy to read. However, only 10.5% of students correctly described a serving size as the amount of food eaten at one time. The use of nutrition labels among young adults may be limited due to the lack of nutrition knowledge in this population. Both college students as well as young working adults would benefit from dietary interventions targeted at teaching label reading to this population.

Food preparation skills may be compromised due to the modernized lifestyles of many Americans. In modern times, convenient easy to fix foods have become the standard in many households. With the average food preparation time for dinner at approximately 37 minutes, families consisting of both parents pursuing full-time careers may have little time for home-cooked meals. The routine consumption of pre-packaged convenience foods and take-out is likely to be passed down to children, adolescents, and young adults living in these households. Young adults often reside in environments which are not conducive to preparing nutritious home-cooked meals. Limited cooking equipment, skills, space, time, money, and other factors commonly prevent young adults
from cooking their own food. Soliah et al\textsuperscript{7} reports that as the frequency of eating out increases, cooking skills decrease. Many young adults resort to purchasing a campus meal plan, dining out at fast food restaurants, or ordering take-out on a regular basis. Meals prepared in the home typically contain more fruits and vegetables and have less fried food and soda consumption.\textsuperscript{7} Home prepared meals have also been found to be higher in nutrients such as fiber, calcium, folic acid, iron, vitamins B6 and B12, vitamin C, and vitamin E and lower in cholesterol, saturated and trans fats than restaurant meals. Preparing a meal at home empowers individuals to make healthy food choices.

Soliah et al\textsuperscript{7} found that the most common reasons students did not prepare food was that they never had been taught, they had no interest in learning, and they did not have time. However, 90\% of students reported that they knew how to prepare basic foods including hamburgers, tacos, mashed potatoes, and scrambled eggs.\textsuperscript{7} Food preparation skills are generally low in the typical college student which commonly results in the over consumption of unhealthy convenience foods. Students being required to live in the dormitory face even greater challenges to preparing food. Many college dorms ban the use of most cooking equipment with the exception of the microwave, limiting cooking to convenience foods high in calories, fat, and sodium and low in fiber other nutrients. In a study of 100 dormitory-residing college students, the majority of students had salty snacks or other savory items, cereal or granola bars, main dishes, desserts or candy, and sugar-sweetened beverages and few students had low-calorie beverages, fruits and vegetables, dairy, tea/coffee, and 100\% fruit/vegetable juice.\textsuperscript{24} Nutrition knowledge and food preparation skills have not been adequately investigated in non-college young adults.
Trends in Dining Out

With the number of fast food restaurants in the U.S. now exceeding 280,000, it is no surprise that fast food sales have skyrocketed over the past few decades. From 1975 to 2004 the fast food industry saw a 900% increase in sales and current sales are over $100 billion each year. Solaih et al reports that 84% of urban families eat out 1 to 3 times per week and 16% eat out more than 4 times per week. The cost and convenience of fast food provides busy families with an easy solution to dinner time meals.

The fast food industry is targeting children, adolescents, and young adults now more than ever. Between 1977 and 1995, fast food consumption by individuals between the ages of 2 and 18 years saw a 5-fold increase and currently one-third of all children consume fast food daily. In a study of 115 college women, 59% ate out 1 to 3 days per week and 41% of participants ate out 4 or more times per week. Soliah et al reports that nutrition is significantly less important to individuals when they are eating away from home. High caloric, high fat meals in combination with poor food choices when dining out often leads to weight gain. It has been found that on days when fast food is consumed, individuals consume more calories, fat, added sugar, and sugar-sweetened beverages and less fruits and vegetables. Another study found a 0.2 unit increase in BMI in those who consume fast food. Fast food typically contains more saturated fat, trans fat, and cholesterol which often leads to the development of atherosclerosis and heart disease later on in life. A longitudinal study among fast food consumers found an association between fast food consumption and weight gain as well as insulin resistance, both of which increase the risk for the development of type II diabetes mellitus.
The high consumption of fast food among children, adolescents, and young adults may be in part to the clustering of fast food restaurants around schools. Many fast food chains are strategically placing restaurants within walking distance of elementary and high schools as well as within college campuses and within close proximity to many businesses. A 2005 study found that 35% of kindergarten, primary, and secondary schools located in Chicago had at least 1 fast food restaurant within 400 meters while nearly 80% of schools had at least 1 fast food restaurant within 800 meters. The convenience of fast food restaurants to this population undoubtedly increases fast food consumption. Obesity and other health problems are often the result of the environment in which individuals live and work. Families as well as college students need to be educated on the consequences of the high consumption of fast food in order to decrease the prevalence of obesity.

In addition to restaurants, dining halls are frequented by thousands of hungry college students every day, many of which serve over 3,500 different food products daily. The typical dining hall offers buffet-style meals with multiple dining stations including options from the grill, deli, salad bar, fast food, ethnic foods, dessert bars and more. The traditional sit-down dining hall provides students with the opportunity to eat large quantities in endless helpings of many of their favorite foods. Dining halls are a significant contributor to the alarming weight gain between the transition from high school to college for many young adults. A study among college freshmen found that students felt they consumed more food in the dining hall setting and had a greater sense of “fullness” after eating in the dining hall. Dining halls often serve larger than normal portions which commonly leads to overeating. When served large portions, adults
commonly consume 30% more food.\textsuperscript{26} Kasparek et al\textsuperscript{26} reports a weight gain of 34 times the rate of non-collegiate individuals in freshmen women living on campus who had a mandatory meal plan.

Similar to dining halls, workplace cafeterias also provide meals to young adults daily. Many cafeterias also utilize a multi-station setup with various dining options including a grill, deli, salad bar, fast food, ethnic foods, and dessert. While the typical workplace cafeteria does not offer an all-you-can-eat buffet, meals are typically high in calories and fat. While many colleges, universities, and businesses are taking action to improve meals and promote healthy eating in the campus dining halls and workplace cafeterias much improvement is necessary to improve the health of these young adults.

**Physical Activity**

Engaging in regular physical activity is one of the most effective ways to maintain a healthy lifestyle. There are numerous recommendations set forth by various organizations as to the most beneficial recommendation of physical activity. The most current recommendation set forth by the CDC for physical activity among adults includes 30 minutes of moderate-intensity aerobic activity (or 15 minutes of vigorous exercise) 5 days per week along with muscle-strengthening activities on at least 2 days of the week working all major muscle groups.\textsuperscript{11} The Department of Health and Human Services (HHS) recommends participation in moderate and vigorous physical activity at least 3 to 5 times per week for about 30 minutes at a time.\textsuperscript{27} While there are many various recommendations for the amount of physical activity one should engage in each day, there is agreement that exercise should be done often, preferably at moderate to vigorous intensities.
Numerous studies have found that the general population as well as young adults are not meeting the recommended levels of physical activity. Buckworth et al report that based on the department of HHS recommendations, 70% of American adults are below the recommended level of physical activity. While the level of physical activity appears to be higher during the adolescent and young adult years, this population has repeatedly fallen short of recommendations as well. In 1995, the CDC conducted the National College Health Risk Behavior Survey (NCHRBS) which found that only 38% of college students are participating in the recommended amount of vigorous exercise and only 20% are participating in the recommended amount of moderate exercise. In 2007, Seo et al found that 56% of students met the CDC’s vigorous exercise guidelines while 39% met guidelines for moderate intensity exercise. These results indicate that physical activity patterns have increased from 1995 to 2007 by up to 19%. In contrast, other studies have found the greatest reductions in physical activity have been seen between the ages of 15 and 19 years with a continuous decline until the age of 29. Regardless of age, it is clear that individuals in the U.S. are not participating in enough physical activity.

The predominant method of working in many developed countries is computer-based, sedentary work resulting in low activity and sitting for a large portion of the day. Sedentary occupations have been linked to weight gain and obesity in men and diabetes and weight gain in women. In a study of 603,139 working individuals, Caban et al investigated occupational groups and their link to obesity. This study found that from 1997 to 2002 the highest rates of obesity were those in sedentary occupations including motor vehicle operators, police and firefighters, cleaning and building service workers,
and material moving equipment operators. In addition, college students are also seated for long periods of time throughout the day due to class schedules and time spent studying and completing assignments.

Obese individuals have been found to be seated for 2 ½ hours longer than lean individuals each day. This low level of activity throughout the day commonly leads to a low non-exercise activity thermogenesis and weight gain among these individuals. McCrady et al found that in a study of 21 subjects of varying weight and body fat that participants sat more on work days than leisure days. While at work these individuals sat for an average of 597 (±122) minutes per day compared to 484 (±83) minutes per day on their days off; a difference of 110 (±99) minutes per day. Multiple studies have shown the association between sedentary lifestyles and an increased prevalence of obesity among individuals. Altering work environments to promote physical activity and healthy behaviors is crucial to decrease work-related obesity.

Consequences of Health Behaviors

Weight Gain

The greatest increase in overweight and obesity has been noted in young adults aged 18-29 years. With more than 10 million full-time college students in the U.S. between the ages of 19-29, the link between the college lifestyle and weight gain has received much attention. The number of overweight and obese adolescents aged 12-19 years has more than tripled from 5% to 17%, a 12% increase from 1976 to 2002. The National College Health Risk Behavior Survey (NCHRBS) estimates that approximately 20.5% of students are overweight. In addition, this survey also found that students older than 25 years of age were nearly twice as likely as students aged 18 to 24 years of age to
be overweight (28.5% vs. 17.2% in men and 29% vs. 13.9% in women). University women were also more likely than women attending a community college to gain 15% or more weight. Differences in lifestyle between living on and off campus may influence weight status in many individuals.

Numerous studies show that during the transition from high school to college a large proportion of individuals become obese and remain obese. The well-known phenomenon of the “freshmen fifteen” assumes that first year college students will inevitably gain 15 pounds due to the drastic changes in lifestyle seen in this population. While numerous studies have found significant weight gain in first year college students, there is little scientific literature supporting the freshmen fifteen. Hoffman et al found that while almost three-quarters of students gained weight, the actual weight gain was frequently less than 15 pounds. This study also found an average weight gain of 7 pounds in college freshmen over 7 months, a substantial weight gain in a short period of time.

A 2004 study among freshmen at Cornell University found first year students experienced significant weight gain during the first 3 months of college. This study also found the average weight gain during this time period to be 1.9 kg or 158.3g/week. With the average weight gain in adults being 8g/week, first year college students gained weight nearly 20 times faster than the average adult. In addition, a 2008 study found that overweight students gain nearly twice as much weight as did students with a healthy BMI. Another study among 118 college freshmen after 2 semesters found an average weight increase of 2.5 (±5.0) kg. In a longitudinal study of 138 female and 66 male college students from freshmen through senior year, Racette et al found a significant increase in weight and BMI. As freshmen, 15% of students were considered overweight
which increased to 23% by the end of senior year. This study also suggests that the rapid increase in weight gain commonly seen during freshmen year, fortunately does not continue throughout college. These substantial increases in weight observed in this population has put young adults at risk for obesity throughout the lifespan.

While it is certain that first year college students are at increased risk for unwanted weight gain, numerous variables have been identified as major contributors. Weight gain may be perpetuated by factors such as increased alcohol consumption, overeating at the dining hall, limited physical activity, making poor food choices, among others. Levitsky et al\textsuperscript{25} identified the number of evening snacks, number of meals consumed on weekends, consumption of junk foods, and recent dieting to be the best predictors of weight gain among freshmen within the first 3 months of college. Adams et al\textsuperscript{32} found women who had an increase in BMI were more likely to practice unhealthy behaviors such as alcohol consumption, consuming foods low in fiber, eating less cruciferous vegetables, and were less likely to follow a low cholesterol diet. Small alterations in dietary patterns and lack of physical activity often result in significant weight gain.

Non-college young adults are also susceptible to weight gain due to lifestyle and environmental influences especially in the workplace. In a study of call center employees, Boyce et al\textsuperscript{29} found a significant weight gain during the initial 8 months of employment with an average weight gain of 5.1 kg for both male and female employees. In addition, 68\% of employees reported gaining weight with the average gain of 7.5 kg.\textsuperscript{29} Obese employees gained more weight than non-obese employees. Studies have shown that a weight gain of 5.0-7.8 kg increases the risk of coronary heart disease and may cause a 2-
fold risk of diabetes.\textsuperscript{29} In addition, a 2.3 kg weight gain has been associated with a decline in health status and an increased risk of diabetes, regardless of BMI.\textsuperscript{29} Therefore, a minimal gain in body weight may place individuals at an increased risk for the development of multiple co-morbidities. This study identified several risks factors for weight gain including previous obesity when hired, history of previous injury, and lack of vigorous exercise.

\textit{Cost}

The current obesity epidemic has resulted in increased healthcare costs for the treatment of obesity-related conditions. In 2000, Kolodinsky et al\textsuperscript{1} reports an estimated $117 billion dollars was spent on obesity related illnesses. More recent data shows that the total average healthcare spending for a family of 4 was 15,609 in 2008.\textsuperscript{34} With employee benefits being one of the greatest employer expenses,\textsuperscript{35} many companies have focused their efforts on decreasing healthcare costs. In a 2008 study among 11,883 working adults, heavier individuals were more likely to have jobs with employment-based health insurance.\textsuperscript{35} In fact, over the past 2 decades employment-based health insurance premiums have seen a 10\% annual increase.\textsuperscript{35} Heinen et al\textsuperscript{34} reports that obese female employees have a higher average medical expenditures than normal weight female employees and the higher the BMI the higher the medical expenses (BMI 30-35: $1,071; BMI 35-40: $1,549). It is therefore likely that the increased prevalence of overweight and obese individuals is a significant contributor to increasing healthcare costs among businesses.

Overweight and obese employees when compared with normal weight employees often have greater rates of absenteeism, occupational injuries, short-term disability, and
self-reported unhealthy physical and mental days.\textsuperscript{34,35} These trends often result in increased healthcare costs and higher costs associated with absenteeism among obese individuals. Yearly lost production time due to health-related issues approached $226 billion in 2002.\textsuperscript{35} It is important for employers to recognize the impact of obesity on both the health of their employees and the financial burden to the organization. Interventions must be implemented targeting the causes of obesity in order to decrease healthcare spending and costs associated with obesity.

**Current Interventions**

*Health Education*

The health behaviors of young adults along with the environmental, social, and developmental transitions that this population faces make these individuals a target group for nutrition education.\textsuperscript{36} Numerous studies report a high proportion of young adults engaging in risky behaviors including poor dietary choices, low physical activity, increased alcohol and tobacco use, and unsafe sexual practices. Interventions focused on the prevention of these behaviors in first year college students are likely to be substantially effective in influencing healthier lifestyles. Desai et al\textsuperscript{31} concludes that nutrition education including information on healthy eating attitudes and emotional strengthening and personality evaluation may be more effective than weight reduction interventions alone in the overweight population. There are multiple approaches to providing young adults with health resources including educational pamphlets, nutrition courses, internet-based information, faculty health education, and peer health education. While many colleges, universities, and businesses have some form of health education resources available to the students, the frequency of use is questionable.
Peer health education (PHE) is a form of health education implemented by institutions throughout the U.S. White et al\textsuperscript{37} defines PHE as the teaching or sharing of health information, attitudes, values, and behaviors by member of groups who are similar in age or experiences. Peer health educators may have an advantage over other health educators due to an increased sense of trust many individuals feel with people of their own age group. In a study of students who either did or did not make contact with peer health educators, researchers found the students who did have contact with peer health educators reported more higher levels of unhealthy weight management in the first year.\textsuperscript{37} Interventions must be focused toward this specific population in order to increase the utilization of educational resources. PHE among other educational techniques are thought to increase the awareness of healthy lifestyle practices among young adults.

\textit{Environmental}

Numerous strategies have been implemented in colleges, universities, high schools, and elementary schools in efforts to slow the increase in obesity. Strategies such as banning soft drink sales in schools and in vending machines in public facilities are becoming more popular. Targeting vending machines to improve the appearance of healthy snacks, designating healthy items as healthy choices, or stocking machines exclusively with low calorie, low-fat foods is of growing interest in many facilities. One study found that lowering prices of low-fat snacks increased sales.\textsuperscript{38} Interventions designed at getting students to make healthful food choices should be implemented in universities around the world. It is crucial that health promoters, student wellness centers, counselors, food service departments, businesses, and other public facilities make an effort to educate students on making healthy food selections.
In addition, many food service facilities have recognized the demand for more nutritious meals and are now providing nutrition information to consumers. Many institutions now employ nutrition professionals and utilize nutrition software in efforts to make the food they serve more nutritious. Nutrition information is now commonly being provided to students through the internet or displayed in the dining hall. Farrell et al report that students around the country are demanding more information about the foods they are being served in the dining halls. In addition, this study also suggests that students want a variety of foods including fresh fruit, salad bars, fruit/vegetable juice health drinks, hot and cold sub sandwiches, and home-style meals such as meat, potatoes, and vegetables. However, while students are requesting these healthy items, it appears actual intake patterns differ with the most frequently ordered items including chicken tenders, popcorn chicken, pizza, French fries, waffle fries, and carbonated beverages. Numerous studies however, report the student’s desire for more nutrition information and healthy foods. Although many food service departments have responded to the growing interest in nutrition information and the demand for healthier options from students, further changes are necessary to promote healthy eating in the college population.

Wellness Programs

Employers are recognizing the impact of obesity and the health and financial burden that accompanies obesity now more than ever before. Many organizations have seen an increased risk for illness and disability due to the obesity of a large percent of the working population and their dependents. Interventions designed to promote living a healthier lifestyle both while at work and during leisure time have been implemented in many of these organizations. The 2005, CDC’s Guide to Community Prevention Services.
recommends worksite programs combining nutrition education and physical activity to control overweight and obesity in workforce. Health promotions must be focused at not only the employee and their spouse, but their dependents as well to ensure a healthy future for the nation’s workforce. Employee benefit incentive programs are among the most common interventions being implemented throughout the workforce. These programs commonly target not only the employee, but the spouse and dependents as well. Other creative approaches to promote healthy living are being designed and implemented throughout the workforce.

A 2008 survey of more than 450 employers identified employees poor health habits as being the greatest challenge to employers while striving to maintain affordable benefit programs. The need for wellness interventions has become crucial in the U.S. to maintain healthy employees and reduce costs. Studies show that many of the leading companies in the U.S. have or believe they should have wellness programs offered to their employees. Large companies face fewer barriers than smaller companies due to increased funds to provide a multitude of programs including weight loss and management, tobacco cessation, substance abuse, and physical inactivity education. Most smaller companies however have not adopted these programs. The most recent National Worksite Health Promotion Survey found a decline in wellness opportunities by employers and that only 21% of employers offer a weight management program. This study found common barriers include lack of employee interest, lack of resources, and lack of support from the management.

Heinen et al identifies 4 common strategies used by employers to promote wellness. Monetary rewards and savings through the implementation of health benefit
insurance packages are appealing to many employees and often increase participation in wellness programs. Health coaches and visits with a registered dietitian or physical trainer are among the requirements for many of these incentive programs. Changes to the workplace environment including healthy on-site dining facilities, catering, and vending provide employees with a choice of healthy meals and snacks and often make the healthier choices more aesthetically appealing than other foods. Open stairways, walking paths with mileage signs are designed to promote physical activity while at work. Some companies are extending the lunch hour to provide extra time to exercise while at work. Break rooms with complimentary filtered water, stretching aids, and the reduction of high fat, high caloric items should be reduced or stored out of view is recommended. Health promotion competitions and activities such as 5K run/walks, biggest loser competitions, and other weight loss programs are being used to make living healthy a fun challenge for employees. Lastly, the community and family component to health promotion may offer various education opportunities including healthy to-go dinners at worksite cafeterias, access to recreational facilities and sporting events, and participation in incentive based health insurance plans. Many companies are using these methods of health promotion to reach out to their employees in efforts to increase healthy behaviors and reduce the prevalence of obesity-related complications and costs in the future.

Implementation of these wellness programs must appeal to employees by use of incentives or creative, inspirational strategies to promote participation. It is important to recognize that healthy behaviors not be pushed on people due to the likelihood of
resistance. Providing the resources necessary to these young adults and promoting wellness activities must be done tactfully. Wellness programs have changed the lifestyles of many individuals in hopes of improving the health of themselves and their families.
CHAPTER 3

METHODS

Overview of NHANES

The National Health and Nutrition Examination Survey (NHANES) is a program designed to assess both the health and nutrition status of adults and children living in the U.S. This study is part of the National Center for Health Statistics (NCHS), a branch of the Center for Disease Control and Prevention (CDC). The NCHS works to provide accurate, relevant, and timely data to health professionals that will be used to guide actions and policies in order to improve the health of the nation.\textsuperscript{40} It is the mission of the CDC to collaborate to create expertise, information, and tools that people and communities need to protect their health through the health promotion, prevention of disease, injury and disability, and preparedness for new health threats.\textsuperscript{40}

NHANES began in the early 1960s and has since developed into a continuous program including a nationally representative sample of U.S. households focusing on the current health and nutritional needs of the general public. Approximately 5,000 participants from various counties across the country are included in NHANES each year. This program includes both physical examination and personal interviews to compile demographic, socioeconomic, dietary, and other health-related information focusing on specific populations in the U.S. Highly trained, bilingual NHANES professionals collect
data and perform health examinations on select individuals traveling in mobile exam centers (MEC). Survey findings are then used to identify specific diseases and risk factors associated with disease to determine prevalence across the nation. Trends in data are used to set national health standards for height, weight, and blood pressure. In addition, NHANES data is also used in other research, in the development of health policy, and to influence health programs and services.

In order to better represent under-represented populations, the survey sample is designed to represent civilian, non-institutionalized individuals of all ages. Over-sampling of persons 60 and older, African Americans, and Hispanics was done to improve the contribution of these groups. Various stages of sample selection were utilized, including 15 Primary Sampling Units (PSUs). Counties or small groups of counties were identified as PSUs and were used to group numerous households within segments.

School Attendance

Education data was collected via the demographic and occupation questionnaire which inquires about highest level of education, current employment and schooling status, and reasons for not working. Participants were categorized into the college or non-college group (or were excluded) based on responses from this questionnaire.

Dietary Intake Interview

The NHANES data is responsible for assessing the quality and adequacy of the U.S. diet in relation to national health recommendations and to identify target groups for health education and awareness programs. The dietary recall is designed to estimate the total intake of food energy, nutrients, and non-nutrient foods. Interviews were conducted
by trained, college educated dietary interviewers. Computer-assisted dietary interview (CADI) software was utilized throughout the survey and instructions were provided to participants in both English and/or Spanish. The CADI addressed food recording instructions, including detailed instructions on food amounts, brand names, and preparation methods. Participants were asked to identify all food and beverage consumed in the 24 hours before the interview. A detailed description of the food consumed (including type, form, and brand name), amount consumed, time, occasion, food source, and place was collected. In addition, day of the week, salt use, special dietary restrictions, source of water consumed, and comparison with typical diet were recorded. Measurement aids and visuals including charts and drawings were used to quantify the amounts of food and beverage consumed. Each individual 24-hour recall was then reviewed with each participant to check for accuracy. A second dietary recall was administered via telephone approximately 3 to 10 days after completion of the MEC exam.

The United States Department of Agriculture’s (USDA) Food and Nutrient Database for Dietary Studies (FNDDS) is a complex database comprised of foods, their nutrient values, and gram weights based on the MyPyramid serving sizes. The USDA’s food coding scheme is used to categorize the individual foods and estimate dietary intake data.

Physical Activity Data

Participants were questioned during the MEC visit via questionnaire on participation of various activities performed over the past 30 days. Duration measured in minutes per week and frequency measured in times per week of physical activity was collected for vigorous, moderate, and total physical activity. Data from the individual
activity files were combined to compute frequency and duration of all activities according to intensity. Frequency for each individual activity was summed and frequency in times per week was calculated. Duration of each activity in minutes per week was calculated by summing the product of the frequency of each activity over the past 30 days by the average duration. Total physical activity was computed by summing frequency measured in times per week and duration measured in minutes per week of moderate and vigorous frequencies and durations. Vigorous activity was defined as activity "that caused heavy sweating, or large increasing in breathing or heart rate?" The total duration and frequency of each activity performed was summed for each intensity.

**Anthropometric Data**

The MEC was utilized to collect all anthropometric data measurements including height and weight, which were measured electronically. Trained NHANES examiners conducted and recorded all measurements.

**Data Collection**

Prior to data collection, surveyed households were identified for inclusion in the study. Letters were sent out to each household via the U.S. Postal Service informing household members that a NHANES interviewer would be visiting their home. Trained NHANES interviewers visited the homes of each household and administered screening questionnaires. Interviews were recorded using a computer-assisted personal interview (CAPI) system. Participants were also scheduled for a comprehensive health examination to take place of the mobile exam center (MEC). Participants who were unable to travel to the MEC received in home health examinations. Health examinations were conducted by a team of medical professionals including a physician, medical and health technicians,
and dietary and health interviewers, many of which are bilingual. Each examination required approximately 3 hours per subject and was completed in the MEC which were open 5 days per week with 2 exams scheduled daily. Examinations included medical, dental, physiological measurements, laboratory tests, as well as anthropometric measurements, a 24-hour recall, and several questionnaires.

Subjects

Approximately 1,968 participants were included in the this study. Young adults, 18-24 years of age with complete anthropometric, dietary intake, physical activity, and education data were included. This analysis excludes 1,722 participants due to pregnancy, undetermined or undesirable education status, or extraneous dietary intake or physical activity data.

Purpose and Objectives

The purpose of this study is to further investigate the health behaviors adopted by young adults in both college and non-college settings and to better understand the behavioral, environmental and personal factors of this population.

Objectives:

1. Describe the dietary patterns including energy intake, macronutrient intake, and consumption from the various food groups of both college students and non-college young adults 18-24 years of age.

2. Describe the physical activity patterns of both college students and non-college young adults 18-24 years of age.
Data Analysis

Data were analyzed using SPSS (Version 17.3, Chicago, IL) for complex samples. Dietary intake and physical activity patterns were examined using descriptive statistics including frequencies, percentages, means and standard deviations. Differences in dietary intake and physical activity patterns were identified using Chi Square analyses and t-tests.
CHAPTER 4
DIFFERENCE IN DIETARY INTAKE AND PHYSICAL ACTIVITY PATTERNS AMONG YOUNG ADULTS

Abstract

Objective: The objectives of this study include: 1) to describe the dietary patterns including energy intake, macronutrient intake, and consumption from the various food groups of both college students and non-college young adults 18-24 years of age; 2) to describe the physical activity patterns of both college students and non-college young adults 18-24 years of age.

Design: Data from the 1999-2002 National Health and Nutrition Examination Survey (NHANES) were examined. Data was collected by highly trained NHANES interviewers which visited participant's homes and administered screening questionnaires. Examinations were performed in mobile examination centers (MEC) by a team of health professionals.

Setting: Household interviews, questionnaires, and MEC examinations were used to collect data.

Participants: Young adults, 18-24 years of age with complete anthropometric, dietary intake, physical activity, and education data were examined, resulting in a sample size of
1,968. There were 1,076 non-college young adults and 892 college students included in this study. Over half (58.9%) of the sample was non-Hispanic white with Hispanics representing 21.9% of the sample, and 12.9% Non-Hispanic Black.

**Measures:** Dietary intake and physical activity patterns of both college students and non-college young adults age 18-24 years were measured.

**Analysis:** Data were analyzed using SPSS (Version 15.0, Chicago, IL) for complex samples. Descriptive statistics were used including frequencies, percentages, means, and standard deviations. Chi Square analyses and t-tests were also utilized. All p values <0.05 were considered significant.

**Results:** College students consumed significantly more protein (p=0.009), servings of fruit (p=0.002), and several nutrients including vitamin A, thiamin, riboflavin, niacin, vitamin B6, calcium, phosphorus, magnesium, iron, sodium, and potassium. The non-college group consumed significantly more added sugars than college students (p=0.003). College students engaged in significantly more vigorous and total physical activity than non-college individuals.

**Conclusions and Implications:** Dietary intake patterns among young adults do not meet MyPyramid recommendations for many of the food groups. College students commonly consumed more servings from the various food groups as well as specific nutrients when compared with non-college individuals. Duration and frequency of physical activity among the sample was high with college students reporting significantly more total and vigorous physical activity.
Introduction

The increasing prevalence of obesity remains a health concern in the United States (U.S.), a problem that is not improving. Obesity in the U.S. has nearly doubled over the past decade. It is estimated that as many as 400,000 Americans died in 2000 due to poor diet and physical inactivity and obesity is on track to surpass tobacco as the number one killer of Americans.\(^1\) Results from the National Health and Nutrition Examination Survey (NHANES) indicate that from 2001-2002, 65.7% of adults were either overweight or obese.\(^2\) The increase in overweight and obesity in the U.S. has been on the rise for a quarter century and is still climbing. The most current NHANES data reports obesity among adult men was 33.3% in 2005-2006, a minimal and not statistically significant rise from the previous 31.1% in 2003-2004.\(^2\) Among adult women there was also a small increase in obesity from 2003-2004 to 2005-2006 with an increase from 33.2% to 35.3%.\(^2\) Although the rate of overweight and obesity continues to rise, it appears that the rate in which obesity is increasing has decreased over the past few years.

The greatest increases in overweight and obesity appears to occur in individuals between the ages of 18-29 years.\(^3\) With more than 10 million full-time college students in the U.S. between the ages of 19-29 years, the link between the college lifestyle and weight gain has received much attention.\(^3\) Rates of overweight and obesity among college-aged people were 12% in 1991, and have increased to rates as high as 36% in 2003, a 24% increase in just 12 years.\(^4\) In 2008, based on self-reported height and weight, the National College Health Assessment (NCHA) and the College Health Risk Behavior Survey (NCHRBS) reported that 29.9% of college students are overweight or obese.\(^3\) Obesity in adolescence is the leading predictor of obesity in adulthood and those
who develop obesity as adolescents rarely lower their body mass index (BMI) out of the obese range.\textsuperscript{5} In addition, other young adults may also be at risk for obesity and co-morbidities due to the high prevalence of sedentary jobs and lifestyles. Healthcare costs have seen a dramatic increase due to obesity and chronic disease with an estimated $117 billion dollars spent on obesity related illnesses in 2000.\textsuperscript{1}

The social cognitive theory (SCT) is a theory of learning based on the belief that behavioral, environmental, and personal factors are interrelated. The environments in which young adults live, work, and socialize undoubtedly influence the lifestyle choices, personal experiences, and personal characteristics of these individuals. Health-related behaviors such as diet and physical activity are among the lifestyle factors influenced by environment. A better understanding of the behavioral, environmental, and personal factors of these young adults may provide insight into the resultant lifestyles of this population.

Young adulthood often represents a person's first time living away from home in which they are required to make their own choices about the lifestyle in which they live. Poor dietary choices often lead to diets high in calories, fat, sodium, and sugar while lacking in essential food groups such as fruits, vegetables, dairy products, and whole grains. In addition, many young adults also face challenges to maintaining a healthy lifestyle as the environment in which individuals work undoubtedly impacts multiple health-related behaviors. Work-related factors including stress, sedentary occupations, time constraints, extended work hours, among others have been thought to promote weight gain. The risky health behaviors seen in college students as well as non-collegiate young adults have made significant contributions to the obesity epidemic in the U.S.
Environmental as well as food and nutrition-related factors including nutrition knowledge, food preparation skills, dining out, and dining halls have a profound impact on one’s health.\textsuperscript{8,17} Results from the 2004 Shopping for Heath Survey indicate that only 10.5\% of students can correctly describe a serving size as the amount of food eaten at one time.\textsuperscript{6} The limited use of nutrition labels among young adults may be due to the lack of nutrition knowledge in this population, making these individuals a target for nutrition education. In addition, college students often reside in environments which are not conducive to preparing nutritious home-cooked meals. Limited cooking equipment, skills, space, time, money, and other factors commonly prevent young adults from preparing their own food. Many young adults resort to purchasing a campus meal plan, convenience foods, dining out at fast food restaurants, or ordering take-out on a regular basis. Home prepared meals are higher in many nutrients including fiber, calcium, folic acid, iron, vitamins B6 and B12, vitamin C, and vitamin E and lower in cholesterol and saturated and trans fats than restaurant meals making the traditional home-cooked meal the healthier option.\textsuperscript{7}

With the number of fast food restaurants in the U.S. now exceeding 280,000, it is no surprise that fast food sales have skyrocketed over the past few decades.\textsuperscript{8} The fast food industry is targeting children, adolescents, and young adults now more than ever. Between 1977 and 1995, fast food consumption by individuals between the ages of 2 and 18 years saw a 5-fold increase and currently one-third of all children consume fast food daily.\textsuperscript{9} This may be due to the strategic clustering of fast food chains within walking distance of elementary and high schools as well as within college campuses and within close proximity to many businesses. On days when fast food is consumed, individuals
consume more calories, fat, added sugar, and sugar-sweetened beverages and less fruits and vegetables. Another study found a 0.2 unit increase in body mass index in those who consume fast food.

In addition to restaurants, dining halls and workplace cafeterias are frequented by thousands of hungry young adults every day, many of which serve over 3,500 different foods daily. The typical dining hall and cafeteria offers buffet-style meals with multiple dining options including selections from the grill, deli, salad bar, fast food, ethnic foods, dessert bars and more. The traditional sit-down dining hall provides students with the opportunity to eat large quantities in endless helpings of many of their favorite foods. While many colleges, universities, and businesses are taking action to improve meals and promote healthy eating in the campus dining halls and workplace cafeterias much improvement is necessary to improve the health of these young adults.

Engaging in regular physical activity is one of the most effective ways to maintain a healthy lifestyle. It is apparent that physical activity among adolescents reduces throughout the teenage years and into young adulthood. The Center for Disease Control and Prevention (CDC) estimates that only 25% of individuals engage in the recommended level of physical activity. Data from the National Health Interview Survey suggest that the greatest reductions in physical activity have been seen in individuals between the ages of 15 and 19 years with a continuous decline until the age of 29. The sedentary lifestyle of many young adults may be the result of the high prevalence of low activity occupations and course schedules. In many occupations most employees are deskbound for most hours of the work day. Many businesses and corporations have made efforts to increase physical activity and wellness by offering
recreation facilities and wellness programs to their employees. Offering incentives to employees such as maintaining a healthy BMI and participating in physical activity in order to prevent chronic illness is of growing interest among many employers. Colleges often provide recreational facilities and recreational sports activities to students in order to increase physical activity and involvement within campus. While young adults are commonly offered access to these facilities at no additional cost, the actual number of people taking advantage of these facilities may be lower than desired.

Obesity commonly leads to serious chronic health conditions such as type 2 diabetes, heart disease, hypertension, stroke, and cancer. Unhealthy lifestyle behaviors such as poor diet, physical inactivity, stress and depression and the use of tobacco, drugs and alcohol have been identified as the primary contributors to the chronic disease epidemic among Americans. Many young adults are pre-maturely suffering from many of these chronic diseases as a result of obesity. Therefore, the purpose of this study is to further investigate the health behaviors adopted by young adults in both college and non-college settings and to better understand the behavioral, environmental and personal factors of this population.

**Methods**

Dietary intake and physical activity patterns were examined in young adults between the age of 18 and 24 years using data from the 1999-2001 National Health and Nutrition Examination Surveys (NHANES). NHANES is a program designed to assess both the health and nutrition status of adults and children living in the United States. NHANES began in the early 1960s and has since developed into a continuous program including a nationally representative sample of U.S. households focusing on the current
health and nutritional needs of the general public. Approximately 5,000 participants from various counties across the country are included in NHANES each year. NHANES interviewers and examiners traveled to various locations in mobile examination centers (MEC) collecting data.

Dietary intake interviews were conducted by trained, college educated dietary interviewers and consisted of a 24-hour dietary recall in order to estimate dietary intake patterns. Computer-assisted dietary interview (CADI) software was utilized throughout the survey. The CADI addressed food recording instructions including detailed instructions on food amounts, brand names, and preparation methods.

Physical activity data were also collected during the MEC visit via questionnaire on participation of physical activity performed over the past 30 days. Data from the individual activity files were combined to compute frequency and duration of all activities according to intensity. Frequency for each individual activity was summed and frequency in times per week was calculated. Duration of each activity in minutes per week was calculated by summing the product of the frequency of each activity over the past 30 days by the average duration. Total physical activity was computed by summing frequency measured in times per week and duration measured in minutes per week of moderate and vigorous frequencies and durations. Duration measured in minutes per week and frequency measured in times per week of physical activity was collected for each activity. The total duration and frequency of each activity performed was summed for each intensity. Anthropometric data measurements including height and weight was collected. All data was collected by highly trained health professionals and NHANES interviewers.
**Data Preparation**

NCHS public use data files were obtained and imported into SPSS for preparation and analysis. Individuals age 18-24 years with complete height, weight, dietary intake, physical activity, and education data were included. Recoding or categorization was required for many of the variables for inclusion in this study. Subjects were coded as either the college or non-college group based on the education and occupation data provided. Daily nutrient intake per day was collected among the sample. Nutrient intakes were adjusted per 1,000 kcals to adjust for variations in caloric intake among the sample. Percentage of dietary intake of macronutrients and MyPyramid recommendations were calculated. The United States Department of Agriculture’s (USDA) Food and Nutrient Database for Dietary Studies (FNDDS), a complex database comprised of foods, their nutrient values, and gram weights based on the MyPyramid serving sizes was utilized to analyze participant dietary intakes.

Participants who had graduated college, were attending high school, and those with undetermined status were excluded (n= 1,247). Pregnant women (n=350) were also excluded. In addition, those with a mean caloric intake and physical activity data 3 standard deviations above the mean were excluded. The resultant sample size was 1,968.

**Statistical Analysis**

Data were analyzed using SPSS (Version 17.3, Chicago, IL) for Complex Samples. Dietary intake and physical activity patterns were examined using descriptive statistics including frequencies, percentages, means and standard deviations. Differences in dietary intake and physical activity patterns were identified using Chi Square analyses and t-tests. In order to better represent under-represented populations, the survey sample
is designed to represent civilian, non-institutionalized individuals of all ages. Over-sampling of persons 60 and older, African Americans, and Hispanics was done to improve the contribution of these groups.

**Results**

*Participant Demographics*

More non-college young adults (70.1%) than college students (29.9%) were included in this study, including more male participants (n=1,077) than females (n=891). Over half (58.9%) of the sample was non-Hispanic white with Hispanics representing 21.9% of the sample, and 12.9% Non-Hispanic Black. The majority (74.7%) of participants were never married. BMI (kg/m\(^2\)) was significantly higher in the non-college group than college students at 26.3 kg/m\(^2\) and 24.5 kg/m\(^2\), respectively (p= 0.013). Mean BMI among the sample was 25.8 kg/m\(^2\). Waist circumference was also significantly higher in non-college individuals (89.1 cm) than college students (84.5 cm) with an average of 87.8 cm among the sample (p=0.011).

*Nutrients*

To control for variations in caloric intake among participants nutrients were adjusted per 1,000 kilocalories. Those with caloric intake 3 standard deviations above the mean (>6,350 kcal) were excluded to eliminate outliers. Protein intake was significantly higher in the college population at 37.23 grams compared to 34.19 grams per kilocalorie in the non-college group (p=0.009). In addition, several micronutrients including vitamin A, thiamin, riboflavin, niacin, vitamin B6, calcium, phosphorus, magnesium, iron, sodium, and potassium were also significantly higher among college students. Energy adjusted nutrient consumption is shown in Table 4.1.
Food Groups

College students consumed 1.16 MyPyramid servings of fruit, while the non-college group consumed an average of 0.77 servings daily indicating college students eat significantly more servings of fruit than the non-college young adults (p=0.002). College students also consumed 59.6% of the recommended fruit intake compared with only 39.6% among non-college individuals (p=0.002). In addition, non-college individuals were 44.2% less likely to meet or exceed fruit recommendations than college students (OR=.442). College students also consumed more grains, whole grains, vegetables, milk, and meat. Although college students consumed more vegetables than non-college individuals, non-college individuals are 3.7% more likely to meet or exceed vegetable recommendations than college students. Figure 1 illustrates differences in food group consumption patterns between the two groups.

The non-college group consumed significantly more added sugars than college students, consuming approximately 33 tsp daily compared with 26 tsp by college students (p=0.003). In addition, the non-college group consumed more discretionary oils and solid fat than college students, but less alcoholic beverages (Figure 4.2).

Physical Activity

This study suggests that college students are more active than non-college individuals. Those with mean frequency and duration of physical activity 3 standard deviations above the mean were excluded. College students engaged in vigorous physical activity an average of 4.2 times per week while non-college individuals averaged 2.8 times per week (p=0.00). Total frequency, regardless of exercise intensity
was also significantly greater among college students than the non-college group at 7.6 and 5.5 times per week, respectively (p=0.001). Frequency of physical activity is shown in Figure 4.3.

Duration of vigorous physical activity was significantly longer among college students, who averaged 229 minutes per week compared with 158 minutes per week among the non-college group (p=0.002). In addition, total duration, regardless the intensity was also significantly greater among college students who reported an average of 386 minutes per week compared with 287 minutes among the non-college group (p=0.002). Duration of physical activity is shown in Figure 4.4.

Discussion

This study depicts health-related behaviors of young adults, as well as comparisons of college and non-college cohorts. Results are consistent with previous research indicating that the young adults commonly do not meet dietary intake recommendations. Physical activity was high among the sample and exceeded CDC recommendations. While there is a plethora of data on the health-related behaviors of college students, the non-college young adult population has not been previously studied.

The USDA's Dietary Guidelines for Americans provides evidence-based recommendations to promote health and reduce the risk for chronic diseases through diet and physical activity. Current recommendations emphasize fruits, vegetables, whole grains, and fat-free or low-fat milk and milk products as well as including lean meats, poultry, fish, beans, eggs, and nuts. Low saturated and trans fats, cholesterol, salt, and added sugar consumption should be limited.
Fruit intake patterns among the sample were consistent with current literature indicating low intakes among young adults as well as the general population.\textsuperscript{19,20} College students; however, consumed significantly more fruit than non-college individuals. Variations in fruit consumption is likely due to differences in environment, access, and food preparation skills between the two groups. Quick, ready to eat foods requiring little preparation such as fruits are likely appealing to college students. In addition, fruit juice may also provide a considerable number of servings of fruit and intake should be limited due to high amounts of added sugar.

High consumption of added sugars and the development of obesity and insulin resistance has been noted in previous research.\textsuperscript{16} Added sugar intake among the sample exceeded USDA recommendations (<10 tsp per day\textsuperscript{15}) with non-college individuals consuming significantly more than college students. High added sugar intake among non-college students may be due to the abundance of baked goods and sugary beverages in many workplaces. In addition, numerous studies have suggested low breakfast intake patterns among college students which may reduce consumption of sweetened breakfast cereals and fruit juices among these individuals.\textsuperscript{41}

Both college students as well as non-college individuals came close to meeting MyPyramid recommendations from the meat and beans group (5.5- 6.5 ounces daily). While college students consumed more servings from this food group no significant differences in intake were found. College students consumed significantly more protein than non-college individuals per 1,000 kcals. A high protein diet is commonly associated with foods from the meat and beans food group as well as milk group which is likely to account for much of the protein intake among the sample. Farrell et al\textsuperscript{10} reports the most
commonly consumed foods among college students are pizza and almost anything chicken including chicken strips and popcorn chicken. These foods are likely the source of much of the protein in this population. Protein rich foods including eggs, nuts, beans, low-fat dairy, and lean meats should be encouraged in this population as alternative sources of protein.

Both groups exceeded recommendations for grains, however whole grain consumption was low throughout the sample. Previous literature has found whole grain consumption among the general population to be low with numerous studies indicating approximately 90% of Americans do not meet recommendations. Grain products including breads and cereals are commonly fortified with various vitamins and minerals. College students consumed significantly more vitamin A, thiamin, riboflavin, niacin, vitamin B6, calcium, phosphorus, magnesium, iron, sodium, and potassium; many of which are fortified in most breads and cereals. Fortified grains may supply a significant amount of these vitamins and minerals in this population. In addition, folate is also fortified in these grain products, however was not significantly higher among college students.

Sodium intake was significantly higher among the college students than the non-college individuals. Based on a 2,000 calorie diet, sodium intake exceeded USDA recommendations (2,300mg) for both college student and non-college individuals at 3,258mg and 2,921mg, respectively. High sodium intake is common among young adults as well as the general public due to the high reliance of processed, convenience foods.
Fresh fruits, vegetables, and whole grains as well as the Dietary Approaches to Stop Hypertension (DASH) diet may be recommended to those struggling with high sodium intake and hypertension.

Recent studies have shown the general population as well as young adults are below recommendations for physical activity. The 2007 Behavioral Risk Factor Surveillance System (BRFSS) indicates that approximately 48.8% of U.S. adults engage in the CDC's recommendations for duration and frequency of physical activity. Mean total frequency and duration of physical activity among this sample was high and exceeded these recommendations. In addition, college students engaged in significantly more total and vigorous activity than non-college individuals. These findings are inconsistent with previous studies which commonly indicate low physical activity patterns among young adults. While participants with extraneous duration and frequency of physical activity were excluded from this study, this study was based on self-report which may account for the high duration of activity among these groups. Additional research is needed to determine actual physical activity patterns in this population using standardized definitions for duration and frequency.

Limitations

Limitations of this study include reliance on self-reported dietary intake and physical activity data through use of secondary data from NHANES 1999-2002. Data was collected based on self-report, leaving opportunity for bias and untruthful data. Participants may have been categorized into the incorrect group based on the education and occupational data provided. Dietary intake was collected via a food recall representing 24 hours prior to the interview. Unusual intake prior to the 24-hour dietary
recall may result in inaccurate intake patterns among the sample. In addition, supplement use among the sample was not examined which may result in lower reported levels of many vitamins and minerals. Distorted perception of physical activity among participants in this study was likely due to the unusually high reported levels of physical activity among the sample.

Conclusions

Results of this study suggest a need for increased consumption from the various food groups with emphasis on whole grains, fruits, vegetables, and low-fat dairy in the young adult population. These data indicate dietary intake patterns among young adults do not meet MyPyramid recommendations for many of the food groups. College students commonly consumed more servings from the various food groups as well as specific nutrients when compared with non-college individuals. High levels of physical activity were reported among the sample.
<table>
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<tr>
<th>Energy Adjusted Nutrient</th>
<th>Non-College n=1,202</th>
<th>College n=532</th>
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<tbody>
<tr>
<td>Protein (gm)</td>
<td>34.2±0.5</td>
<td>37.2±1.0</td>
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<td>Carbohydrate (gm)</td>
<td>134.9±1.3</td>
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<td>Total Sugars (gm)</td>
<td>70.5±1.9</td>
<td>63.1±3.3</td>
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<tr>
<td>Dietary Fiber (gm)</td>
<td>5.9±0.2</td>
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<td>Total Fat (gm)</td>
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<td>Saturated Fat (gm)</td>
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<td>Monounsaturated Fat (gm)</td>
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<td>13.5±0.5</td>
<td>0.53</td>
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<tr>
<td>Polyunsaturated Fat (gm)</td>
<td>6.7±0.1</td>
<td>7.1±0.2</td>
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<td>Cholesterol (mg)</td>
<td>113.4±3.8</td>
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<td>Vitamin A (mcg)</td>
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<td>Folate (mcg)</td>
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<tr>
<td>Vitamin C (mg)</td>
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<td>48.1±3.9</td>
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<tr>
<td>Calcium (mg)</td>
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<td>Phosphorus (mg)</td>
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<tr>
<td>Magnesium (mg)</td>
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<td>Iron (mg)</td>
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<td>Alcohol (gm)</td>
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All p values <0.05 are significant

Table 4.1: Daily nutrient intake per 1,000 kcals among young adults
Figure 4.1: Daily food group intake among young adults

Figure 4.2: Consumption of discretionary foods among young adults
Figure 4.3: Frequency of physical activity among young adults

Figure 4.4: Duration of physical activity among young adults
Conclusion & Recommendations

Results of this study suggest a need for increased consumption from the various food groups with emphasis on whole grains, fruits, vegetables, and low-fat dairy in the young adult population. These data indicate dietary intake patterns among young adults do not meet MyPyramid recommendations for many of the food groups. College students commonly consumed more servings from the various food groups as well as specific nutrients when compared with non-college individuals. High levels of physical activity were reported among the sample.

It is apparent that both college students and non-college young adults are not meeting recommendations for many food groups as well as physical activity crucial to maintaining a healthy lifestyle. A lack of resources, knowledge, and application of healthy lifestyle choices is likely high in these young adults. Interventions are needed to provide nutrition education to this population focusing on making healthy choices, increasing nutrition knowledge and skills, and consumption of a balanced diet. Interventions must be tailored based on the environmental, behavioral, and personal factors of these unique groups of young adults.
College students would likely benefit from alterations in campus dining hall menus. While previous studies have indicated student interest in healthy foods in the dining halls, actual consumption of these foods remains low.\textsuperscript{10} Interventions including peer health education and providing nutritional information within dining halls and online are recommended to colleges and universities. In addition, young adults may also benefit from healthy cooking classes as well as education on consumption of a balanced diet. Participation in daily physical activity should be encouraged in all individuals especially young adults due to the decrease in activity seen in young adulthood.

Focus on comprehensive wellness programs are needed in the workplace to support healthy lifestyle behaviors among non-college attending individuals. Implementation of wellness programs must appeal to employees by use of creative, inspirational strategies or incentive programs such as health benefit packages and monetary rewards. Changes to the workplace environment including healthy on-site dining facilities and vending machines as well as providing opportunities for physical activity such as open stairways, walking paths, and extended lunch hours are recommended. Providing the resources necessary to these young adults and promoting wellness activities must be done tactfully in order to reduce resistance to adopting these healthy behaviors.

The dietary intake and physical activity behaviors seen in these young adults are likely influenced by the environments in which they live, work, and socialize. Alterations in environmental factors including the reduction of fast food restaurants within close proximity to schools and college campuses and alterations to campus dining facilities may increase healthy intake patterns. Increasing outdoor parks and recreational
opportunities as well as recreational facilities within college campuses and worksites are likely to increase physical activity in young adults. Public policy and legislation are necessary to promote implementation of these strategies.

**Limitations**

Limitations of this study include reliance on self-reported dietary intake and physical activity data through use of secondary data from NHANES 1999-2002. Data was collected based on self-report, leaving opportunity for bias and untruthful data. Participants may have been categorized into the incorrect group based on the education and occupational data provided. Dietary intake was collected via a food recall representing 24 hours prior to the interview. Unusual intake prior to the 24-hour dietary recall may result in inaccurate intake patterns among the sample. In addition, supplement use among the sample was not examined which may result in lower reported levels of many vitamins and minerals. Distorted perception of physical activity among participants in this study was likely due to the unusually high reported levels of physical activity among the sample.

**Further Research**

Additional research is needed to fully understand differences in dietary intake and physical activity patterns among college and non-college young adults. Identifying specific food intake patterns including the consumption of individual foods among this population may assist in developing intervention strategies. Identifying the consumption of various milk and meat products including fat and leanness levels may be helpful in
determining target foods for these young adults. In addition, further investigation of beverage consumption specifically fruit juices and soda intake would elucidate sources of added sugar and empty calories in the diet.

Additional research as to the specific nutrition-related knowledge as well as cooking and food preparation skills in young adults would assist in the development of appropriate intervention strategies. Further examination of consumption patterns in campus dining halls, workplace cafeterias, and restaurants is needed to fully understand dietary intake among young adults.

Due to the lack of standardized definitions for duration and frequency of physical activity in the current study, additional research is needed to fully understand physical activity patterns in this population. A standard definition of physical activity as well as specifications regarding frequency and duration are crucial. More research is needed on the health behaviors adopted by young adults in the college and non-college settings including emphasis on the environmental, behavioral, and personal influences of this unique population.
REFERENCES


APPENDIX
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<td>n=532</td>
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<tr>
<td>Protein</td>
<td>13.5 ± 0.2</td>
<td>14.8 ± 0.4</td>
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<td>53.3 ± 0.5</td>
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**Appendix A.1: Percentage of total caloric intake among young adults**

<table>
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<tr>
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<th>Non-College</th>
<th>College</th>
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<tbody>
<tr>
<td></td>
<td>n=1,202</td>
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</tr>
<tr>
<td>Grain</td>
<td>106.8 ± 3.0</td>
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</tr>
<tr>
<td>Vegetable</td>
<td>51.9 ± 1.8</td>
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<td>Fruit</td>
<td>39.6 ± 3.7</td>
<td>59.6 ± 6.2</td>
<td>0.00</td>
</tr>
<tr>
<td>Milk</td>
<td>60.0 ± 3.5</td>
<td>64.8 ± 5.2</td>
<td>0.48</td>
</tr>
<tr>
<td>Meat</td>
<td>97.9 ± 3.0</td>
<td>99.6 ± 5.1</td>
<td>0.77</td>
</tr>
</tbody>
</table>

**Appendix A.2: Percentage of food group recommendations among young adults**

<table>
<thead>
<tr>
<th></th>
<th>Non-College</th>
<th>College</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=757</td>
<td>n=455</td>
<td></td>
</tr>
<tr>
<td>Frequency (times/week)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>2.7 ± 0.2</td>
<td>3.3 ± 0.3</td>
<td>0.09</td>
</tr>
<tr>
<td>Vigorous</td>
<td>2.8 ± 0.2</td>
<td>4.2 ± 0.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>5.5 ± 0.3</td>
<td>7.6 ± 0.5</td>
<td>0.01</td>
</tr>
<tr>
<td>Duration (minutes/week)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>129 ± 9</td>
<td>157 ± 18</td>
<td>0.19</td>
</tr>
<tr>
<td>Vigorous</td>
<td>158 ± 11</td>
<td>229 ± 17</td>
<td>0.00</td>
</tr>
<tr>
<td>Total</td>
<td>287 ± 14</td>
<td>386 ± 27</td>
<td>0.00</td>
</tr>
</tbody>
</table>

**Appendix A.3: Frequency and duration of physical activity among young adults**