ABNORMAL EATING ATTITUDES AND BEHAVIORS AMONG UNDERGRADUATE COLLEGE STUDENTS: THE INFLUENCE OF LOW CARBOHYDRATE DIETING TRENDS

Amy L. Smith

A Thesis

Submitted to the Graduate College of Bowling Green State University in partial fulfillment of the requirements for the degree of

MASTER OF FAMILY AND CONSUMER SCIENCES

December 2005

Committee:

Julian H. Williford, Jr., Advisor

M. Sue Houston

Priscilla K. Coleman
ABSTRACT

Julian H. Williford, Jr., Advisor,

The purpose of this study was to identify the prevalence of abnormal feelings, attitudes and behaviors indicative of eating disorders among college students based on their self-reported EAT-26 questionnaire scores. Attitudes and behaviors regarding carbohydrates were also examined by utilizing item number 6 of the EAT-26 questionnaire. Age, gender, and class level were examined in relation to eating attitudes and behaviors, as were individual dietary intakes obtained through 5-day self-reported dietary records.

A convenience sample of students was taken from an introductory food and nutrition course at Bowling Green State University (BGSU). Students voluntarily completed EAT-26 questionnaires and students completed 5-day dietary records as a mandatory class assignment. The EAT-26 is a 26-item Liekert scale instrument, which measures the severity of eating disorder symptomatic responses. Cut-off scores of $\geq 20$ were considered to reflect risk for an eating disorder.

Findings from the current study showed that 16% of participants had EAT scores above the cut-off score, indicating abnormal eating attitudes and behaviors, and that 12% of students reported avoiding carbohydrate foods at least often. Data analysis revealed that females scored significantly higher on the EAT-26 than males and that females avoided carbohydrates significantly more than males. When participants were separated by age, class rank, and BMI, significant differences only existed between class rank, with freshman and underclassmen having significantly higher EAT-26 scores than upperclassmen. No differences were found regarding self-reported attitudes towards carbohydrates.
EAT-26 scores and item number 6 of the EAT-26 scores were also compared to average 5-day nutrient intakes. Nutrients examined in this study included total calories, protein, carbohydrate, fat, thiamin, riboflavin, niacin, vitamin B₆, folate, iron, and zinc. Results revealed that EAT-26 scores were inversely related to consumption of total calories, protein, fat, and carbohydrate. Item number 6 of the EAT-26 was inversely related to consumption of carbohydrate and riboflavin. There were no significant associations between other nutrients and abnormal eating attitudes and behaviors.

The current study demonstrated that abnormal eating attitudes and behaviors occur in a substantial amount of college students, and that current low-carbohydrate dieting trends are influencing a number of college students as well. Preventative and educational interventions regarding healthy dietary habits may reflect more positive outcomes if directed towards female and freshman college students. Future research is needed to investigate the extent of negative attitudes towards carbohydrates, and to determine what specific food consumptions are related to having a negative attitude towards carbohydrates.
This thesis is dedicated to my parents and family who have supported my efforts both emotionally and financially throughout my academic career. Your motivation, prayers, and encouragement helped me to finally finish this and for that I cannot thank you enough!
TABLE OF CONTENTS

CHAPTER I. INTRODUCTION

Statement of the Problem  
Significance of the Study  
Hypotheses

CHAPTER II. REVIEW OF LITERATURE

Overview of Eating Disorders

Anorexia Nervosa

Bulimia Nervosa

Eating Disorders Not Otherwise Specified

Onset of Eating Disorders

Prevalence of Eating Disorders

Consequences of Eating Disorders

Low Carbohydrate Dieting Behavior

The Atkins’ Diet

The South Beach Diet

The Zone Diet

The Enrichment Program

Consequences of Low Carbohydrate Dieting Behavior

Low Carbohydrate Dieting and Weight Loss

Low Carbohydrate Dieting and Blood Lipid Levels

Low Carbohydrate Dieting and Ketonuria
CHAPTER I

INTRODUCTION

Young adults enter college at a time when they are enthusiastic about becoming independent and excited about beginning many new experiences. For many, college is the first long experience away from home, where individuals can start fresh, meet new people, grow as a person, become confident in a new place, and be independent in choices and actions. Along with the excitement of this change comes the pressure of making decisions and creating a personal image that is accepted in the new college community. Creating a new personal image may lead students to change their eating behaviors in order to achieve a thinner body. In fact, Schwitzer, Rodriguez, Thomas, and Salimi (2001) reported that 83% (N=110) of their female college participants had concerns about either eating, or weight management, or both. Because of the copious quantity of dieting books and magazines that promise easy dieting, quick weight loss, and increased energy, as well as other pressures which may affect one’s view of one’s personal image, college students are inclined to jump on the bandwagon of new dieting trends.

For example, Linda is a college sophomore who struggled personally and academically through her freshman year and never really felt like she fit in with other students around her. She became worried that her appearance was the main reason why she was struggling, so she decided to buy a book about foods to help with her weight loss. She came across a book called “The South Beach Diet.” This diet is based on “good carbohydrates versus bad carbohydrates” and also promises hunger prevention and weight loss. Despite Leslie’s high education level, she gets confused while reading the book and ends up believing that she should avoid all carbohydrates, rather than try to distinguish the good carbohydrates foods from the bad carbohydrate foods.
Linda’s attitude towards carbohydrate foods becomes so negative that avoiding them becomes a dietary habit for her.

Mathew and his friends are college freshman who were thin and active in high school and always ate as much as they wanted without gaining weight. However, as fall semester closes, their activity level has gone down, their partying frequency has gone up, and their body weight has increased. They decide to use the convenience of the Internet to find a quick and easy way to lose weight before going home to see their old friends and family over the Christmas break. They come across “Dr. Atkins’ New Diet Revolution” and decide the diet is perfect for them. The Atkins’ Diet claims that a low carbohydrate diet is the key to weight loss because carbohydrates cause high insulin levels that lead to fat storage. Mathew and his friends read over the diet information and begin eating foods like meat, poultry, eggs, and cheese while avoiding foods such as breads, pastas, fruits, milk, and sweets. They spread this idea to several other friends in their dormitory, and pretty soon several people are avoiding high carbohydrate foods in hopes of losing weight.

The above examples illustrate how popular trends in dieting can affect a college population’s eating habits. Recently, popular diet books including, The “South Beach Diet,” “Dr. Atkins’ New Diet Revolution,” “Good Carbs, Bad Carbs,” and “The New Glucose Revolution” have contributed to many individuals choosing low carbohydrate dieting and adopting negative attitudes towards high carbohydrate foods. Several studies have indicated that college students are engaging in dieting behavior, however, research is needed to determine the prevalence of college students using low carbohydrate methods for weight loss (Nelson, Hughes, Katz, & Searight, 1999; O’Dea & Abraham, 2002; Prouty, Protinsky, & Canady, 2002; Ross & Gill, 2002).
Eating related problems, particularly low carbohydrate dieting, could represent a significant health concern on college campuses. Many carbohydrate foods are enriched with necessary vitamins and minerals that are important for energy, growth, pregnancy, and overall health. Decreasing high carbohydrate foods may put young adults at risk for deficiencies in these nutrients. Replacing carbohydrate foods with alternatives like beef, cheese, and other high fat, high cholesterol foods may cause the beginning of other health problems, such as excessive fat deposition in blood vessels, which may contribute to cardiovascular problems.

The purpose of this study was to identify surveyed college students’ prevalence of eating disorders and attitudes towards carbohydrates based on their self reported EAT-26 questionnaire scores. Individually reported dietary records were also analyzed to determine potential nutrient deficiencies that may be associated with negative attitudes towards carbohydrates. Specifically, total calories, carbohydrates, protein, fat, folate, thiamin, niacin, riboflavin, iron, zinc, and vitamin B₆ were analyzed. Also, age, gender, and year in college were examined in relation to total EAT-26 questionnaire scores and responses to item number 6 of the EAT-26 questionnaire. Total EAT-26 scores provided information to investigate any relationships with risks for eating disorders, and item number 6 of the EAT-26 questionnaire provided information regarding attitudes about carbohydrates.

Statement of the Problem

Anorexic like behaviors and eating disorders are generally believed to be common among college females, and may be more common among college males than reported previously (Nelson et. al, 1999). The eating behaviors that college students choose may not always be based on solid scientific evidence. In fact, eating behaviors may be based on advice from friends and family, television and the media, from the variety of diet books available for purchase, or from
the latest fad diets. Currently, many diet books and fad diets are based around a similar notion that all carbohydrate foods contain the target nutrients that need to be eliminated or modified in order to lose weight. Despite the popularity of low carbohydrate diets, there are few scientific studies actually supporting the adherence to such dietary habits. There is also very little clinical data to support the safety of these diets, or the impact they may have on risk factors for dietary deficiencies. The intents of the current study were to determine the prevalence of eating disorders among surveyed volunteer college students, to review their questionnaire determined attitudes towards carbohydrate foods, and to analyze self-reported dietary nutrient intakes for deficiencies, which may be associated with disordered low carbohydrate dieting.

Significance of the Study

The significance of the current study was to demonstrate, using the EAT-26 questionnaire data from volunteer college students, that abnormal eating behaviors and attitudes exist among current college students, and that these abnormal behaviors may be associated with the current trend of avoiding dietary carbohydrates. The results may also provide evidence of dietary nutrient deficiencies in students who have negative attitudes towards carbohydrates, as measured by both their answers on the EAT-26, and their self-reported 5-day food intake record. Determining dieting behaviors and trends, along with associated deficiencies in nutrients will help researchers and nutritionists make dietary recommendations that are appropriate for the present and future college populations.

Hypotheses

Ho1: Females are more likely to have higher total EAT-26 questionnaire scores than males;
Ho2: Students’ age will be negatively related to total EAT-26 scores;
Ho3: Students’ year in college will be negatively related to total EAT-26 scores;
Ho4: Females will have higher scores on item number 6 of the EAT-26 than males, indicating that more females will have negative attitudes toward carbohydrates than males;

Ho5: Students’ age will be negatively related to item number 6 score of the EAT-26, indicating that younger students will have more negative attitudes toward carbohydrates than older students;

Ho6: Students’ year in college will be negatively related to attitude towards carbohydrates, as measured by the item number 6 score of the EAT-26;

Ho7: Student’s total EAT-26 score will be negatively associated with intakes of nutrients (calories, protein, carbohydrate, fat, thiamin, riboflavin, niacin, vitamin B6, folate, iron, and zinc);

Ho8: Students’ intake of measured nutrients (calories, protein, carbohydrate, fat, thiamin, riboflavin, niacin, vitamin B6, folate, iron, and zinc) will be negatively associated with their attitude towards carbohydrates, as measured by item number 6 on the EAT-26 questionnaire;

Ho9: Student’s BMI, based on self-reported body weight and height, will be negatively related to their total EAT-26 score; and,

Ho10: Student’s BMI, based on self-reported body weight and height, will be negatively related to their attitude towards carbohydrates, as measured by the score on item number 6 of the EAT-26 questionnaire.
CHAPTER II
REVIEW OF LITERATURE

This literature review focuses primarily on the following topics: an overview of eating disorders, perceptions, attitudes, and behaviors of eating disorders, consequences of eating disorders, and consequences of low-carbohydrate diets. The review also explores why the EAT-26 is a strong eating disorder assessment tool, and why the 5-day, 24-hour self-reported diet record is a strong tool for looking at nutrient intake. Finally, this section will review the relationship between eating disorders and low carbohydrate intake.

Overview of Eating Disorders

Current research indicates an overall agreement that disordered eating among adolescent and young adult males and females is increasing. The majority of research regarding eating disorders has been conducted on adolescent and young adult females; however males have not been ignored (O’Dea & Abraham, 2002). When untreated, eating disorders are potentially serious and could lead to body harm or death. Thus, researchers should continue to study the prevalence and trends of eating disorders, and examine the nutritional outcome of these disorders in order to develop effective treatment regimens.

There are several different ways to define an eating disorder; however, the most common terms related to eating disorders tend to be anorexia nervosa and bulimia nervosa. There are also different characteristics of eating disorders based on the duration of the eating disorder or the intensity of the eating disorder. According to the American Psychiatric Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV), there are three different types of classified eating disorders: anorexia nervosa, bulimia nervosa, and eating disorders not otherwise specified. In
order to be classified as having an eating disorder, one must meet specific criteria set by the DSM-IV (American Psychiatric Association [APA], 1994).

Anorexia Nervosa

DSM-IV characterized anorexia nervosa as follows:

a) refusal to maintain body weight at or above a normal weight for age and height;

b) intense fear of gaining weight, despite the person being significantly underweight;

c) body weight or shape disturbance; and
d) amenorrhea in post-menarche women.

In addition, anorexia nervosa is classified into further categories including:

a) restricting anorexia nervosa – which includes the previously mentioned criteria with no involvement of binge purge behaviors, and

b) binge-eating purging – which includes the previously mentioned criteria and also the involvement of binge-purge behaviors.

The pathogenesis of anorexia nervosa has been linked to several factors, which include the following: intra-psychic conflict, self-deficits, family dynamics, sociocultural norms, sexual trauma, and biological and genetic factors (Nelson et al., 1999). In Nelson et al.’s (1999) study of 471 undergraduate students, males and females were reported to have different characteristics leading to problem eating. The female problem eaters were found to have low physical and personal self-esteem; whereas the male problem eaters most notably had current psychological distress. When considering family dynamics, Wonderlich, Ukestad, and Perzacki (1994) found that women with bulimia reported more control and less affection from their fathers, compared to their perceived sibling-parent relationships, than controls without bulimia.


**Bulimia Nervosa**

Bulimia Nervosa is characterized by the DSM-IV as having several diagnostic criteria that include the following:

a) binge eating episodes that involve eating large quantities of food in a short time period;

b) engagement in compensatory behaviors to prevent weight gain;

c) a minimum of bingeing and compensatory behaviors occurring twice every three weeks for three months;

d) sense of self is influenced by weight and shape; and

e) anorexia nervosa is not present during the eating disturbances.

Similar to anorexia nervosa, bulimia nervosa is also further categorized. These subcategories include the following:

a) purging – the subject engages in self-induced vomiting and laxative/diuretic abuse; and,

b) non-purging – the subject engages in other compensatory behaviors besides purging.

**Eating Disorders Not Otherwise Specified**

Eating Disorders Not Otherwise Specified (EDNOS) is the third category of eating disorders that the DSM-IV has identified. EDNOS is the terminology used to describe subjects who have some form of an eating disorder, but do not meet enough criteria to be classified as having either anorexia nervosa or bulimia nervosa. One example of EDNOS is binge eating disorder. This is similar to bulimia nervosa because subjects have an episode of eating large quantities of food in a short period of time without having dietary control during the episode (ADA, 1994). However, binge eating disorder does not involve compensatory behaviors or
anorexia nervosa, so it cannot be classified as either bulimia nervosa or anorexia nervosa. Other examples of EDNOS are similar to anorexia nervosa. For example, individuals may meet all of the criteria for anorexia nervosa, but continue to have their normal menses and/or fail to lose weight, therefore they cannot be diagnosed specifically as having anorexia nervosa.

Onset of Eating Disorders

Some research has reported that eating disorders are beginning at younger and younger ages (Bruch, 1981), however that the most common reported onset of eating disorders is around age 18 (Thelen, Mann, Pruitt, & Smith, 1987). The onset of eating disorders has been reported at different ages for men and women, and a recent study reports that 90% of eating disorders occur in females between the ages of 12 and 25 years old (Gittes, 2004). Braun, Sunday, Huang, and Halmi (1999) studied a clinical population and found that men were more likely to have an onset of eating disorders at a later age than women. The researchers estimated from this study that the onset of eating disorders for men occurred around age 20.6 years and for women around age 17.2 years. In a similar study of 93 undergraduate men, O’Dea and Abraham (2002) reported that the average age of men with eating disorders was 24 years, which is well above the previous mentioned average onset age of 18 for eating disorders that encompasses both males and females.

Prevalence of Eating Disorders

According to Hoyt and Ross (2003), the research on American college and university campuses over the past 10 years has estimated that 1 to 4% of female college students meet the full DSM-IV (APA, 1994) criteria for anorexia nervosa or bulimia nervosa. Similarly, Robinson (2000) found that 1 to 2% of all women in general are affected by eating disorders. In addition, 35 to 70% of females report symptoms of disordered eating, such as; loss of appetite control,
periodic use of laxatives, purging or excessive exercise to inhibit weight gain, body image dissatisfaction and distortion, obsessive monitoring of caloric and fat content, unhealthy weight fluctuations, excessive weight monitoring, moderate depression, or low self-esteem. Individuals who do not meet the full DSM-IV diagnostic criteria, but display problematic behaviors and attitudes have been shown to account for most of the eating pathology found on college campuses. One reason that college campuses are targets for eating disorder problems may be due to the high proportion of similar peers living in one small geographic area, which may lead to increased pressures for being thin.

A recent study conducted on students from a large, public, mid-Atlantic, rural university reported that 17% of late adolescent and young women were struggling with disordered eating based on the abbreviated Eating Attitudes Test (EAT-26) (Garner, Olmstead, Borh, & Garfinkle, 1982 and Prouty et al., 2002). Another study used the EAT-26 questionnaire on 471 undergraduate college students at two midwestern liberal arts colleges and found that up to 20% of the females and 10% of the males had anorexic symptomatology (Nelson et al., 1999). Despite these large numbers, another similar study at a midwestern university found that only 9% of females and 1% of males met Garner et al.’s (1982) EAT-26 cutoff score for anorexic symptomatology (Smead & Richert, 1990).

In a study of 555 counseling center students at a large university in the Rocky Mountain region of the United States, 12.9% of the males and females had symptomatology of eating disorders based on an EAT-26 score of 20 or more or a BMI of 18 or less. Of these clients, 90% were female and over 50% of these clients were found to be at risk of having binge/purge behavior (Hoyt & Ross, 2003).
Eating disorders among males may occur less often than they occur among females, however these disorders cannot be disregarded. According to a study reported by O’Dea and Abraham (1999), between 5% and 20% of males reported using restrained eating, vomiting, laxative use, or cigarette smoking as a means for weight control. Similarly, O’Dea and Abraham (2002) studied 93 undergraduate college men randomly chosen from a variety of study programs and found that 20% of these men displayed eating attitudes and behaviors characteristic of eating disorders and disordered eating, based on the Eating and Exercise Examination (EEE-C). The EEE-C is a self-report, computer-generated and computer-reported examination of eating and exercise behavior, attitudes and feelings. The EEE-C is clinically useful for assessment of eating and exercise disorders, as a therapeutic tool to provide feedback to patients, and as an instrument to provide standardized data for cost effective and relapse prevention studies (Abraham & Lovell, 1999).

Consequences of Eating Disorders

The consequences of having an eating disorder are just as complex to treat as the eating disorder itself. There are wide ranges of physiological and psychological problems one may face when he/she has an eating disorder. Not only can an eating disorder cause physical damage to the body, the resulting emotional and mental stress can lead to social challenges. There is also much variety in the severity of consequences to eating disorders. Some people with eating disorders may incur only mild consequences that are difficult to diagnose, while others may suffer from more dramatic outcomes that affect them for the rest of their lives. In addition, death can be attributed to eating disorders in some severe cases, as Gittes (2004) reports an 8% to 15% mortality rate for anorexia nervosa, which is the highest mortality rate for any psychiatric illness. Regardless of the severity or variety of eating disorder consequences one may have to confront,
suffering from an eating disorder generally results in some sort of harmful effect on either one’s body and/or psyche.

Clinical and physical consequences of eating disorders include symptoms that vary based on the type of eating disorder, the severity of the eating disorder, and the length of time the eating disorder has been in effect. Symptoms of eating disorders may include weight loss, food allergies, infertility, and/or diarrhea (Bean & Weitzin, 2001). Another serious effect of eating disorders on the body is the risk of losing visceral sensations related to hunger and satiety (Bean & Weitzin). An eating disorder can cause the body to revert back to a pre-pubertal stage hormonally, which causes the body to visually appear to be at a pre-pubertal stage (Bean & Weitzin). Although all eating disorders can be severely dangerous, anorexia nervosa has been associated with a substantial risk of death and/or suicide (Herzog et al., 2000).

Emotional and mental consequences of eating disorders, although not any less serious, may be more difficult to notice than physical consequences. In fact, some emotional consequences of eating disorders may also be attributed to being a cause of the eating disorder. Some emotional and mental feelings related to eating disorders may include, but not be limited to, feelings of general inadequacy, insecurity, worthlessness, emptiness, and lack of control over one’s life (Bean & Weitzin, 2001). Socially, individuals suffering from eating disorders may experience times of interpersonal distrust, feelings of alienation, and a reluctance to form close relationships (Bean & Weitzin).

Low Carbohydrate Dieting Behavior

Despite the criticism of physicians, dietitians, and other health care professionals, carbohydrate restrictive dieting has become enormously popular in the general public. In fact, low carbohydrate dieting books are now one of the biggest selling dieting publications in the
United States (Moyad, 2005). There are three popular low carbohydrate diets that seem to be garnering attention at this time, the ‘Atkins’ Diet’, the ‘South Beach Diet’, and the ‘Zone Diet’. Unlike traditional dieting methods that focus on limiting calories and fat, these diets foci specifically address carbohydrates consumed, what kind of carbohydrates are consumed, and how the body’s metabolism reacts to the energy consumed. An overview of these three popular diets and some of the consequences to these dieting behaviors follows.

*The Atkins’ Diet*

The traditional Atkins’ Diet is comprised of four stages, including diet induction, ongoing weight loss, pre-maintenance, and lifetime maintenance. The Atkins’ Diet goes beyond including total carbohydrates, and stresses the term ‘net carbohydrates,’ (Atkins, 2002, 2004). The term ‘net carbohydrates’ refers to the total grams of carbohydrates in a food or beverage minus the foods’ total grams of fiber. The traditional Atkins’ diet is comprised of four different stages, all with specific outcome goals based on the number of carbohydrates allowed in a day. These stages include induction, ongoing weight loss, pre-maintenance, and lifetime maintenance.

Induction is the first stage of the Atkins’ Diet and requires the strictest adherence to limiting carbohydrates. In this stage carbohydrates are limited to under 20 grams of net carbohydrates in a day. In order to adhere to this diet, Atkins’ dieting books provide lists of foods that are discouraged during this phase. This phase typically lasts 14 days and has a main focus on changing the body’s metabolism into a form of ketosis (Atkins, 2002, 2004).

The second phase of the Atkins’ Diet is the ongoing weight loss stage, which lasts anywhere from two weeks to two months (Atkins 2002, 2004). At this point in the Atkins’ Diet, carbohydrate restriction becomes less strict gradually. A dieter is encouraged to increase his or her intake of grams of net carbohydrates by 5 grams daily. The dieter is encouraged to do this
until he or she feels that he or she is at their highest potential for carbohydrate intake while still being able to lose weight. If the dieter begins to gain weight again, the Atkins’ Diet prescribes reduction of carbohydrate intake gradually again until the individual restarts to lose weight.

After the dieter has lost enough weight to consider himself or herself within 3 to 10 pounds of his or her ideal body weight, the pre-maintenance stage of the Atkins’ diet begins (Atkins, 2002, 2004). Similar to the previous stage, this stage can last from a few weeks up to a few months. This is a stage where weight loss is expected to be slower and the dieter is expected to learn more about the variety and changes he or she can make in his or her diet while still maintaining a slow weight loss.

The final phase of the Atkins’ Diet is the lifetime maintenance phase. In this phase, the dieter is expected to know the total number of carbohydrates that he or she can consume for continued weight loss or maintenance. The Atkins’ Diet suggests that limiting consumption to 40 to 60 grams of net carbohydrate daily is probably sufficient for weight maintenance during this stage.

The South Beach Diet

The South Beach Diet entails three phases, simply known as Phase 1, Phase 2, and Phase 3 (Agatston, 2003, 2004). The South Beach Diet takes carbohydrate control to a different level than the Atkins’ diet, and recommends concentrating on the glycemic index of food rather than just the grams of carbohydrate in the food. Similar to the Atkins’ Diet, the South Beach Diet provides lists of foods that are either recommended or discouraged during different phases of the diet.

Phase 1 of the South Beach Diet is the most restrictive of the phases, and is set up to theoretically eliminate cravings for foods with carbohydrates in them. Cravings are suppose to be
eliminated by avoiding all starch foods, such as breads, potatoes, rice, sugars, whether from fruit or alcohol, and any beverages with sugars in them. In replacement of these foods, nutrient dense foods such as vegetables are promoted to satisfy the dieter’s appetite. Phase 1 of the South Beach Diet is scheduled to last two weeks, and according to the diet book, a dieter can plan on losing anywhere from 7 to 13 pounds during this first phase (Agatston, 2003, 2004).

The second phase of the South Beach Diet is also similar to the Atkins’ diet because it begins to gradually allow more foods into the diet. At this point, the South Beach Diet begins to label certain foods as having supposedly ‘good carbohydrates.’ A dieter in this phase of the South Beach Diet is recommended to gradually increase only ‘good carbohydrates.’ ‘Good carbohydrates’ for the purposes of this diet, are considered to be whole grains and fruits (Agatston, 2003, 2004). In addition to the previous recommendations, having a glass of red wine each day with a meal is suggested for it’s potential ability to slow digestion. This second phase of the South Beach Diet has no definitive length. A dieter is recommended to stay in this phase until he or she reaches his or her own personal weight goal.

Once a personal weight goal is reached, the third phase of the South Beach Diet can be started. This third phase is considered the maintenance phase of the diet (Agatston, 2003, 2004). For this phase, no specific restrictions are provided. Instead, the dieter is supposed to be knowledgeable about the glycemic index of foods and choose ‘good carbohydrate foods’ accordingly. According to the South Beach Diet, the glycemic index should be considered as having three ranges: low equals 55 and below, medium equals 56 to 69, and high equals 70 and above. Once a dieter has reached this phase, he or she should be aware of, or have access to the glycemic index of most foods and choose to eat only foods that are in the low glycemic index range.
The Zone Diet

The Zone Diet is also sometimes referred to as the ‘Low-Glycemic Index Diet.’ This diet was written by Barry Sears and promotes the idea that dieters will eventually enter their ‘Zone,’ determined by a variety of calculations to determine the appropriate number of carbohydrate and protein grams to be eaten (Sears & Lawren, 1995). This diet recommends eating a specifically balanced ratio of carbohydrates and protein over a period of 3 meals and 2 snacks daily. According to this diet, the appropriate protein-to-carbohydrate ratio is 0.75. This means that for every 7.5 grams of protein eaten, 10 grams of carbohydrate should be eaten to provide balance. The Zone Diet converts macronutrient levels of foods into so-called ‘blocks’ of macronutrients. For example, one protein block equals 7 grams of protein, one carbohydrate block equals 9 grams of carbohydrate, and one fat block equals 1.5 grams of fat. By doing this, Sears recommends to simply eat the same number of ‘blocks’ of each macronutrient at each meal and snack.

Unlike the previous two diets mentioned, the Zone diet does not provide lists of foods that are discouraged or encouraged. Instead, the Zone Diet provides a list of foods based on how many ‘blocks’ of macronutrients they contain. The diet then uses this list to provide examples of how to construct meals with balanced macronutrient blocks. For example, one block each of protein, carbohydrate, and fat would contain one ounce of lean meat, 1 medium apple, and half a teaspoon of peanut butter, respectively. The Zone diet also provides examples of how to ‘eyeball’ portions of foods to determine the number of ‘macronutrient blocks’ they contain. Using this block system, the Zone Diet recommends no more than 500 calories per meal and 100 calories per snack for a total of no more than 1700 calories a day to be consumed. The Zone diet
also puts stipulations on the timing of meals by recommending meals to be no longer than five hours apart unless having one of the two allowed snacks in between each meal.

Similar to the previous two diets mentioned, the Zone diet puts a label on foods that considers them to be ‘bad carbohydrates’ based on the food’s glycemic index (Sears & Lawren, 1995). Some of these foods include carrots, corn, peas, potatoes, sweet potatoes, bananas, raisins, prunes, papayas, all fruit juices, most breads, ice cream, granulated sugar, honey, and jelly. This diet puts emphasis on high fiber and low fat foods such as spinach, green beans, blueberries, apples, and monounsaturated fat such as olive oil.

The Zone diet uses calculations based on body weight to provide information about how much protein should be eaten (Sears & Lawren, 1995). Once protein requirements are formed, carbohydrate requirements are calculated. The Zone diet also accounts for the amount of physical activity and percentage of body fat when making these calculations. A dieter is expected to follow the recommended amounts and proportions of protein and carbohydrate to enter ‘the zone’ of weight loss. According to the author of the diet, the more carbohydrates consumed, the harder it is to lose weight.

In order to enter the Zone of permanent weight loss, the calculated proportion of protein and carbohydrate should be consumed daily. This determined proportion ends up reducing total carbohydrate intake daily to less than 40% of total calories. This is much lower than the USDA recommendations to get 55 to 60% of total calories from carbohydrates. In the Zone diet, the carbohydrate calorie decrease is adjusted by increasing calories from protein to 30%, compared to the USDA recommendations of getting 12 to 15% of total calories from protein. Fat recommendations for the Zone diet end up comparing to the USDA recommendations of getting 30% of total calories from fat, and having most of this fat come from monounsaturated sources.
According to Sears and Lawren (1995), this dietary plan is considered the 40% carbohydrate - 30% protein - 30% fat diet plan.

The Enrichment Program

Currently, several high carbohydrate foods are enriched with vitamins and minerals, which are important for prevention of disease. The history of cereal enrichment dates back to the 1930s when severe cases of vitamin deficiency diseases such as beriberi, Korsakoff’s disease, pellagra, and anemia became a concern, especially in the southern United States (Sebrell, 1992). Although it was known that insufficient intakes of nutrients such as thiamin, riboflavin, niacin, and iron were related to these deficiency diseases, supplemental treatment with these nutrients was usually only prescribed under medical supervision.

In the 1940s, scientists reported that these nutrients and others were lost in the conversion of wheat grain to white flour (Sebrell, 1992). During the milling process, the grain undergoes grinding and separating stages that remove most of the grain’s bran layers and germ, and the remainder of the grain is a light colored white flour (Sebrell). Because most of the vitamins and minerals are present in the pre-processed grain, the refined flour that is used widely for baked goods in the United States was left deficient in these nutrients. At least 20 nutrients are lost in varying amounts during the milling process (Sebrell). Some of these nutrients include thiamin, riboflavin, niacin, folate, vitamin E, calcium, iron, zinc, and manganese.

In 1941, the War Food Administration Order No. 1 made the first mandatory enrichment of white flour and bread. At this time enrichment of processed wheat flour products was made mandatory for the duration of World War II (Sebrell, 1992). Enrichment of four nutrients including thiamin, riboflavin, niacin, and iron was mandatory at this time. By 1977, similar laws made processed wheat flour enrichment mandatory over 35 states in the United States and Puerto
Rico. In addition to the mandatory enrichment nutrients, in 1974, the Food and Nutrition Board of the National Research Council-National Academy of Sciences proposed that six more vitamins, and 4 minerals be added to white flour and cereal grain products (Sebrell), and it has also been proposed for vitamin D and calcium to be added (Newmar, Heaney, & Lachance, 2004). Despite these proposals, current enrichment is mandatory for only thiamin, riboflavin, niacin, iron, and folate [which was added in 1998] (Sebrell; Newmar). Currently, nutrients such as vitamin D, calcium, vitamin A, pyridoxine, magnesium, and zinc are optional, but not mandatory for enrichment (Sebrell, 1992; Newmar et al., 2004).

Common foods that are enriched are also common foods that are high in carbohydrates. Some examples of enriched foods include flour, bread and rolls, corn grits, corn flour, farina, rice, and macaroni and noodle products (Newmar et al., 2004). Due to the fact that these foods all contain carbohydrates, several of these foods may be deleted or decreased in the diet of those who are following low carbohydrate diets. Therefore, insufficient intakes of enrichment nutrients may become a concern in the college population if public attitudes towards dietary carbohydrates are negative and individual intakes of carbohydrates are lower than DRI dietary recommendations.

Consequences of Low Carbohydrate Dieting Behavior

Low carbohydrate diets have unarguably become very popular among people in the United States. Because of this dietary behavior, several studies have recently reported some of the consequences of this type of dieting. As with any dieting behavior, health factors such as weight and blood lipid levels may be altered. Some of the main health markers studied regarding changes caused by low carbohydrate dieting include short term and long term weight loss, HDL cholesterol, LDL cholesterol, triglycerides, blood sugar levels, and reactions of organs such as
the kidneys and liver to the new dietary regiment. Unfortunately, similar to low-fat dieting, low carbohydrate dieting has a low participant compliance and the dropout rate is typically seen at 33-50% for short-term studies, so long-term effects of the diet are hard to obtain (Moyad, 2005).

**Low Carbohydrate Dieting and Weight Loss**

Originally, research studying the safety and effectiveness of low carbohydrate diets was scarce, and of the studies available before 2000, most were small sample sizes and were conducted over short periods of time (Kennedy, Bowman, Spence, Freedman, & King, 2001). As a result of Kennedy et al.’s (2001) research, including 20 other studies prior to 2000, a general consensus was reached that subjects consuming low-carbohydrate diets had a pattern of weight loss ranging from (-)2.8 to (-)12.0 kg. Although popular low-carbohydrate diet books suggest that total energy intake is irrelevant (Atkins, 1992), data from Kennedy et al’s study in 2001 indicated that total energy intake typically decreased along with the carbohydrate intake of individuals following the low carbohydrate diet. In addition, Alford, Blankenship, and Hagen, (1990) and Golay et al., (1996) found evidence to refute the fact that low carbohydrate diets, in the absence of energy restriction, provide a metabolic advantage for weight loss.

Westman, Yancy, Edman, Tomlin, and Perkins (2002) reported a study of 41 overweight or obese volunteers, where subjects consumed daily, on average, 23 ± 10 grams of carbohydrate, 115 ± 29 grams of protein, and 98 ± 27 grams of fat. Of the study subjects, 27 reported following the dietary recommendations for 2-weeks, 25 for 12-weeks, and 15 for 24-weeks. Thirty-nine of the subjects lost weight and from baseline (the beginning of the study) to 24 weeks, average overall body weight change was (-)10.3% ± 5.9% (p < 0.001; range, 0% to 20.2%). Weight loss was found to correlate with dietary adherence to the low carbohydrate diet guidelines; however, no data comparing total energy consumed was reported.
Low carbohydrate dieting also showed positive results for weight loss in a study of 20 overweight women, between the ages of 18 and 60 years, who completed an 8-week diet that reduced daily carbohydrate intake from 232 to 71 grams (Meckling, Gauthier, Grubb, & Sanford, 2002). With the use of an electronic scale, collected data indicated that, over this eight week time period, average weight loss was 5 Kg total. Both underwater weighing and bioelectrical impedance was used to determine body mass composition, and the average weight loss was reported to come from a combination of an average of 4 Kb fat mass loss and 1 Kg lean mass loss.

**Low Carbohydrate Dieting and Blood Lipid Levels**

Despite reported research evidence supporting positive outcomes of low carbohydrate dieting, a common concern about health consequences of this type of dieting seemed to a rise among healthcare professionals recently, when low-carbohydrate diets became popular. Healthcare professionals were concerned that low carbohydrate dieting would cause an increase in dietary consumption of fat and cholesterol, therefore increasing the potential risk for heart disease. Contrary to this original concern, new research has reported that high-protein, low-carbohydrate dieting is less risky than previously believed (Schatz, Ferrari, Junge, McGrath, & Merz, 2003). In fact, leaving aside the problem of high participant dropout rates in low carbohydrate dieting studies, data indicated that limiting carbohydrate in favor of protein and fat poses no greater health risks than following the more traditional carbohydrate, protein, fat type of diet endorsed by most healthcare experts (Schatz et al., 2003). This data however only considers the first year of the diet, and does not incorporate long-term consequences of low-carbohydrate dieting.
In Westman et al.’s (2002) study of 41 volunteers, beneficial effects on serum lipid levels were observed from baseline to six months. Twenty-nine (71%) of the 41 subjects to complete the study had a reduction in LDL cholesterol levels, and 37 (90%) of the subjects had an increase in HDL cholesterol. Only 12 subjects had an increase in LDL cholesterol, ranging from 4 to 53 mg/dL, and only one subject had an increase in cholesterol/HDL cholesterol ratio. In a shorter study of overweight women ages 18 to 60, total cholesterol and LDL cholesterol were significantly reduced after only 8 weeks of intervention \( [n = 20, p < .01] \) (Meckling, et al., 2002).

Dashti, et al. (2003) revealed similar findings in a 12-week study of 102 obese subjects placed on a ketogenic diet. The diet consisted of 20 to 30 grams of carbohydrate in the form of green vegetables and salad, and 80 to 100 grams of dietary protein. Polyunsaturated and monounsaturated fats were included in the diet. After 12 weeks of adherence to this diet, obese patients had significantly decreased blood levels of triacylglycerols (\( p < 0.0001 \)), total cholesterol (\( p < 0.0022 \)), LDL cholesterol (\( p < 0.0160 \)), and glucose (\( p < 0.0009 \)). Also, subjects had significantly increased blood levels of HDL cholesterol (\( p < 0.0022 \)).

These results show contradictory evidence to the early concerns about low-carbohydrate dieting. In fact, these studies indicated, not only that low carbohydrate dieting appears to be safe, but that such diets can produce favorable modifications to the risk factors of heart disease. Even more contrary to early beliefs, Moyad (2005) reported that, through a series of studies, low carbohydrate dieting improved HDL and triglyceride levels more than low-fat dieting. However, the same studies showed that LDL cholesterol was improved more from low fat dieting rather than low carbohydrate dieting.
Low Carbohydrate Dieting and Ketonuria

In Westman et al’s (2002) six-month study mentioned earlier, all 41 participants developed ketonuria, despite several who had short-term adherence to the dietary recommendations. Eight subjects had ketosis greater than ‘moderate’ ketonuria (≥3), 20 subjects had ‘moderate’ to ‘trace’ ketonuria (between 1 and 3), and 13 subjects averaged ‘trace’ ketonuria (≤1). The level of ketonuria appeared to be strongly correlated with self-reported dietary adherence (p = 0.002). In support of these findings, Meckling et al. (2002) reported that blood ketone levels rose quickly after initiation of a low carbohydrate diet and levels appeared to peak at either two weeks or four weeks into the diet. However, as reported by the authors of this study, ketone levels began to decrease after week four, and by week eight the dieters had ketone levels that were significantly below peak levels and closer to baseline levels.

Low Carbohydrate Dieting and Blood Sugar Levels

Meckling et al. (2002) found no significant changes in fasting concentrations of glucose, insulin, total or free IGF-1, or total IGFBP-3 over an eight week trial of 20 overweight women, following a low carbohydrate diet. However, within this group of women, four subjects had impaired fasting glucose as described by the American Dietetic Association, and of these four subjects, only one continued to have impaired fasting glucose at the end of the eight week diet period. Two additional subjects in this study had normal fasting glucose but impaired glucose tolerance at baseline; and after the eight-week diet, both individuals had normal glucose tolerance based on an oral glucose tolerance test.

Long-Term Consequences of Low Carbohydrate Dieting

Long-term consequences of low carbohydrate dieting are hard to find in the research literature. In 2005, Moyad reported findings identifying three major long-term concerns of low
carbohydrate dieting. These findings indicated that calciuria, or renal stones, combined with reduced bone mass were consequences of a low carbohydrate diet. Another potential problem identified was that low carbohydrate dieting typically involves high protein content in the diet which is damaging for patients with kidney or liver problems. A final long-term consequence identified by Moyad (2005) was the atherogenicity of the diet, or the fact that low carbohydrate diets are high in saturated and trans fat, and cholesterol while having a relative absence of fruit, vegetables, and whole grains.

Dieting and Health in College Students

The traditional age to begin college is around 18 years, and college campuses are typically considered to have an environment that emphasizes physical attractiveness, which is currently socially defined as thin and/or physically fit (Hoyt & Ross, 2003). Despite this reputation concerning college campuses, a great increase in obesity (BMI ≥ 30 kg/m²) has been reported in the United States, with the greatest increases found among 18- to 29-year-olds, and those with some college education (Mokdad et al., 1999). In fact, data from the National College Health Risk Behavior Survey suggests that 35% of college students may be either overweight or obese (Lowry et al., 2000), and by 2001, projections indicated that 21% of 18 to 29-year-olds with some college education would be obese (Mokdad, Ford, & Bowman, 2003). Similarly, in 2004, Butler, Black, Blue, and Gretebeck reported significant increases in body weight parameters of 54 freshman women within five months of entering a college community. These authors reported that total calorie consumption significantly decreased upon entry to college, and that the cause of increases in body-weight parameters was associated more with significant decreases in total physical activity rather than dietary behavior.
Data specifically focusing on dietary habits of college students is difficult to find. Of the few studies discovered, college students were found to have unhealthy dietary habits compared to current recommendations. According to the Dietary Guidelines for Americans (2005) published by the Department of Health and Human Services (HHS) and the Department of Agriculture (USDA), no more than 20 to 35% of total calories should come from fat and foods should be chosen with little added sugar (USDA & HHS, 2005). In a study of 2,489 college students reported by Schuette, Song, and Hoerr in 1996, only 4% of participants reported eating 30% or less of total calories from fat, and 10% or less of calories from sugars per day. A more recent study in 2002 involved 736 college students aged 18 to 27 years and reported that more than two thirds (69.4%) of the participants consumed fewer than 5 servings of fruits and vegetables daily (Huang et al., 2003). This is below the national recommendation for a 2000-calorie diet, which is to consume at least two cups of fruits and two and a half cups of vegetables each day (USDA & HHS, 2005).

Eating Behavior Assessment Instruments

Identifying eating disorders in individuals is a sensitive subject. Although eating disorders are common in several people, individuals may not be willing to answer forward, self-admitting questions such as, “Do you purposely vomit after meals to aid in weight control?” Therefore, several less direct assessment tools have been developed to help identify signs of eating disorders in individuals. Although these assessment tools cannot replace a qualified physician or psychiatrist, these instruments can be used to determine if a subject is at risk for an eating disorder by measuring questionnaire responses as indicators of signs and symptoms of abnormal eating behavior.
The EAT-26 Questionnaire

The EAT-26 questionnaire, which was used in this study, is one example of this type of an eating disorder assessment tool. The EAT-26 is a self-reported psychometric measurement that assesses attitudes and related behaviors that may be characteristic of eating disorders (Garner & Garfinkel, 1979). EAT-26 is a modified version of the EAT-40, in which 14 items were eliminated from the original EAT-40, based on a factor analysis that found these items to be statistically redundant (Garner et al., 1982). Individuals who meet or exceed the EAT-26 cut-off score may have disturbed eating attitudes and behaviors, but not necessarily clinical anorexia nervosa. According to Garner et al. (1982), most individuals who have high scores on the EAT do not satisfy the criteria for anorexia nervosa, however most have been found to experience abnormal eating patterns, which interfere with normal psychological functioning. The EAT-26 questionnaire has been used to study eating disorders in North America and Europe (Steinhausen, 1985; Williams, Schaefer, Shisslak, Gronwaldt, & Comerci, 1986).

Advantages of the EAT Questionnaire

The EAT-26 is considered the most widely utilized self-report instrument for measuring symptoms of eating disorders (Garner, 1993). The EAT-26 is also very efficient and can be completed in only 5 to 10 minutes. This makes the EAT-26 a simple tool to administer to a large population in a short period of time, and because of the standardization of the EAT-26, it can be administered even without the presence of a trained interviewer. Also, the EAT-26 has been widely used in counseling centers throughout the United States (Hoyt & Ross, 2003). The EAT-26 has been validated as “a screening tool for identifying non-clinical women who are likely suffering from an undifferentiated DSM-IV eating disorder,” and the EAT-26 has a proven accuracy rate of approximately 90% when used with non-clinical women (Mintz & O’Halloran,
2000). In addition, the EAT-26 has an uncomplicated scoring system, making it even faster and more economical to use for large populations of people.

Disadvantages of the EAT Questionnaire

As with most research data tools, the EAT-26 questionnaire does have its limitations. One limitation of the EAT-26 is that it is a face valid instrument; therefore, most participants are probably aware of the purpose of the questionnaire and some clients who actually have eating disorder symptoms may choose not to complete the survey, or they may answer dis-honestly. This assumption is based on Beglin and Fairburn’s (1992) research, which indicated that as many as 38.5% of women who refuse to participate in surveys related to eating disorders actually had symptoms of eating disorders. This may be partly caused by the participants not trusting the confidentiality of the questionnaire. Similarly, the EAT-26 is a self-reported questionnaire, making the data susceptible to distortion. For example, participants may have the perception that there are correct and incorrect answers to the questionnaire and base their responses accordingly.

Determining Dietary Intakes

Determining dietary intakes can be one of the most difficult parts of analyzing the nutritional health of an individual or population. Whenever attention is directed towards an individual’s diet, the person may be consciously or unconsciously altering his/her diet to either make recording of the dietary information easier, or to impress the researcher collecting the information (Guthrie, 1989). In either case, these alterations in a diet record can interfere with the validity of the data obtained, and therefore, alterations in accurate reporting of individual diet records must be considered. In some cases, the researcher can directly observe the participant, to record the subject’s actual dietary intakes, however, because this is not always practical with larger groups, use of a previously prepared instrument or document that allows participants to
provide data themselves is often necessary. Information about actual dietary intake can be collected through direct observation or through an inventory of foods eaten.

There have been several different instruments developed that have helped make dietary intake data a more consistent and simple type of data to collect. These instruments can be used in several different settings to determine nutritional inadequacies among individuals or populations. The average dietary intake for most individuals can usually be accurately reflected when records are kept for a 72-hour period (Medlin & Skinner, 1988). In the event that a dietary record is incomplete, collection of data for longer than 72 hours may be necessary. The collection of dietary intake data often involves recording by the participant themselves. Participants may record their own intake daily or at the end of a set period of time. Their dietary record can then be provided to a professional who can do a nutrient analysis of the diet to determine nutritional inadequacies. However, nutrient deficits found based on the Nutrient Intake Analysis (NIA) do not necessarily portray a nutritional deficiency, but they do provide information to place an individual or population at risk for a deficiency, based on dietary intake. The major instruments designed to help collect dietary intake information are: daily food diaries, food frequency questionnaires, and 24-hour recalls (Medlin & Skinner, 1988).

**Food Frequency Questionnaires**

The Food Frequency Questionnaire (FFQ) is a document of dietary intake from past or retrospective data (Medlin & Skinner, 1988). Data can consist of food eaten per day, week, or month. A food frequency questionnaire is usually organized into groups of foods based on similar nutrients in these foods. Therefore, information about general types of foods consumed will be obtained rather than data on each specific food. Unlike a daily food diary, a food frequency questionnaire may not be significantly affected by one or two days of unusual eating.
This is because the food frequency questionnaire allows the participant to answer in a way that gives information about their usual, or common eating habits. A food frequency questionnaire can be easily administered to a large population, so it is often the preferred method of dietary data collection in epidemiologic studies (Axelson & Csernus, 1983). Once the food frequency document has been filled out completely, a professional or researcher can analyze it for nutrient adequacy based on several guidelines, including Recommended Dietary Allowances or Food Pyramid Guidelines.

24-Hour Recall

The 24-hour recall method of collecting dietary data involves having the participant list all foods he or she ate in the last 24 hours (Medlin & Skinner, 1988). This means the information obtained relies on the participant being able to remember what foods he or she ate, and what amounts of foods they ate over the last 24-hours. Also, since this method of obtaining dietary intake information only includes one day of data collection, there is a chance that this day might not accurately reflect the typical diet of the participant. At the same time, when there is no opportunity or time to have someone do a daily food diary, the 24-Hour Recall method may be the most practical approach to obtaining dietary data of any kind.

Daily Food Diaries

A daily food diary, or record, is a document of dietary intake as food is consumed (Mela & Aaron, 1997). According to Mela and Aaron, food records are recorded by participants based on what food they ate, how the food was prepared, and what portion size of food they consumed. Participants record their intakes as close to the time they ate as possible, to make the record most accurate. The record of dietary intake then continues daily for a set amount of time, which is usually 3 to 7 days long. At the end of the desired recording period, the participant provides the
diary of intake to a professional, or researcher, to be analyzed and compared to Recommended Dietary Allowances, Food Pyramid Guidelines, or other criteria.

Advantages and Disadvantages of a Daily Food Diary

The daily food diary provides a record of food eaten for the researcher to analyze. This method of dietary data collection provides an opportunity for collection of specific information that other retrospective data collection methods may not be able to include. For example, quantity of food, how the food was prepared, where the food was eaten, and what time the food was eaten are all easily included in this data with little error, since the participant is recording the information as it occurs (Karvetti & Knuts, 1992). Therefore, this data collection method does not involve the risk of memory affecting the recorded data. A daily food diary also has the advantage of multiple days of dietary data collection, where average values can be obtained from the data to determine a typical day of eating. This method helps to prevent any unordinary days from significantly altering the data.

Disadvantages of daily food diaries also exist. For one, they require the participant to accurately record amounts and types of food eaten (Medlin & Skinner, 1988). This means the participants must be literate and able to accurately measure volumes of food for data to be valid. Also, because data is recorded as food is eaten, some participants may change their diets based on what they think is desirable dietary intake they should report (Mela & Aaron, 1997). The act of recording food itself may become unreliable if participants either forget or are unable to record food as it is eaten, and therefore, the use of guessing amounts and types of food might cause inaccuracies in the food recording (Krall & Dwyer, 1987).
CHAPTER III
METHODOLOGY

Population and Method of Sampling

A convenience sample was obtained from an existing data set of 354 volunteer undergraduate college students, enrolled in an introductory nutrition course, during the spring and fall semesters of 2003, and the spring semester of 2004 at a Midwestern university. This University is located in northwest Ohio and enrolls approximately 20,300 students, 90% of whom are from within Ohio. This university has approximately 17,300 undergraduate students and 3,000 graduate students enrolled in classes. Of these students, approximately 7,000 live on campus each school year. There was no control over who enrolled in the introductory nutrition course, nor was there any way to determine whether or not students were repeating the course. Majors that require this course include nursing, physical education and recreation, sports management, physical therapy, gerontology, nutrition sciences, and dietetics. Other students may take this course as either an elective or for personal interest. The data set collection received approval by the Human Subject Review Board, and can be located under the file number H03P126FE7.

Data Collection

Five questionnaires were provided on the Internet, via Blackboard, in FN 207, Introduction to Human Nutrition. Enrolled students were able to voluntarily access and complete these questionnaires at the beginning of each semester. In order to improve the response rate of students, extra credit points were provided to students for completing the online questionnaires. Also during each semester, students had a required assignment to complete a 5-day, 24-hour self-reported diet record. Students were provided written instructions concerning how to record the 5-
day diet record, and all students were informed that this self-reported data would be used for statistical analyses on nutrition behavior topics, such as, eating attitudes, eating behaviors, and psychological or socio-demographic backgrounds. Privacy was ensured to volunteer students by assigning nine-digit identification code numbers to replace their names on their response sheets. Graduate student assistants documented these code numbers before providing the survey responses to the research team. Once the surveys and diet records were all collected, the data were recorded on a spreadsheet for further statistical analysis.

Instrumentation

This study used data collected on a demographic/background measures questionnaire, the EAT-26 questionnaire, and a 5-day, 24-hour self-reported diet record. The demographic/background measures and EAT-26 questionnaire were collected sporadically over a spring, fall, and following spring semester. Students individually recorded their 5-day, 24-hour food record during their choice of any consecutive 5-day period within the semester. Food records contained information such as specific food items, preparation methods, serving sizes, and estimated number of servings. Each student entered the information from their food record into the Diet Analysis Plus 6.0 computer program, which calculated a 5-day average nutrient intake for macronutrients and micronutrients. Each student then printed this calculated information, combined the printout with their completed questionnaires, and handed them in to the graduate assistants for documentation.

**Scoring the EAT-26 Questionnaire**

A 6-item, 6-point Likert-scale was used to rate the items on each EAT-26 questionnaire. Respondents replied to the items using the following terms: Always, Very Often, Often, Sometimes, Rarely, and Never. A scoring technique weighing each item from zero to three was
used in order to prevent the asymptomatic responses from contributing to the total score. The responses Sometimes, Rarely, and Never were assigned the weight of zero, Often was assigned the weight of one, Very Often was assigned the weight of two, and Always was assigned the weight of three, thus having a score as follows: (Always = 3, Very Often = 2, Often = 1, Sometimes = 0, Rarely = 0, Never = 0). Item number 4 on the EAT-26 was scored in the opposite direction as this item reflects positive attitude toward trying new rich foods. The total EAT-26 scores for the questionnaire were computed by summing all individual item scores.

Scores greater than or equal to 20 on the EAT-26 were used to distinguish between respondents who may be predisposed to eating disorders (Garner & Garfinkle, 1979). A total score $\geq 20$ on the EAT-26 was not assumed to reflect a diagnosis of an eating disorder in an individual, rather, the score was used to indicate the possibility of an eating disorder (Garner & Garfinkle, 1979; Garner et al., 1982). Scores $> 0$ on item number 6 of the EAT-26 were considered abnormal and scores that $= 0$ were considered normal for item number 6 of the EAT-26 questionnaire.

**Scoring the 5-day, 24-hour Food Record**

The 5-day, 24-hour food record was a record of 5-days of food consumption without including supplement intakes. Students entered data from their 5-day food record into the Diet Analysis Plus Wadsworth computer program for approximations of individual nutrients consumed. This diet analysis program analyzed the nutrient composition for each day and calculated the average nutrient intake for the 5-day period. A printout of these values was obtained and examined for the average intake of total calories, carbohydrates, protein, fat, folate, thiamin, niacin, riboflavin, iron, zinc, and vitamin B$_6$ over the five-day period. The average
calculated values for these nutrients were compared to the total EAT-26 score and to the individual score of item number 6 on the EAT-26 questionnaire.

Limitations of the Study

For appropriate interpretation of the collected data, the following limitations of the study must be considered:

1. Students may have turned in their EAT-26 questionnaires and their personal diet records at different times during the semester, which leaves the possibility that they changed their eating habits as they adjusted to the college atmosphere, and learned basic nutrition during the course;

2. The 5-day 24-hour diet record was a mandatory and self reported class exercise, therefore some participants may have created false results as a way to quickly finish the project;

3. The researcher assumes that the self reported format for the surveys was true and accurate;

4. Responding to the EAT-26 questionnaire was voluntary, and because some students chose not to participate in the survey, certain attitudes and behaviors may have been omitted, or the data may have been skewed;

5. Food lists were not available for collection, therefore further analysis on nutrient intake and specific item intake was not possible;

6. The addition of alcoholic beverages such as beer, wine, and mixed drinks in the diet may skew the nutrient intake analysis and make it difficult to determine the percent of nutrients coming from food sources rather than alcohol beverages;

7. Season variations occur over the semesters of data collection, from fall to spring to fall which may cause seasonal variations and changes in food choices;
8. The data were collected over a period of three different semesters, all of which may have led to unique results because the popularity of fad diets tends to be fast and constantly changing; and,

9. Follow-up interviews to verify if the high-scoring students had a clinical eating disorder were not conducted.

Analysis of Data

The data were analyzed using the SPSS (Statistical Package for the Social Sciences) software program (SPSS Incorporated, 2005). The total EAT-26 scores were computed using the previously described scoring technique. In addition, the individual score for item number 6 on the EAT-26 was recorded for each respondent. Subjects considered to have abnormal eating attitudes and behaviors were those who scored $\geq 20$ for the total EAT-26 score, and those considered to have normal eating attitudes and behavior were those who scored $< 20$. Subjects considered to have abnormal attitudes about carbohydrate foods had a score of $> 0$ on item number 6 of the EAT-26 and those with normal attitudes about carbohydrate foods had a score $=0$ on this item.

Contingency tables were used to examine the frequency of participants who scored $\geq 20$, and those who scored $< 20$ on the total EAT-26. They also contained information regarding the frequency of those who scored $> 0$ on Eat-26 item number 6, and those who scored 0 on EAT-26 item number 6. These data were examined according to age group, gender, year in college, and body mass index (weight in kilograms divided by height in meters squared). Age was further split into two groups as follows: 19 years and younger or 20 years and older. This division split the subjects into two groups of 164 (46.3%) and 190 (53.7%) respectively.
The following illustrated how each hypothesis was analyzed. For each analysis, an alpha level of 0.05 was used to determine statistically significant differences. For some analyses, the total number of participants may vary due to the necessary elimination of participants with outlying data that may have skewed the results.

**Ho1:** Females are more likely to have higher total EAT-26 questionnaire scores than males;

In order to test this hypothesis, an independent t-test was performed. Further investigation of this hypothesis used a logistic regression to determine if female students were more likely to be at risk for clinically significant EAT-26 scores (total EAT-26 score is ≥20) than male students.

**Ho2:** Students’ age will be negatively related to total EAT-26 scores;

A Pearson correlation coefficient was used to examine this hypothesis. In addition, a logistic regression was used to determine risk for clinically significant EAT-26 scores based on age. Subjects were then split into two age groups (≤19 years or ≥20 years). A second logistic regression was conducted to compare and determine any differences between the younger and older age groups.

**Ho3:** Students’ year in college will be negatively related to total EAT-26 scores;

An analysis of variance was used to analyze this hypothesis. Year in college was the independent variable and total EAT-26 score was used as the dependent variable for this analysis. Scheffe follow-up tests were conducted to determine where significant differences occurred. The subjects were then split into a group of underclassmen (freshman and sophomores) and a group of upperclassmen (juniors and seniors). A logistic regression was performed to analyze these groups for their likeliness of having clinically significant total EAT-26 scores.
Ho4: Females will have higher scores on item number 6 of the EAT-26 than males, indicating that more females will have negative attitudes toward carbohydrates than males;

An independent t-test was performed to analyze this hypothesis. For this test, the independent variable was the gender of the participant and the dependant variable was the score on question number 6 of the EAT-26 questionnaire.

Ho5: Students’ age will be negatively related to item number 6 score of the EAT-26, indicating that younger students will have more negative attitudes toward carbohydrates than older students;

A Pearson correlation coefficient was used to examine this hypothesis. For this test, the independent variable used was age of the participants, while the dependent variable was the participant’s score on question number 6 of the EAT-26 questionnaire.

Ho6: Students’ year in college will be negatively related to attitude towards carbohydrates, as measured by the item number 6 score of the EAT-26;

An analysis of variance was used to examine this hypothesis. Student’s year in college was used as the independent variable while the dependent variable was the participant’s score on question number 6 of the EAT-26 questionnaire.

Ho7: Student’s total EAT-26 score will be negatively associated with intakes of nutrients (calories, protein, carbohydrate, fat, thiamin, riboflavin, niacin, vitamin B6, folate, iron, and zinc);

A series of Pearson correlation coefficients were used to examine this hypothesis. The total EAT-26 score was examined with each measured nutrient intake that was calculated from
the 5-day, 24-hour food record. Nutrients utilized for this analysis were calories, protein, carbohydrate, fat, thiamin, riboflavin, niacin, vitamin B6, folate, iron, and zinc.

**Ho8:** Students’ intake of measured nutrients (calories, protein, carbohydrate, fat, thiamin, riboflavin, niacin, vitamin B6, folate, iron, and zinc) will be negatively associated with their attitude towards carbohydrates, as measured by item number 6 on the EAT-26 questionnaire;

A series of Pearson correlation coefficients were used to assess this hypothesis. Each individual nutrient measured was analyzed with the score of item number 6 of the EAT-26 questionnaire, whereas the EAT-26 score was the independent variable and the individual nutrient intakes were the dependent variables. Nutrients utilized for this analysis were calories, protein, carbohydrate, fat, thiamin, riboflavin, niacin, vitamin B6, folate, iron, and zinc.

**Ho9:** Student’s BMI, based on self-reported body weight and height, will be negatively related to their total EAT-26 score;

Pearson correlation coefficients were used to examine this hypothesis. BMI was calculated based on the participant’s self-reported height and weight, and was used as the independent variable. The total EAT-26 score was used as the dependent variable.

**Ho10:** Student’s BMI, based on self-reported body weight and height, will be negatively related to their attitude towards carbohydrates, as measured by the score on item number 6 of the EAT-26 questionnaire;

Pearson correlation coefficients were used to examine this hypothesis. The independent variable for this test was the individual’s calculated BMI. The dependent variable for this test was the score on item number 6 of the EAT-26 questionnaire.
CHAPTER IV

RESULTS

Descriptive Statistics

Table 1 shows frequencies of all categorical values examined in this study. Of the 354 subjects, there were more females than males, and the majority of subjects were between the ages of 18 and 22 years. Most of the subjects were sophomores, with the next largest group being freshman, followed by juniors, and finally seniors. Only two participants were greater than senior status in college. A total EAT-26 score was obtained from all 354 subjects and a cut off score of $\geq 20$ was used as a marker of those respondents’ scores that indicated abnormal eating attitudes and behaviors, and may reflect their potential to develop eating disorders (Garner et al., 1982). Item number 6 of the EAT-26 questionnaire was also assigned a cutoff score of $\geq 1$ and was used as a marker of those respondents’ scores that indicated negative attitudes and behaviors towards carbohydrates.

Table 2 contains descriptive statistics (mean, standard deviation, and range) for all of the variables from the data set that were measured on a continuous scale. Variables measured on a continuous scale included attitude towards carbohydrate containing foods as measured by individual responses to item number 6 on the EAT-26 questionnaire. The other continuous variables measured were the intakes of nutrients, including: calories (kcal), total protein, total carbohydrates, total fat, thiamin, riboflavin, niacin, vitamin B6, folate, iron, and zinc.
Table 1

*Frequencies of Categorical Variables for Gender, Year in College, Age and Eat-26 Scores*

<table>
<thead>
<tr>
<th>Categorical Value</th>
<th>Frequency (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>68</td>
<td>19</td>
</tr>
<tr>
<td>Female</td>
<td>286</td>
<td>81</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>354</td>
<td>100</td>
</tr>
<tr>
<td><strong>Year in College</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>77</td>
<td>22</td>
</tr>
<tr>
<td>Sophomore</td>
<td>170</td>
<td>48</td>
</tr>
<tr>
<td>Junior</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>Senior</td>
<td>35</td>
<td>10</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>354</td>
<td>100</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>32</td>
<td>9</td>
</tr>
<tr>
<td>19</td>
<td>132</td>
<td>37</td>
</tr>
<tr>
<td>20</td>
<td>91</td>
<td>26</td>
</tr>
<tr>
<td>21</td>
<td>63</td>
<td>18</td>
</tr>
<tr>
<td>22</td>
<td>22</td>
<td>6</td>
</tr>
<tr>
<td>23</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>31</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>36</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>43</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>354</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total Score, EAT-26</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 20</td>
<td>298</td>
<td>84</td>
</tr>
<tr>
<td>≥20</td>
<td>56</td>
<td>16</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>354</td>
<td>100</td>
</tr>
<tr>
<td><strong>Item 6 Score, EAT-26</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1</td>
<td>303</td>
<td>88</td>
</tr>
<tr>
<td>≥1</td>
<td>43</td>
<td>12</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>346</td>
<td>100</td>
</tr>
</tbody>
</table>
Table 2

Mean, Standard Deviation, and Subject Range of item number 6 score of the Eat-26, Calories, Protein, Carbohydrates, Fat, Thiamin, Riboflavin, Niacin, Vitamin B6, Iron, and Zinc

<table>
<thead>
<tr>
<th>Continuous Variable</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Min</th>
<th>Max</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAT-26, Item 6 Score</td>
<td>346</td>
<td>0.18</td>
<td>0.55</td>
<td>0.00</td>
<td>3.00</td>
<td>3.0</td>
</tr>
<tr>
<td>Calories (kcal)</td>
<td>346</td>
<td>1810.33</td>
<td>702.42</td>
<td>447.85</td>
<td>5183.44</td>
<td>4735.59</td>
</tr>
<tr>
<td>Protein (gm)</td>
<td>346</td>
<td>72.38</td>
<td>33.31</td>
<td>23.54</td>
<td>274.96</td>
<td>251.42</td>
</tr>
<tr>
<td>Carbohydrates (gm)</td>
<td>346</td>
<td>244.33</td>
<td>97.99</td>
<td>9.75</td>
<td>806.83</td>
<td>797.08</td>
</tr>
<tr>
<td>Fat (gm)</td>
<td>346</td>
<td>61.45</td>
<td>31.09</td>
<td>6.78</td>
<td>240.37</td>
<td>233.59</td>
</tr>
<tr>
<td>Thiamin (mg)</td>
<td>346</td>
<td>1.21</td>
<td>0.77</td>
<td>0.13</td>
<td>6.12</td>
<td>5.99</td>
</tr>
<tr>
<td>Riboflavin (mg)</td>
<td>346</td>
<td>1.58</td>
<td>1.92</td>
<td>0.15</td>
<td>1.58</td>
<td>1.43</td>
</tr>
<tr>
<td>Niacin (mg)</td>
<td>346</td>
<td>15.94</td>
<td>9.08</td>
<td>1.15</td>
<td>83.95</td>
<td>82.80</td>
</tr>
<tr>
<td>Vitamin B6 (mg)</td>
<td>346</td>
<td>1.29</td>
<td>0.85</td>
<td>.04</td>
<td>6.56</td>
<td>6.52</td>
</tr>
<tr>
<td>Folate (mcg)</td>
<td>346</td>
<td>258.02</td>
<td>144.48</td>
<td>0.65</td>
<td>992.30</td>
<td>991.65</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>346</td>
<td>13.72</td>
<td>7.58</td>
<td>3.61</td>
<td>93.41</td>
<td>89.80</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>346</td>
<td>7.04</td>
<td>3.99</td>
<td>0.18</td>
<td>31.27</td>
<td>31.09</td>
</tr>
</tbody>
</table>

**Ho₁:** Females are more likely to have higher total EAT-26 questionnaire scores than males;

Accept Ho₁.

In order to test this hypothesis, which predicted that females would have a higher total EAT-26 score than males, an independent t-test was performed. The results supported the hypothesis with females (M = 10.66; DS = 10.48) scoring significantly higher than males (M =
7.06; SD = 6.90), + (150) = -3.46, p = .001. A logistic regression analysis was also conducted in order to determine if female students were at a significantly higher risk for clinically significant EAT-26 scores (EAT-26 ≥ 20). The results revealed that females had a 173% greater likelihood of possessing a clinically significant EAT-26 score when compared to males in this study (OR = 2.73, p < .04, 95% CI = 1.05 – 7.14).

**Ho₂: Students’ age will be negatively related to total EAT-26 scores;**

**Reject Ho₂.**

A Pearson Correlation Coefficient was used to test this hypothesis. The result was not significant, r(352) = -.05, p = .166. In order to further investigate this hypothesis, age was split into two groups. The first group consisted of subjects who were 19 years or younger, and was comprised of 46.3% (n = 164) of the total subjects. The second group consisted of subjects who were 20 years or older and was comprised of 53.7% (n = 190) of the total subjects. Using these two age groups, a logistic regression analysis failed to show any increased risk for clinically significant EAT-26 scores based on age (OR = .65, p = .142).

**Ho₃: Students’ year in college will be negatively related to total EAT-26 scores;**

**Accept Ho₃.**

An analysis of variance with year in college as the independent variable and EAT-26 scores as the dependent variable was conducted. The result of the univariable F-test was significant F(3,348) = 3.25, p = 0.02 with Scheffe follow up tests indicating that freshman (M = 12.96; SE = 1.13) scored significantly higher than sophomores (M = 9.55, SE = 1.68). Further, a logistic regression analysis revealed that underclassmen were 157% more likely to possess clinically significant EAT-26 scores when compared to upper classman (OR = 2.57, p = .003; 95% CI = 1.39 – 4.75).
**$H_0_4$:** Females will have higher scores on item number 6 of the EAT-26 than males, indicating that more females will have negative attitudes toward carbohydrates than males;

**Accept $H_0_4$.**

This hypothesis was tested using an independent t-test. The results were significant, $t(171) = -2.06, p = .04$, with females revealed to have higher scores ($M = .20, SD = .58$) than males ($M = .09; SD = .34$).

**$H_0_5$:** Students’ age will be negatively related to item number 6 score of the EAT-26, indicating that younger students will have more negative attitudes toward carbohydrates than older students;

**Reject $H_0_5$.**

This hypothesis was tested using a Pearson Correlation Coefficient and was not supported $r(352) = -.02, p = .326$.

**$H_0_6$:** Students’ year in college will be negatively related to attitude towards carbohydrates, as measured by the item number 6 score of the EAT-26;

**Reject $H_0_6$.**

In order to test this hypothesis, an analysis of variance was used. Support for this hypothesis was not obtained, $F(3,348) = 1.00, p = .391$.

**$H_0_7$:** Student’s total EAT-26 score will be negatively associated with intakes of nutrients (calories, protein, carbohydrate, fat, thiamin, riboflavin, niacin, vitamin B6, folate, iron, and zinc);

$H_0_7$ was accepted and rejected, depending on the nutrient tested.
A series of Pearson correlation coefficients were used to test the EAT-26 scores in association with the average daily intake of measured individual nutrients in this hypothesis. The results revealed that total EAT-26 scores were inversely related to caloric intake, \( r(344) = -.18, p < .001 \), carbohydrate intake, \( r(344) = -.13, p = .016 \), fat intake, \( r(344) = -.23, p < .001 \), and protein intake, \( r(344) = -.11, p = .039 \). Significant associations were not detected for any of the micronutrients compared, including thiamin, riboflavin, niacin, vitamin B\(_6\), folate, iron, and zinc.

Independent t-tests were conducted to assess whether or not clinically significant EAT-26 scores were related to the compromised nutrient intake. The only significant effect observed was between EAT-26 scores (<20 versus \( \geq 20 \)) and calories, \( +(350) = 2.32, p = .021 \). Lower caloric intake was reported by students with EAT-26 scores \( \geq 20 \) (M = 1606.18; DS = 591.81) when compared to those with scores <20 (M = 1848.30; SD = 738.67).

\[ \text{Ho}_8: \quad \text{Students’ intake of measured nutrients (calories, protein, carbohydrate, fat, thiamin, riboflavin, niacin, vitamin B}_6\text{, folate, iron, and zinc) will be negatively associated with their attitude towards carbohydrates, as measured by item number 6 on the EAT-26 questionnaire.} \]

\[ \text{Ho}_8 \text{ was accepted and rejected depending on the nutrient tested.} \]

A series of correlation coefficients was used to test this hypothesis. The results revealed significant associations between the score of item number 6 of the EAT-26 questionnaire and intakes of carbohydrate, \( r(344) = -.13, p = .020 \) and riboflavin, \( r(344) = .11, p = .046 \). Other nutrients, including protein, fat, thiamin, niacin, vitamin B\(_6\), folate, iron, and zinc showed no significant effects when compared to the item number 6 response of the EAT-26 questionnaire. Independent t-tests were conducted to determine differences in nutrient intakes between two groups of individuals responding to item number 6 of the EAT-26 questionnaire. The first group
used for this analysis was comprised of those students scoring 0 on item number 6, indicating no negative attitudes or behaviors towards carbohydrates, and the second group included all other participants who scored either 1, 2, or 3 on item number 6, indicating varied degrees of negative attitudes towards carbohydrates. Results of the independent t-tests indicated that only a significant difference was detected for carbohydrate, $t(344) = 2.29$, $p < .05$. The mean for those scoring 0 on item number 6 was 248.85 (SD = 98.41) and the mean was 212.52 (SD = 89.74) for those scoring in the range from 1 to 3.

**Ho**: Student’s BMI, based on self-reported body weight and height, will be negatively related to their total EAT-26 score;

Reject Ho.

Support for this hypothesis was not obtained using a Pearson correlation coefficient, $r(141) = -.05$, $p = .265$.

**Ho**: Student’s BMI, based on self-reported body weight and height, will be negatively related to their attitude towards carbohydrates, as measured by the score on item number 6 of the EAT-26 questionnaire;

Reject Ho.

Support for this hypothesis was not obtained using a Pearson correlation coefficient, $r(141) = -.05$, $p = .275$. 
CHAPTER V
DISCUSSION

Results showed that 56 out of 354 (15.8%) participants scored ≥20 on the EAT-26 questionnaire, and that females had higher total EAT-26 scores than males. Results also revealed that females were 175% more likely to score ≥20 on the EAT-26 questionnaire than males. These results indicated that more females in our study were prone to suffering from an eating disorder than males. Interestingly, Murphy, Williford, Houston, and Garner (1997) reported similar findings 8 years earlier in a study performed at the same university. Using the EAT-26 questionnaire, Murphy et al. (1997) reported that 5% of males and 19% of females scored above the cut-off score for exhibiting abnormal eating attitudes and behaviors. These results were also similar to Hoerr, Bokman, Lugo, Bivens, and Keast (2002), who reported that 10.9% of college women and 4.0% of college men had total EAT-26 scores ≥20. Another similar study, involving 471 college students in two Midwestern liberal arts universities, found much higher results reporting that 20% of females and 10% of males met the cutoff score for disturbed eating (≥20) on the EAT-26 questionnaire (Nelson et al., 1999). Although the cause(s) of these different EAT-26 scores is unclear, one item of interest for future research may be identifying the atmospheric differences between large public universities and small liberal arts colleges/universities.

Results of the current study also indicated that females were more likely to avoid foods that have high carbohydrate content than males. Avoiding carbohydrate-containing foods may originate from the current wave of low carbohydrate diets including the Atkins’ Diet, the South Beach Diet, and the Zone Diet. These results are parallel with the overall EAT-26 scores in which females scored higher in general than males, which may indicate that the act of avoiding foods based on carbohydrate content goes hand in hand with disordered eating. Although there
are few, if any, studies specifically looking at attitudes about carbohydrates, a study in 2004 by Hinton, Sanford, Davidson, Yakushko, and Beck, revealed that 62% of college female athletes and 23% of college male athletes wished to lower their weight, and that only 15% of these student athletes met their recommended daily consumption of carbohydrates.

Among participants in the current study, age was not found to be a predictor of attitudes or behaviors of eating. This compares to results of an earlier study at this same university, which found no significant differences of EAT-26 scores between subjects of different ages (Murphy et al. 1997). There was also no relationship found between age and attitudes about carbohydrate containing foods. The ages of participants in this study ranged from 18 to 43 years with over 96% ranging from 18 to 22 years of age. Not only is this range small, making it difficult to find any statistically significant effects, but it also falls in an age range that is above the national average for onset of eating disorders. As reported earlier, 90% of individuals suffering from eating disorders are between the ages of 12 and 25, and average onset age for women is 17.2 years (Braun et al., 1999; Gittes, 2004).

Although age itself did not show any relationship to disordered eating in the current study, class ranking did relate to eating behaviors and attitudes. Results indicated that freshman were more likely to suffer from eating disorders than second year students, and that underclassmen (freshmen and sophomores) were more likely to suffer from disordered eating than upperclassmen (juniors and seniors). Since age did not appear to be the reason for these differences, there may be some characteristic of each class that influences their likeliness to experience an disordered eating. One explanation may be the pressure of relocating from home to a university. In 2004, Butler et al. studied female college freshman and reported that within 5 months of leaving home and entering a university, physical activity had significantly decreased,
while body weight parameters increased. Alongside this finding, caloric intake also significantly decreased within 5 months of entering a university. These findings acknowledge that lifestyle changes occurring among freshmen and sophomores may have more of an impact on their eating behaviors and attitudes than their age alone, when compared to upperclassmen. Despite this belief, evidence from Vohs, Heatherton, and Herrin’s study (2001) indicated that disordered eating attitudes and symptoms are established before college. This study included 342 females who were surveyed before and after their freshman year started, and results revealed that individual dieting behaviors were the same before and after the onset of college.

There are several other factors that differ among classes at a college university, besides age that could influence the significant differences between underclassmen and upperclassmen. For example, underclassmen at the university where the data were collected in the current study typically live on campus, and upperclassmen typically live in off-campus housing. Living on campus involves stresses of living in confined spaces surrounded by several peers and little private space. While living on campus, most activities of daily living are spent in the vicinity of several other people. Space availability on campus for personal activities such as eating and showering is usually limited to public, semi-private areas, whereas eating and showering for those living off campus can be done in the privacy of one’s home or apartment. This limited availability for privacy when eating and showering may cause some underclassmen to feel self-conscious and anxious about their appearance and decisions regarding food. Another difference between upperclassmen and underclassmen that may influence their eating attitudes and behaviors is the maturity level. Upperclassmen may or may not be older than underclassmen, but they have achieved a higher level of education and have already experienced the first two years
of college. This experience may help upperclassmen adjust to and resist the ongoing social pressures of peers and the media.

Regardless of age, gender, or year in school, overall EAT-26 scores showed a relationship with total intakes of certain nutrients. Subjects with higher EAT-26 scores were also more likely to have lower intakes of calories, carbohydrates, fat, and protein; and, subjects who had EAT-26 scores above the cutoff for disordered eating were found to have lower intakes of calories. No other nutrients, including all micronutrients examined, were associated with overall eating attitudes and behaviors.

Disordered eating was related to lower calorie intakes in this study population and according to this sample group, all macronutrients, rather than just carbohydrates or fat, were reduced to achieve this calorie reduction. Research indicates that the ‘fear’ of eating certain types of foods can be a precursor for a disordered eating pattern (Gonzalez & Vitousek, 2004); however, according to the results of this study, all types of foods were avoided regardless of their overall macronutrient content. These results contrasts with past studies during the 1960s and 1970s, when anorexic patients were reported to be ‘carbohydrate phobic’ (Crisp & Kalucy, 1974; and Russell, 1979). These results also contrast with more recent studies that focused on the elimination of fattening foods rather than carbohydrate in the diet (Gonzalez & Vitousek, 2004; Kales, 1990). Recent studies have reported that elimination of fat containing foods and the likeliness of having an eating disorder have been associated (Haberman & Luffey, 1998; Hoerr et al., 2002), however no research studies were found that report a relationship between dietary carbohydrate or protein elimination and disordered eating.

The present study data were collected when low-carbohydrate diets were very popular among persons in the United States. Although all macronutrients were decreased in subjects at
high risk for eating disorders in this study, it is possible that there is a link between ‘carbohydrate phobias’ of the 1970s and the decrease in carbohydrate consumption of the present study. This may be a result of the popularization of the Atkins Diet Revolution, which was first introduced in the 1970s and later brought back as the Atkins New Diet Revolution in 1992 (Atkins, 1992). Researchers studying eating disorders between these time frames may not have witnessed the influence of low carbohydrate dieting on their study participants’ diets. Although the current study did not request information regarding specific diets that participants may be following, the study data support that availability of literature about low-carbohydrate dieting may have been impacting the way college students chose their dietary patterns. For example, rather than simply eliminating foods that are high in fat content, subjects in this study appeared to decrease foods based on carbohydrate and protein content as well. One way to investigate these trends in the future would be to conduct a study that collects data on actual foods eaten, rather than just the average nutrient consumption from these foods. The use of questionnaires that are more specifically focused on attitudes and behaviors towards carbohydrates rather than overall eating attitudes and behaviors would assist data collection and analysis.

Participants within the current study who revealed that they avoid carbohydrate-containing foods appeared to be educated about their dietary choices, as these same participants reported actual dietary carbohydrate intakes lower than other participants in the study. Because the United States follows a program that involves enrichment of riboflavin, thiamin, niacin, folic acid, and iron into the processed flour of wheat products used to make many carbohydrate containing foods, this researcher hypothesizes that participants who avoided carbohydrate-containing foods would also be at risk for lowered intakes of these enrichment program nutrients. Results indicated that riboflavin was the only nutrient associated with negative carbohydrate
attitudes and intakes, and the intakes of other enrichment nutrients were not related to negative carbohydrate attitudes and behaviors. The study mentioned earlier by Hinton et al., 2004, involving female and male college athletes, found similar results in that dietary deficits in macronutrients occurred without any apparent decreases in micronutrient consumption. Supplements and vitamins were not accounted for in the current study, and therefore, results of total individual nutrient intakes from total intake averages may be skewed. Also, actual carbohydrate intakes were not compared to individual recommended intakes. This means that an individual may have consumed a significantly lower number of carbohydrates compared to other participants, yet concurrently, may have consumed an accurate and healthy amount of dietary carbohydrates based on their recommended needs. This makes it hard to generalize the health consequences of participants in the current study because there was no possible method to determine whether participants consumed their recommended amounts of nutrients. Determining recommended amounts of nutrients was not possible in the current study because data regarding height and weight of participants was not available to this researcher.

Results in the current study were unable to show any relationship between BMI and eating attitudes and behaviors, showing that BMI alone cannot be a predictor for placing someone at risk for an eating disorder. Similarly, BMI did not appear to have any relationship with attitudes and behaviors regarding carbohydrate-containing foods. These results are similar to another study that reported BMI was only a weak predictor of eating behaviors and attitudes for females, and not for male participants (Hoerr et al., 2002). Other studies have found that eating disorders are not related to actual body weight as much as they are to an individual’s dissatisfaction with one’s body and personal dieting, therefore BMI only relates to disordered
eating if it also relates to an individual’s body satisfaction (Zimmerman & Hoerr, 1995, and Wong & Huang, 1999).

Although a somewhat large data set, the present study made use of a convenience sample, which differed from the overall campus population, and therefore limits the ability to generalize the results. The sample was predominantly females and occurred in a nutrition related class, leading to a sample that may be more educated about their dietary behaviors than other individuals at the university. Data collection from a more representative sample of males and females, and of all age groups and education levels would be more desirable. One possible way of achieving this would be by advertising the study through a computer communication devise that allows computerized questionnaires to be accessed and returned by all students at the university. Researchers do not know how non-respondents may have differed from respondents, because data was collected as a voluntary assignment for class, however class participation for this project was 98% meaning that only a small number of potential subjects chose not to participate.

Another important aspect regarding the results of this study is the potential influence of seasonal affective disorder (SAD) on eating attitudes and behaviors. SAD has been recognized as a common syndrome, and appears to have links with eating disorders (Eagles, McLeod, Mercer & Watson, 2000). Core symptoms of SAD include carbohydrate craving and weight gain during the fall and winter months, and overt eating disorders are common among patients with SAD (Gruber & Dilsaver, 1996). The current study involved data collection over three semesters, two of which were spring semester and one that was fall semester. Therefore, one might argue that comparison of the responses to the EAT-26 questionnaire may have been skewed based on the season in which participants completed them. However, supporting the consistency of this study,
Eagles et al. (2000), had 322 subjects complete the EAT-26 questionnaire in the summer and 443 subjects complete the EAT-26 questionnaire in the winter, and found no significant seasonal differences on eating pathology. Also, despite SAD having a large influence on carbohydrate cravings during certain months, Eagles and colleagues reported no seasonal differences in participants’ attitudes towards carbohydrates.

Regardless of any limitations to the results of this study, there were still several interesting outcomes that can be helpful for both healthcare professionals and university food service professionals. University employees are constantly attempting to find ways to give students a positive college experience. Maintaining the health and well being of students, along with meeting their preferences and demands are major tasks on which university employees must focus. Healthcare professionals on a university campus can begin influencing students the first day they step on campus. According to this study, freshman females were most likely to have attitudes and behaviors indicative of having an eating disorder. University healthcare providers could use this information to develop a program that reaches out to first year students, and educates them on the importance of healthy diets and managing healthy body images.

Incorporating a nutritional program into freshman year orientation materials may help alleviate some of the misconceptions and assumptions that students have regarding their food choices.

Food service professionals may take special attention to the fact that several participants of this study did, in fact, show signs of eating disorders and some hesitancy towards eating foods with carbohydrate content. Therefore, making several low-carbohydrate foods available to students living on campus may help to meet the demands and preferences of many students. Also, the fact that several students did show tendencies to avoid carbohydrates is a sign that fad diets do have an overall influence on food choices of college students. This indicates the
importance of food service operators and all university staff maintaining updated knowledge of how fad diets may affect the overall food demands and characteristics of university students.
CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

The purpose of the current study was to determine the prevalence of eating disorder attitudes and behaviors among college students, and to determine their attitudes and behaviors towards carbohydrate containing foods. In addition, information was obtained to determine the nutritional consequences of negative attitudes and behaviors toward carbohydrate containing foods. Based on the findings reported in this study, there are several implications that nutritionists and health care professionals may be able to use in diet planning and individual diet counseling. These implications relate to eating disorders and current dietary trends among college students as they pertain to personal nutrition and health.

The current study revealed that risk for disordered eating was evident in a substantial number of college students, and that dieting trends may be influencing the dietary intakes of many college students. Females were more at risk for eating disorders than males, which is consistent with reported research. Underclassmen were more prone to eating disorders in this study, despite the fact that age itself showed no influence on eating attitudes and behaviors. This may mean that other characteristics associated with being an underclassman have stronger influences on disordered eating than age. For example, the lifestyle adjustments that are made when becoming a college student for the first time may be a major precursor to college aged disordered eating. Nutritionists and health care professionals can use this information in their attempts to educate and prevent disordered eating. Targeting female freshman and sophomores when creating disordered eating educational tools is one strategy that may help health care professionals make an impact on preventing eating disorders. Also, providing education about
the benefits of carbohydrates may help offset some of the information in the popular literature that seems to place a stigma around foods that have a high carbohydrate content.

Although the current study did witness a population with negative attitudes towards carbohydrates, few negative consequences were found in regard to nutritional intake. Current trends that include the popularity of low carbohydrate dieting may have influenced the attitudes and behaviors of some college aged students, however this did not appear to detrimentally affect their nutritional status. These students with negative attitudes towards carbohydrates appeared to have lower carbohydrate intakes than their peer study participant students, however they still managed to have similar intakes of vitamins and minerals as students who did not have negative attitudes towards carbohydrates. There are several factors that could explain this, one of which being the type of foods consumed during the day. Students who consumed fewer overall carbohydrates may have chosen foods that were more nutrient dense, or foods that had more vitamins and minerals for the same amount of carbohydrate. Since this study obtained 5-day food intakes from students who were near the end of a 15-week nutrient course, it is likely that students had increased knowledge of food components. The increased knowledge that this study’s participants had may have helped them to choose highly nutritious and nutrient dense foods, regardless of their efforts to decrease carbohydrates in their diet. The typical college student, who is likely to have little formal nutrition education, may not be as likely to choose low-carbohydrate foods that are nutrient dense.

Using the EAT-26 questionnaire and the daily food record for this study provided a large overview of disordered eating patterns, attitudes towards carbohydrates, and nutrient intakes. The result of this study show interesting data, suggesting that not only do eating disorders exist on the college campus, but that low-carbohydrate dieting and significant decreases in calories,
carbohydrates, fat, and protein also exist. Interesting follow-up research to this study may include the use of more detailed questionnaires that delve into specific food choices, attitudes about specific dieting approaches, and knowledge about food choices and their health.

Recommendations for Future Research

The following recommendations are suggested for further understanding, intervention, and research in this area.

1. A large sample of the EAT questionnaire was obtained, however this was done over a course of more than one year as they were turned in by students over three different semesters. The trends with dieting in the media and college population may have changed over the course of this time making individual trends of each semester difficult to predict. Obtaining a similar sample size all during one semester may be beneficial to provide more specific information about the most current college dieting trends.

2. The EAT questionnaires were completed by students at the beginning of the semester during a nutrition course, and the 5-day intakes were completed towards the end of the 15-week semester. Students’ responses to these questions may have differed at the end of the semester, compared to the beginning of the semester, due to gains in nutrition knowledge throughout the course. A future study obtaining EAT questionnaire results and 5-day food records at both the beginning and the end of the semester for each student may be helpful to determine if nutrition education had any influence on dieting attitudes and food intakes.

3. One purpose of this study was to investigate attitudes and behaviors towards carbohydrate foods, however, only one question from the EAT-26 questionnaire acknowledged this purpose. Preparing a questionnaire specifically based around
carbohydrates may help provide more detail regarding attitudes and behaviors towards carbohydrates.

4. The current study used a convenience sample to examine eating attitudes and behaviors in college students. This convenience sample may not have been representative of the whole university population, making it difficult to generalize findings for the whole population. Also, this convenience sample likely included many students pursuing a health related degree. Students who choose health related courses and degrees may have preconceived attitudes and behaviors toward eating that are different from other college students. It would be beneficial to perform a study using a random sample of the whole university student population, so that results can be generalized for the entire student population.

5. The current study did not use available data regarding specific foods eaten by participants. It is possible that current fad diets that restrict carbohydrate foods have led to specific foods being omitted from the diet without affecting overall carbohydrate intakes. A future study comparing EAT-26 results with actual foods consumed might be beneficial to determine popularity of certain categories of foods.

6. Future research on the college population using the Food Phobia Survey (Vitousek, 1998) combined with obtaining information about popular diets in the population may help researchers to determine the impact that popular diets have on food choices.

7. Future research could further examine the impact of eating attitudes and behaviors by testing actual blood samples for nutrient deficiencies. This may be a more accurate assessment of participant’s nutritional status, when compared to relying on participant’s self reports of nutritional intake.
8. The current study found definite incidences of abnormal eating attitudes and behaviors in the population studied, especially in females and underclassmen. This information could be used for the development of a program that targets and educates female underclassmen about the role of good nutrition for their overall health.

9. Fad diets tend to be popular in phases, and specific fad diets appear to lose their popularity after short periods of time. One interesting study for the future may involve longitudinal data from a group of subjects over time (i.e., from freshman to seniors). With this type of study, comparisons made between ages, class level, and seasons would include the same participants rather than separate groups and may lead to exciting results.
Bibliography


APPENDIX A: EATING ATTITUDES TEST (EAT-26)

Please check a response for each of the following questions:

A = Always; B = Very Often; C = Often; D = Sometimes; E = Rarely; F = Never

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>1. Am terrified about being overweight</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>2. Avoid eating when I am hungry</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>3. Find myself preoccupied with food</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>4. Have gone on eating binges where I feel I may not be able to stop</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>5. Cut my food into small pieces</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>6. Particularly avoid foods with a high carbohydrate content (e.g., bread, potatoes, rice, etc.)</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>7. Aware of the calorie content of foods that I eat</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>8. Feel that others would prefer if I ate more</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>9. Vomit after I have eaten</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>10. Feel extremely guilty after eating</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>11. Am preoccupied with a desire to be thinner</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>12. Think about burning up calories when I exercise</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>13. Other people think that I am too thin</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>14. Am preoccupied with the thought of having fat on my body</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>15. Take longer than others to eat my meals</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>16. Avoid foods with sugar in them</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>17. Eat diet foods</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>18. Feel that food controls my life</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>19. Display self-control around food</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>20. Feel that others pressure me to eat</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>21. Give too much time and thought to food</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>22. Feel uncomfortable after eating sweets</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>23. Engage in dieting behavior</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>24. Like my stomach to be empty</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>25. Enjoy trying new rich foods</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>26. Have the impulse to vomit after meals</td>
</tr>
</tbody>
</table>