UNDERSTANDING PREVALENCE AND ATTITUDES: DIETARY AND EXERCISE BEHAVIORS AMONG AFRICAN AMERICAN COLLEGIATE ATHLETES

by

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ABSTRACT

Context: Eating disorders, a serious public health issue, affect an estimated 8-11 million Americans (Hudson, Hiripi, Pope & Kessler, 2007; National Institutes of Mental Health [NIMH], 2010). The lack of inclusion of diverse minority populations from robustly-designed eating disorder research has produced limitations to the generalizability for theory-based prevention, diagnosis, and treatment programs, particularly among non-Caucasian populations.

Objectives: The purpose of this study was to examine eating and exercise behaviors among student-athletes enrolled at historically black colleges and universities (HBCUs) through application of existing disordered eating, exercise dependence, and body image instruments.

Participants: A battery of surveys was disseminated to 601 varsity level athletes enrolled at HBCUs, of which 71% (*N* = 427) were used in the analysis.

Outcomes and Procedures: The main outcomes of interests were eating disorder (ED) risk, exercise dependence (ExD) risk, and orthorexia nervosa (ON) risk, and difference between perceived and ideal body stature. These outcomes were operationalized through application of the Eating Attitudes Test (EAT-26), Exercise Dependence Scale (EDS-21), ORTO 15 questionnaire (ORTO 15), and Pulvers and colleagues' (2004) Figural Stimuli. Regression (Logistical and Simple), chi-square, ANOVA/ANCOVA, and simple descriptive statistical analyses served as quantitative means of measurement.

Results: Findings revealed that among HBCU student-athletes in this study, 10.8% were at risk for an ED, 10.3% were at risk for ExD, and 66.3% were at risk for ON. With respect to ED and ON risk, between group differences did not exist among most men's sports, while race and academic classification group differences were present among several women's sports. The Theory of Planned Behavior (TPB) construct, attitude, exhibited the largest influence on future intentions to engage in disordered eating among both male (p = .005) and female (p = .001) participants. Significant differences between ideal and perceived body stature exist among female subjects ($p < .001$).

Conclusions: The ED risk findings among HBCU student-athletes failed to challenge current literature as to populations at increased risk for an ED. Also, individual treatment for EDs and ExD among HBCU student-athletes at risk should occur concurrently. ON risk findings among HBCU athletes exceed levels reported for European populations. Since ON is a novel phenomenon in the US, future research is warranted with respect to other American populations and the at-risk ORTO 15 threshold for athletes.

DEDICATION

This dissertation is dedicated to everyone who helped me and guided me through the daily rigors associated with drafting this document. Without these individuals, the accomplishment of receiving a doctorate would be virtually impossible.

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LIST OF ABBREVIATIONS AND SYMBOLS

α	Cronbach's index of internal consistency
df	Degrees of freedom: number of values free to vary after certain restrictions have been placed on the data
F	Fisher's *F* ratio: A ratio of two variances
M	Mean: the sum of a set of measurements divided by the number of measurements in the set
SE	Standard error
p	Probability associated with the occurrence under the null hypothesis of a value as extreme as or more extreme than the observed value
r	Pearson product-moment correlation
t	Computed value of *t* test
<	Less than
>	Greater than
=	Equal to
f	Frequency
D	Used in Kolmogorov-Smirnov normality test
φ	Measure of association for a 2 x 2 chi square contingency table
V	Measure of association for a contingency table greater than 2 x 2

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CHAPTER I

INTRODUCTION

Eating disorders, a serious public health issue, affect an estimated 8-11 million Americans [Hudson Hiripi, Pope, & Kessler, 2007; National Institute of Mental Health, (NIMH, n.d.). Eating disorders are frequently associated with other psychopathologies or conditions of role impairment which often go untreated (Hudson et al., 2007). Shisslak, Crago, and Estes (1995) reported that an estimated 41% of all Americans diet in some form or fashion. Among those, 35% progress to pathological dieting; with 20% of that group advancing to clinical classification of having an eating disorder (Shisslak et al., 1995). According to the Diagnostic and Statistical Manual of Mental Disorders Fourth Edition [DSM-IV-TR; American Psychiatric Association (APA), 2000], an eating disorder is a mental illness characterized by atypical and unhealthy dietary practices.

Hospital and outpatient treatment for eating disorders costs patients and their families at least $3,000 per year (Simon, Schmidt, & Pilling, 2005), which was approximately 6% of the United States' (US) median income in 2009 (DeNavas-Walt, Proctor, & Smith, 2010). Treatment for eating disorders also burdens American employers, with medical claims reaching $3.8 billion in 2001 (Gordon et al., 2008). Recent work by Crowe and colleagues (2008) concluded that 30% of their participants' grocery budgets were allocated to excess food and beverages to sustain binging dietary practices.

The National Institutes of Health (NIH, n.d.) purported that nearly 50,000 people die every year due to an eating disorder-related condition. Depression (Grubb, Sellers, & Waligroski, 1993), bipolar disorder (Kruger, Shugar, & Cooke, 1996), obsessive-compulsive disorder (Thornton & Russell, 1997), and self-mutilation (Yaryura-Tobias, Neziroglu, & Kaplan, 1995) are all commonly concurrently diagnosed with bulimia and anorexia nervosa. Moreover, a combination of these co-morbidities of eating disorders has been found to correlate with increased risk of suicide (Herzog et al., 2000).

Historically, eating disorder research has been primarily centered on Caucasian females between the ages of 15 and 24 years (Baum, 2006; Hudson et al., 2007; Hoek, 2006; Johnson et al., 2004b), since easily identifiable populations at increased risk include Caucasian female athletes and non-athletes in this age range. Now that research has drawn increased attention to differing populations, especially males (Petrie, Greenleaf, Reel & Carter, 2008; Tchanturia et al., 2011) , scholars such as Baum challenge the notion that eating disorders are only “white-female” mental illnesses. This shift in focus has helped health educators and clinicians reassess who is at increased risk for eating disorders, and refocus on what precursors to look for in attempting to initiate primary, secondary, and tertiary prevention.

Though the 1990s ushered in increasing attention and research on Caucasian males (Baum, 2006; Striegel-Moore et al., 2009), the literature still lacks depth in studies examining risk levels of various ethnic populations. The exclusion of ethnic populations from robustly designed eating disorder research has produced a profound limitation to the generalizability for theory, treatment, and diagnosis. Hence, findings in current eating disorder research, based on outcomes of studies primarily consisting of Caucasian females, creates a pool of ethnic males perceived to be at low-risk by society (Johnson et al., 2004b; Ousley, 2008).

Orthorexia nervosa, an eating disorder not otherwise specified (EDNOS) identified by its obsessive compulsive behavior toward healthy eating, is gaining attention in the eating disorder literature (Bratman, 2001; Donini, Marsili, Graziani, Imbriale, & Cannella, 2005). First described by Bratman, orthorexia is driven by the fear of eating chemicals in common food, as opposed to the fear of being fat. Comorbidities of orthorexia parallel that of bulimia and anorexia (Bratman, 2001). Since orthorexia is still an emerging topic, it is not well examined in the literature. The few substantial studies have revealed that prevalence rates of orthorexia nervosa among subjects on average are higher than the rates of anorexia and bulimia nervosa (Bağci Bosi, Camur & Güler, 2007; Donini, Marsili, Graziani, Ibriale, & Cannella, 2004).

For years, public health research has published the benefits of exercise to the physical and emotional health of individuals (Anderson & Brice, 2011; Cotman, Berchtold, &Christie, 2007; Gulve, 2008; Lange-Asschenfeldt & Kojda, 2008; Terry, Szabo, &Griffiths, 2004). Like many human physiological processes and actions, too much of a good thing can turn into a bad thing. When performed at too high a frequency or intensity, exercise can develop into an addiction, which may have negative consequences (Adams & Kirkby, 2002; Aidman & Woolard, 2003; Hausenblas & Downs, 2002a; O'Dea & Abraham, 2002). This addiction to exercise is called exercise dependence. Though not recognized by the DSM-IV-TR as an official disorder, researchers use the DSM-IV-TR clinical diagnostic criteria for substance abuse as a means to assess exercise dependence.

Exercise dependence has been found to co-exist with other disordered behaviors (O'Dea & Abraham, 2002; Zmijewski & Howard, 2003), especially disordered eating (Zmijewski & Howard, 2003). Athletes are also at increased risk for developing symptoms of exercise dependence (Blaydon & Lindner, 2002; Yates, Edman, Crago, & Crowell, 2003). Initial research on exercise dependence has been performed on Caucasian female athletes as the target population; hence, the literature is severely lacking in the areas of minority athletic populations.

Purpose of the Study

The purpose of this study was to examine groups at increased risk for dietary and exercise mental disturbances among athletes at HBCUs. From this examination, risk level of eating disorders, orthorexia nervosa, and exercise dependence were assessed. This study also examined the magnitude of norms, attitudes, and behavioral control influences linked with disordered eating behaviors among athletes at HBCUs through conceptual application of the Theory of Planned Behavior (TPB).

Significance of the Study

There is an absence of research examining eating disorders, orthorexia nervosa, and exercise dependence among African American athletes. This study contributes to the literature on emerging topics in a poorly investigated population. An understanding of the prevalence and eating disorder risk levels among African American athletes better equips health officials to develop interventions that will optimize the physical and mental health of this population.

In addition to enlightening health officials on an under-studied population, the results of this study also provide functional benefits to the public health field. This study imparts information that is useful in reducing the proportion of adolescents who engage in disordered eating behaviors in an attempt to control their weight, as is stated in objective Mental Health and Mental Disorders: Healthy People 2020-4 (MHMD HP2020-4) of the United States Department of Health and Human Services' *Healthy People 2020* initiative (USDHHS, n.d.). In addition, this study also allows health officials to better understand the application of elements of the Theory of Planned Behavior for these particular behaviors and this population.

Research Questions

This study addressed the research questions detailed below.

1. What is the prevalence rate among athletes at HBCUs for eating disorder risk, exercise dependence risk, and orthorexia nervosa risk?

2. Are there relationships between HBCU student athletes' prevalence for being at risk for an eating disorder, exercise dependence, and orthorexia nervosa?

3. Are there between group differences within the HBCU athletic population for prevalence rates of eating disorder risk, exercise dependence risk, orthorexia nervosa risk?

4. Are there between group differences within each sport among the HBCU athletic population for risk of eating disorders? If so, is the relationship between sport and eating disorder risk level influenced by BMI or age?

5. Are there between group differences within each sport among the HBCU athletic population for risk of orthorexia nervosa? If so, is the relationship between sport and orthorexia nervosa risk level influenced by BMI or age?

6. Are HBCU athletes' attitudes toward disordered eating dietary behavior related to their intention to engage in disordered eating behavior?

7. Are there social norms related to intention to engage in disordered eating behavior among HCBU athletes?

8. Is behavioral control related to intention to engage in disordered eating behavior among HBCU athletes?

9. Are there significant differences between participants' ideal body stature and their perceived body stature? Are there group differences between the HBCU student-athlete population with respect to ideal body stature and perceived body stature?

Limitations

Limitations are present in any study. This study was limited due to the use of a homogeneous convenience sample of athletes at HBCUs in the Southeastern US. This limitation reduced the ability to infer results to other populations. Moreover, since the study's analysis was based on the responses of a self-reported survey, subject honesty was a potential threat to validity.

Delimitations

This study was delimited to approximately 427 varsity African American athletes between the ages of 18-24, enrolled at HBCUs in the southeastern US.

Definitions

The following terms are defined for the purposes of in-depth understanding of this study:

Aesthetic sports. Aesthetic sports are sports where success is highly dependent on subjective ratings among judges, officials, or reviewers; including any fashion or form of appearance assessment. Examples of such sports include gymnastics and cheerleading.

Amenorrhea. Amenorrhea is the absence of one or more menstrual periods (Mayo Clinic, n.d.).

Anorexia nervosa. Anorexia nervosa is a clinical eating disorder characterized by controlling diet through starvation practices. Some visual signs of anorexia nervosa include "wasted" body stature and abnormal menstrual periods in women (APA, 2000).

Athlete. An athlete is a person who is officially registered to play on a competitive, intercollegiate athletics team.

Bulimia nervosa. Bulimia nervosa is a clinical eating disorder characterized by cycles of bingeing and purging (vomiting, laxative abuse, diet pill abuse, excessive exercising). It is possible for a person with bulimia nervosa to have a weight stature regarded as "normal" (APA, 2000).

Body mass index (BMI). BMI is a number calculated from a person's weight and height. This index is used to screen for body fatness comorbidities that may lead to health problems (CDC, n.d.). Table 1 categorizes the weight stature of individuals.

Table 1

Standard BMI Chart Used to Classify Individuals Into Particular Weight Stature Categories

BMI Score (kg/m^2)	**Classification**
Below 18.5	Underweight
18.5 – 24.9	Normal
25 – 29.9	Overweight
30 and Above	Obese

***Diagnostic and Statistical Manual of Mental Disorders* (4th ed., Text Revised) (DSM-IV-TR).** DSM-IV-TR is the current edition, as of 2012, of a clinical publication that serves as the standard classification of mental disorders used by mental health officials in the US (APA, 2000).

Disordered eating. Disordered eating is the actual behavior of abnormal dietary practice.

Eating disorder. Eating disorders are mental illnesses that are characterized by atypical eating patterns. To be qualified as having an eating disorder, one must meet strict criteria of requirements to achieve clinical diagnosis (APA, 2000).

Eating disorder not otherwise specified (EDNOS). Individuals who experience a mix of anorexia and/or bulimia and/or binge-eating symptoms, but who do not fall neatly into one of the medical categories, are said to have an EDNOS (National Eating Disorder Information Centre, n.d.).

Epidemic. An epidemic is a disease/condition that appears as new cases in a given human population (incidence rate), during a given period, at a rate that substantially exceeds what is expected, based on recent experience (World Health Organization, n.d.).

Female Athlete Triad. The Female Athlete Triad is a syndrome of three interrelated conditions that exist on a continuum of severity, including energy deficit/disordered eating, menstrual disturbances/amenorrhea, and bone loss/osteoporosis (Nativi et al., 2007).

Gross domestic product (GDP). GDP is a popular indicator that measures the health of a country's economy. The economic indicator represents the total dollar value of all goods and services produced by a country (US Bureau of Economic Analysis, 2007).

Lean sport. Lean sports are sports where athletes' successes are correlated with a lean physique or particular body type. Examples of these types of sports include certain track events, swimming, and volleyball.

Linear regression. A statistical model that establishes a linear equation, which depicts a line that bests fits a set of data observations. This equation also predicts a value for the dependent variable from a set of values of the independent variable. The quality of the aforementioned equation is based on the distance from the prediction line of an actual observation (Urdan, 2005).

Non-lean sport. Non-lean sports are sports where athletes' successes are not necessarily correlated with a lean physique or particular body type. Success in these sports are more dependent on performance, which may (or may not) be influenced by a lean weight stature. Examples of this sport categorization include football, basketball, baseball, softball, and soccer.

Obsessive compulsive behavior. For the purposes of this study, obsessive compulsive behaviors are individual actions that serve as symptoms of obsessive compulsive disorder.

Obsessive compulsive disorder. Obsessive compulsive disorder is an anxiety disorder where individuals have undesired and recurrent thoughts, feelings, sensations (i.e., obsessions), or behaviors that drives them to do something (i.e., compulsions) (NIH, n.d.).

Outpatient treatment. For the purposes of this study, outpatient treatment refers to medical care that does not require 24-hour medically supervised attention at a live-in facility or hospital.

Pathophysiology. For the purposes of this study, pathophysiology is the study of disturbances in bodily functions which are caused by illnesses or their symptoms.

Social physique anxiety. Hart, Leary, and Rejeski (1989) defined Social Physique Anxiety as a subtype of social anxiety that occurs as a result of the prospect or presence of interpersonal evaluation involving one's physique.

Theory of Planned Behavior (TPB). A popular psychosocial theory in public health education, the TPB is a "value-expectancy" theory designed to predict behavior through gauging one's intention to perform behavior. This theory was created by Icek Azjen (1985) and includes the following direct constructs: Attitude, Subjective Norm, Perceived Behavioral Control, and Intentions.

Weight categorized sports. Weight categorized sports are sports whose events are divided such that participation is contingent on an athlete's individual body weight or the aggregate body weight of a group of athletes. Examples of these types of sports include crew, wrestling, weightlifting, and boxing.

CHAPTER II

REVIEW OF LITERATURE

Chapter II of this dissertation will provide a necessary review of literature in the following areas: general information about eating disorders, the epidemiology of eating disorders, risks associated with eating disorders, eating disorders and the female label, eating disorders and athletes, eating disorders and minorities, orthorexia nervosa, general information about exercise dependence, epidemiology of exercise dependence, risks associated with exercise dependence, sport culture and exercise, the Theory of Planned Behavior, eating disorders survey instruments, exercise dependence questionnaires, and general information about statistical procedures used in this study.

General Information About Eating Disorders

Eating disorders and DSM IV. Eating disorders are mental illnesses that pose significant risks to the quantity and quality of one's life (Becker, Grinspoon, Klibanski, & Herzog, 1999; Gordon, 2000; Klump, Bulik, Kaye, Treasure, & Edwards, 2009). The mental illness is also reported to affect 8-11 million Americans (Hudson et al., 2007; NIMH, 2010) and 70 million people worldwide (Crowther, Wolf, & Sherwood, 1992). The standardized definition and criteria for eating disorders are detailed in the text revision of the DSM-IV (APA, 2000). The DSM-IV-TR defines an eating disorder as a mental illness characterized by abnormal deviations from healthy dietary behavior, with most of the eating behavior disturbances arranged in three distinct categories: Anorexia nervosa, bulimia nervosa, and eating disorders not otherwise specified (APA, 2000).

Anorexia nervosa. Anorexia nervosa is distinguished by the drastic restriction of caloric intake. It is often accompanied by inaccurate perception of body image, extremely thin body stature (BMI $\leq$ 18.5), and constant pursuit of having a thin body frame (APA, 2000).

DSM IV-TR diagnostic criteria. The first DSM IV-TR diagnostic criterion for anorexia nervosa is a purposeful maintenance of body weight below that of normal for age and height (APA, 2000). The next diagnostic criterion for anorexia nervosa is an intense fear of weight gain, even though a person is actually underweight; followed by an immense displeasure of one's own body weight or shape, often accompanied by inaccurate assessment of stature (APA, 2000). The final criterion, involving only post-menarcheal women, is the lack of at least three consecutive menstrual cycles (APA, 2000).

Types. There are two types of individuals within the anorexia nervosa disorder: the restricting type and binge eating/purging type. The restricting type limits intake of food to maintain a body stature that is considered thin; hence, binge-eating or purging behavior is not present (APA, 2000). The binge eating/purging type uses binge-eating and purging behavior to acquire desired weight (APA, 2000).

Bulimia nervosa. Another eating disorder, bulimia nervosa, is generally defined as the dietary behavior of cyclical binging eating and purging (APA, 2000). Unlike anorexia, bulimia nervosa can occur in individuals of low (BMI < 18.5), normal (BMI < 25), or high weight (BMI $\geq$ 25).

DSM IV-TR diagnostic criteria. The first DSM IV-TR diagnostic criterion for bulimia nervosa is recurrent episodes of binge eating characterized by uncontrollable intake of large quantities of food that are more than what most people would eat during a similar time period (APA, 2000). This binge eating behavior is followed by an inappropriate compensatory behavior to prevent weight gain (APA, 2000). These behaviors include self-induced vomiting; misuse of laxatives, diuretics, enemas, or other medications; fasting; or excessive exercise. The second diagnostic criterion for bulimia nervosa requires that the binge eating and compensatory behavior both occur, on average, at least twice a week for at least 3 months (APA, 2000). The patient's self-evaluation must be heavily influenced by body stature and weight (APA, 2000) and the episode cannot occur during bouts of anorexia nervosa (APA, 2000).

Types. Bulimia nervosa is subcategorized into purging type and nonpurging type. Patients with purging type regularly engage in self-induced vomiting or the misuse of laxatives, diuretics, or enemas (APA, 2000). Those with nonpurging type engage in other inappropriate compensatory behavior that does not include self-induced vomiting or the misuse of laxatives, diuretics, or enemas (APA, 2000).

Eating Disorders Not Otherwise Specified. The third and final eating disorder, EDNOS, includes individuals who engage in chronic abnormal dietary practices that do not clearly fit into the anorexia and bulimia nervosa groups (APA, 2000). This also includes binge eating disorder (BED). BED is defined as uncontrolled binge eating without inappropriate compensatory behavior. It is typically, but not always, correlated with obesity symptoms. Fairburn and Bohn (2005) suggested that EDNOS was added because some health psychologists and officials believed that the diagnostic criteria for bulimia and anorexia nervosa were too strict, resulting in underestimation of national eating disorders prevalence.

Characteristics of individuals at-risk for eating disorders. Most who engage in disordered eating behavior typically have high amounts of intelligence coupled with feelings of inadequacy, inferiority, and unworthiness (Bardone et al., 2007; Scott, 1988). Other common impetuses to eating disorders include low self-esteem, an external locus of control in life, past history of depression/anxiety, trouble in relationships, and having been a victim of physical and sexual abuse (Caspi et al., 2008). These common precursors are often neglected by those who suffer from the mental illness, because control of diet and body image provides a euphoric sense of relief that conceals the root issue (Nelson, Hughes, Katz, & Searight, 1999). As with many mental and physical illnesses, the longer it takes to detect an eating disorder, the lower the statistical odds of successfully eradicating the behavior (Papadopoulos, Ekbom, Brandt, & Ekselius, 2009). This statement forecasts a diminished quantity and/or quality of life for populations who are affected by this disorder, since those empowered with the ability to alleviate their condition are equipped with a treatment method that will become increasingly ineffective as time passes.

Financial costs of eating disorders. Not only do eating disorders have negative health effects, they are also financially burdensome to individuals and society.

Influence on personal finances. Due to the potentially dangerous outcomes often associated with chronic disordered eating behavior, treatment programs in hospitals and out-patient treatment facilities are costly. Hospital and out-patient treatment for those who seek help with anorexia nervosa cost an estimated $6,000 per year (Simon et al., 2005), while out-patient treatment for those who seek help with bulimia nervosa costs an estimated $3,000 per year (Simon et al., 2005). Those who seek treatment years after initial onset can expect to spend more, as relapses in disordered eating behavior are typical among these individuals.

The economic implications of bulimic behaviors are high in and of themselves. Crowe and colleagues (2008) concluded that 30% of the grocery budgets of their bulimic female subjects were allocated to the purchase of excess food and beverage.

Influence on American and global economy. Eating disorders not only affect individuals suffering from them, but they may also impact national and global economies. According to Poisal and colleagues (2007), in 2006 health care costs in the US reached 16% of the national gross domestic product of $2.02 trillion. This is forecasted to grow to 20% by the year 2016. Mark and colleagues (2007) suggested that mental disorders, including eating disorders, account for 6.2% ($125 billion) of the US expenditures on health care. As staggering as these numbers appear, the full impact of mental illnesses such as eating disorders cannot be captured through assessment of direct costs of treatment. There are also indirect costs associated with mental illnesses. As stated by Insel (2008), what makes the costs of mental illnesses (like eating disorders) unique is the fact that indirect costs generally outweigh direct costs. Typical indirect costs of mental illnesses include reduced labor, public income support payments, and lower educational attainment. Kessler and colleagues (2008) suggested that mental illnesses are associated with an annual loss of earning in the US totaling $193 billion.

Epidemiology of Eating Disorders

Who is at risk. This section of the literature review provides epidemiological information regarding key groups at risk for eating disorders.

Age. Most individuals who are diagnosed with an eating disorder are within the adolescent or young adult demographic. Hoek (2006) reported that over 80-90% of those diagnosed with an eating disorder are between the ages of 15 and 24 years. Eating disorders also ranks fourth among college students in negative health behaviors behind alcohol abuse, illicit drug abuse, and behaviors that cause sexually transmitted infections (Garman, Hayduck, Crider, & Hodel, 2004).

Gender. With respect to gender, bulimia nervosa exists in an estimated 2-3% of all US women (Hudson et al., 2007), with anorexia nervosa and EDNOS found in an estimated 1% and 3.5%, respectively, of this population. Conversely, an estimated 0.3% American males are classified as having anorexia nervosa. Approximately 0.5% US males suffer from bulimia nervosa and 0.2% have BED (Hudson et al, 2007).

Though the aforementioned statistics appear to show low to moderate prevalence rates, it is important to remember that the diagnostic criteria for an eating disorder are rigorous. In a different study done by Hudson and colleagues (2006), those estimated to engage in disordered eating, but technically not classified as having an eating disorder are almost twice that of individuals estimated as meeting requirements for clinical diagnosis. When those at risk for having clinical eating disorders and those with a sub-clinical disease state are considered together, the potential impact of these disorders is evident.

Additional statistics. With the proliferation of low-calorie and low-fat food offerings in grocery stores and restaurants within the last 20 years, it has become evident that Americans are becoming increasingly interested in their physical appearance and health. Shisslak and Crago (1995) reported that 41% of all Americans diet in some form or fashion. Among those Americans who diet, 35% progress to pathological dieting; and among those who engage in pathological dieting, 20% advance to clinical classification of having an eating disorder.

According to a meta-analysis conducted by Smolak, Murnen, and Ruble (2000), people with anorexia nervosa are up to 10 times more likely to die because of the illness when compared to other mentally ill individuals without anorexia nervosa. In a replication performed by Hudson and colleagues (2007), subjects with a lifetime diagnosis of anorexia nervosa had significantly lower current BMI than respondents without any eating disorder. An opposite pattern was discovered for BED, with significantly more participants with BED having a BMI greater than 40 than subjects without any eating disorder. BED was also statistically associated (OR = 3.1, $p < .05$) with severe obesity (Hudson et al, 2007). These findings are consistent with other publications on eating disorders and BMI (de Zwann, 2001; Hudson et. al., 2006; Striegel-Moore & Francko, 2003).

Risks Associated With Eating Disorders

Eating disorders have the highest mortality rates among all metal illnesses. The NIMH (2010) reported that approximately 50,000 people die every year because of an issue related to an eating disorder. Similarly, work by Herzog and colleagues (2000) revealed that eating disorders, especially anorexia nervosa, are associated with the substantial risks of death and suicide. Further investigations indicated that suicide rates were highest among people with anorexia nervosa, and those among patients with EDNOS (specifically, BED) had the potential to be even greater (Herzog et al., 2000). The researchers deduced that binge eating mortality rates are difficult to quantify because co-morbid illnesses related to obesity (e.g., type 2 diabetes mellitus, hypertension, coronary heart disease, etc.) are often listed as the cause for mortality; hence, statistics may be conservative for that eating disorder classification.

Physiological medical issues associated with eating disorders are hypokalemia, hyponatremia, amenorrhea, hypoglycemia, abnormal liver function, esophagitis, Mallory-Weiss tears, esophageal rupture, hypocalcemia, and early onset of osteoporosis (Rosen & the Committee on Adolescence, 2010). Though most physiological effects of eating disorders are mitigated through improved nutrition practices and ceasing of purging practices; there is worry that some complications (e.g., growth retardation, structural brain changes, and low bone mineral density), with time, are irreversible (Katzman, 2005).

According to Brambilla and Monteleone (2003), malnutrition is the reason for most of the immediate physiological issues related to eating disorders. As a result, the human body attempts to adapt to the caloric deficits through decreased capacity of energy levels. Over time, if inadequate nutrition practices are maintained, metabolic rates generally decrease, followed by a lower body temperature, which has the capacity to compromise nearly every organ system in the human body (Brambilla & Monteleone, 2003).

Low bone mineral density is a common physiological effect of eating disorders among both males and females (Rosen, 2010). Bone density loss is not only an issue because of increased risk of bone fractures; but also because of its potential to be irreversible, which will adversely affect one's skeletal health throughout their entire life span (Katzman, 2005). The pathophysiologic factors of bone mineralization among eating disorder patients are comprehensive and multifarious (Rosen, 2010). They include estrogen and/or testosterone deficiencies, low calcium and vitamin D levels, and reduced muscle mass.

An example of the decreased quality of life associated with eating disorders can be seen in Knapp's study (2003) which revealed that the constant obsession with dietary behavior related to eating disorders causes decreased attention to both personal and professional obligations, in turn, potentially leading to poor life choices. Mond, Hay, Rodgers, Owen, and Beumont (2004) discovered similar results in their study, which sampled 169 women, and found that those with eating disorders are more likely to report a low quality of life. Subjects in both of these investigations (Knapp, 2003; Mond et al., 2004) stated that disordered eating behavior consumed them mentally to the point of displeasure.

Eating disorders not only manifest in physiological complications but they also have psychological effects. Eating disorders are associated with high rates of psychiatric comorbidity (Pallister & Waller, 2008) including: depression (Grubb et al., 1993), bipolar disorder (Kruger et al., 1996), and obsessive-compulsive disorder (Thornton & Russell, 1997).

In a study involving a sample of 105 patients with eating disorders, Braun, Sunday, and Halmi (1994) reported that 82% had at least one psychiatric comorbidity, with depression, anxiety, and substance misuse being the most common. Furthermore, approximately 70% of their sample met clinical qualifications for at least one personality disorder.

Eating Disorders and Gender

Increase in male prevalence rates. Prior to the 1990s, eating disorders among males were estimated as occurring once for every 8 to 10 females (Anderson, 1995). More recent scholarly publications estimated that 20% of all anorexia nervosa cases and 10% of all bulimia nervosa cases occur in males (Woodside et al., 2001). Natenshon's investigation (1999) also supported this increase, as he reported a 100% increase over a 20-year span in the numbers of males meeting most of the criteria for anorexia nervosa. More specifically, Cohn (2000) revealed that male prevalence for clinical eating disorders was estimated to be 16%, ; representing a 30% increase from the 1980s, yet some scholars still believe that estimates for male prevalence of eating disorders are severely conservative (Graham, 2004).

Though the prevalence rates for males with eating disorders are increasing, unfortunately, only 1 in 15 males classified as such seek treatment (Graham, 2004). Galdas, Cheater, and Marshall (2005) reported that in the United States, males are less likely than females to seek attention from health professionals for personal medical problems. Chapple, Ziebland, and McPherson (2004) suggested that this phenomenon occurs because of traditional masculinity roles that exist in various cultures across the globe. Appearance of superior health and lack of weaknesses (physical and mental) are key characteristics of masculinity (Harris, 2008).

Eating disorders and the female label. Health care providers often fail to notice symptoms related to eating disorders in males in a timely manner when compared to female patients (Cohn, 2000). Many physicians are unaware that anorexia and bulimia nervosa occur in both sexes (Strumia, Manzato, & Gualandi, 2003), which helps explain why eating disorders are underdiagnosed among males. Under-diagnosis in males, relative to females, occurs because the onset of illness (especially with anorexia nervosa) is more noticeable (e.g., menstrual irregularity or absence) in women; whereas in males the mere presence of any muscle mass may increase reluctance to diagnose eating disorder.

This under-diagnosis phenomenon also occurs with bulimia nervosa, especially since this condition may not involve the drastic weight loss typically seen in anorexia nervosa (Cohn, 2000). Schneider and Agras (1987) stated that males suffering from bulimia nervosa are more likely to substitute excess vomiting and laxative abuse with excessive exercise as a preferred method of purging; thus hiding the symptoms of bulimia nervosa because exercise is viewed as positive. Striegel-Moore and colleagues (2009) also reported that males are more likely to use excessive exercising to control body weight, as opposed to conventional purging methods.

The nature of the medical field generally motivates physicians to rely on clear-cut indicators of eating disorders. An example of one of these indicators is amenorrhea, a component of the Female Athlete Triad syndrome (Nativi et al., 2007). From an eye-test perspective, physicians typically rely on drastic weight changes, which may or may not occur throughout the duration of the disease, in the diagnosis of males with eating disorders (Souza & Toombs, 2010). There are other opportunities for prompt male diagnosis. For instance, constant obsession with body composition, loss of sex drive, and sharp decreases in testosterone levels are all common symptoms of chronic male disordered eating (Olivardia, Pope, Borowiecki & Cohane, 2004).

Unfortunately, these are all issues male eating disorder patients are reluctant to discuss with physicians (Crisp & Burns, 1983). This is why the likelihood of delayed diagnosis in females is lower than that in males (Blinder, 2001). Male diagnosis often occurs 3 to 4 years after onset of disease (Crisp & Burns, 1983), which is why males are typically diagnosed in an advanced stage (Blinder, 2002). This delayed diagnosis strengthens the intensity of the disease, with more deeply engrained behaviors associated with the disease.

American society and weight. In the US it is socially acceptable for women to be publically dissatisfied with body image when it does not meet the culture's ideal standard (Smolak, 1996). Unfortunately, men do not share this social acceptance, which also amplifies their reluctance to openly discuss disordered eating issues with health clinicians. Thus, a more vocal female patient who is dissatisfied with her weight provides more cues warranting attention from physicians and significant others for eating disorder diagnosis than males who do not express the same dissatisfaction.

Social Norms of Weight. Another reason why eating disorders are sometimes referred to as a female mental illness is because body fat worries have generally been classified as a female issue. Though EDNOS can involve binge-eating without purging (which is not always aligned with the desire to achieve thinness), most think of thinness as an eating disorder characteristic (bulimia and anorexia nervosa) when they think about eating disorders (Cohn, 2000).

Eating disorders are often more prevalent in cultures that provide increased social capital for a desirable appearance that can be acquired through a high level of thinness. The desirable appearance is often portrayed in various media forms throughout the culture (Tylka, Bergeron, &

Schwartz, 2005). In an examination of the media, it doesn't take long to understand that it is more socially acceptable for women to be thin, and for men to be muscularly lean. Hence, positive male media images are often associated with muscle mass, and positive female images are often correlated with lean body shape.

Body image and the media. Though media commercials are recently showing more male products for weight-loss (e.g., Nutra-system for males), most weight loss products are marketed toward females. More thinness products are marketed toward women because sociocultural norms in US promote thinness in females moreso than in males (Anderson, 1992).

Anderson (1992) examined the 10 magazines most commonly read by young men and women for advertisements and articles promoting weight loss or shape change. He found that the women's magazines contained 10.5 times as many advertisements and articles promoting weight loss as the men's and that men were disproportionately subjected to incentives to change body shape (e.g., "V-Shaped" figure) compared to body weight. Ironically, in a non-related Gallup poll conducted by Men's Health Magazine, many female participants perceive overweight and overeating males as more desirable than men who were smaller (in stature) and ate less than them. Anderson's study results showed that thinness is a feminine ideal. This type of thinking feeds and perpetuates the lack of enthusiasm behind increasing awareness and health interventions designed for males at risk for bulimia and anorexia nervosa (Cohn, 2000).

Phillips and de Man (2010) also accredited media influences for the body image dissatisfaction of males in their study. In a study that involved 110 participants, Phillips and de Man used a self-report survey to investigate whether key mediums of entertainment have influences of body image satisfaction. Results list common media images of males as reasons why participants whose BMI classified them as overweight have a desire to lose weight ($p < .05$).

Phillips and de Man's study also attributed media images as reasons why participants whose BMI is classified as normal or underweight wish to have a larger physique ($p < .05$).

Medical criteria. Based on findings from previous epidemiological research with regard to eating disorders, there is evidence that the rubrics of anorexia and bulimia nervosa may be less relevant to men than to women. The DSM-IV TR criteria of anorexia and bulimia nervosa do not consider body dissatisfaction without the presence of weight-loss preoccupation. Men with eating disorders are often obsessed with body size and shape, whereas women are often concerned with their total body weight (Cororve & Gleaves, 2001). Therefore, males who do not care to be thin are often overlooked when diagnosis for an eating disorder should possibly occur. Since most men who are at risk for or have an eating disorder generally reside in the subclinical level of DSM-IV-TR diagnosis, they would actually fall under the EDNOS category (Button, 2005). Therefore, Keel, Gravener, Joiner, and Haedt (2010) suggested that the EDNOS diagnosis is the most relevant framework with which to understand the eating disorder phenomenon among male patients.

Eating Disorders and Athletes

Athletes at Increased Risk. College varsity athletes in select sports are at increased risk of eating disorders compared to the general population (Davis, Kennedy, Ravelski, & Dionne, 1994; DePalma, Koszewski, & Romani, 2002; Garner, Rosen, & Barry, 1998; Johnson, Powers, & Dick, 1999; Kleifield, Wagner, & Halmi, 1996; Skolnick, 1993; Smolak et al., 2000; Thiel, Gottfried, & Hesse, 1993a, 1993b). This is especially the case in the male intercollegiate sports of wrestling and track and the female intercollegiate sports of volleyball, track, and gymnastics (DePalma et al., 2002; Johnson et al., 1999). Though there has been increased attention on athletes and eating disorders, most published studies populations' included a high proportion of white female athletes (Baum, 2006; DePalma et al., 1993). The current literature lacks quality studies observing male (Baum, 2006; DePalma et al., 1993) and minority populations (Brown, Cachelin, & Dohm, 2009).

Black's (1991) rationale behind the increased likelihood of eating disorders in the aforementioned sports is due to the increased pressure and competitive environment of collegiate athletics. So much recent attention has been put on the increased risk among athletes that some experts have called for a standardized eating disorder screening test designed specifically for athletes (Black, Larkin, Coster, Leverenz & Abood, 2003).

Johnson et al. (1999) examined eating disorder diagnosis among 1,445 National Collegiate Athletic Association (NCAA) athletes and found an estimated 35% of female athletes and 10% of male athletes were at risk for having anorexia nervosa. They also stated that approximately 38% of both male and female athletes are at risk for bulimia nervosa. The extremely high percentages among males and females at risk for bulimia nervosa illustrate the seriousness of this mental disorder.

In a study involving collegiate male athletes, Petrie and colleagues (2008) found no occurrences of clinical eating disorders, but found that 20% of participants were classified at the subclinical level. Over 66% of this sample was classified as overweight or obese according to BMI, with 40% of the total sample being unsatisfied with their current weight (Petrie et al., 2008).

In another study involving female collegiate athletes, Greenleaf and colleagues (2009) discovered that 2% of participants were classified as having a clinical eating disorder and approximately 26% of participants showed signs of an eating disorder at the subclinical level.

Greenleaf and colleagues (2009) also found that exercise was the preferred purging method among their sample of female athletes.

Both Petrie and colleagues (2008) and Greenleaf, Petrie, Carter, and Reel (2009) indicated that athletes who suffer from subclinical levels of eating disorders experience problematic quality of life and physiological complications. In a study involving 156 adults who were receiving treatment for eating disorders, Bamford and Sly (2009) investigated their participants' quality of life. Similarly, their findings revealed that psychosocial and cognitive quality of life are the most prevalent issues affecting patients diagnosed with eating disorders (Bamford & Sly, 2009).

Trattner-Sherman, Thompson, Dehaas, and Wilfert (2005) stated that collegiate coaches at NCAA member institutions often mistake disordered eating behaviors among athletes as required competitiveness for athletes to excel in their sport. Thirty-seven percent of collegiate coaches who participated in their survey indicated that amenorrhea was normal. Overall, the researchers concluded that coaches fail to acknowledge signs of eating disorders among athletes when present, and under some circumstances increase the likelihood of eating disorders occurring through their paternalistic monitoring methods.

Body weight versus eating behavior. Most of the general US population considers body weight, not eating behaviors, when thinking of disordered eating. This tendency ignores unusual behaviors, such as eating in solitude, only eating safe foods, and basing dietary habits on rituals and myths (NIMH, 2010). When coupled with the normative behaviors associated with sports, this phenomenon makes the development of an eating disorder and its subsequent diagnosis even more problematic.

Within the culture of many sports, it is socially acceptable to engage and display eating disorder behaviors (Sundgot-Borgen & Torstveit, 2004). For example, an American football participant who plays a position that benefits from having a large amount of weight (e.g., lineman) can eat excessive amounts of food in one sitting without critical judgment from peers, coaches, and fans. Jonnalagadda, Rosenbloom, and Skinner (2005) disseminated a nutrition and attitudes questionnaire to 31 NCAA Division I freshman football players. They discovered improper dietary and supplementation habits among their participants (Jonnalagadda, Rosenbloom, & Skinner, 2005). Based on qualitative feedback from their initial study, the researchers commented on the general level of acceptedness in the athletic environment with regard to unconventional ways to achieve desired weight among the athletes. In some instances, an athlete's maladaptive behavior may be perceived as expected and revered by these groups of people.

The culturally normative combination of strict dietary practices and excessive exercise to achieve optimal performance is standard at many athletic departments in colleges and universities across the US (Sundgot-Borgen & Torstveit, 2004). This is especially the case in competitive collegiate conferences that generate large amounts of revenue from sporting events. As national popularity and revenues among collegiate sports have increased over the last 5 decades, so has the acceptance of pathogenic and maladaptive weight control practices in sport (Williamson et al., 1995). The fame facilitated by modern American sport culture also increases the likelihood of maladaptive behaviors associated with enhanced performance. According to Bissell and Porterfield (2006), social physique anxiety, a strong predictor of anorexia and bulimia in women, is more prevalent among athletes (especially female) in sports that are televised regularly. The fear of millions of individuals evaluating their physiques in a negative manner motivates some athletes to engage in disordered eating (Bissell & Porterfield, 2006).

Sport culture and behavior. Since disordered eating is considered a normative behavior in various sport cultures (Jonnalagadda et al., 2005), athletes subconsciously resist attempts to normalize eating and exercise patterns. This resistance occurs due to fear of decreased performance and sub-prime physique (Sagar, Lavallee, & Spray, 2007). Resistance to normal dietary and exercise behavior are higher in environments where disordered eating and excessive exercise has become a team behavior (Cintado, 2007). In some sport environments, behaviors that deviate from the team standard may put athletes at risk of decreased social status, acceptance among fellow team members, and maybe even approval among coaches (Sagar et al., 2007).

Involvement in athletics further increases the complication to detecting eating disorders; this is especially the case in male athletes. Male athletes have an increased tendency to restrict certain foods, as well as consume specific foods with fidelity, to increase the probability for athletic success, which also increases the likelihood of an eating disorder occurrence (Knowlton, 1995). Sparked by America's high regard for male athletes and their perfect physiques, very few correlate the Adonis male figure with eating disorders, though some athletes achieve this body stature through disordered eating practices (Sherman & Thompson, 2001). Sherman and Thompson (2001) also suggested that the eating disorder phenomenon among male athletes gets further blurred because it is really difficult to distinguish disordered eating from the habits of a dedicated athlete.

In athletic eating disorder research, many scholars assert that aesthetic, lean, and weight-categorized sport participants are at increased risk of having an eating disorder (Anderson, 1995; Greenleaf et al., 2009; Hulley, Curry, Njenga, & Hill, 2007; Petrie et al., 2008; Sundgot-Borgen

& Torstveit, 2004). Many of these studies involve examinations of female participants and the eating disorder classifications of bulimia and anorexia nervosa.

DePalma and colleagues (1993) examined 131 male college lightweight football players through use of an eating disorder questionnaire, and found that 11% were at a significant risk for developing an eating disorder. Also, the study revealed that 52% of the football players (a sport not traditionally considered in eating disorder studies) displayed dysfunctional eating behaviors opposite of anorexia and bulimia nervosa behaviors (DePalma et al., 1993). Though the study was conducted before EDNOS was accepted as an eating disorder classification, it recognized that over half of the football players in their study exhibited disordered eating behaviors that were not classified as anorexia and bulimia nervosa. Petrie and colleagues' (2008) study showed a similar trend, where a majority of male athletes involved in the study displayed behaviors correlated with EDNOS. These studies reinforced the notion that eating disorders and EDNOS among athletes require further examination.

Eating Disorders and Ethnicity

Historically, in the US, eating disorders have been referred to as a mental illness that primarily affects Caucasian, upper-middle class women (Striegal-Moore & Smolak, 2000). This conceptualization was born out of research studies that typically omitted individuals of varying racial demographics. Until recently, many public health scholars acknowledged Caucasian upper-middle class women as the population at highest risk for eating disorders because that population received so much attention in the literature (Perez & Joiner, 2003).

The exclusion of ethnic populations from robustly designed eating disorder research has profound influences for theory development, treatment, and diagnosis for the mental illness. An example of this influence can be seen in common inferences among physicians that women of color suffer from lower rates of eating disorders when compared to Caucasian women. These inferences generate a race bias that ultimately impacts the rate at which women of color are diagnosed with an eating disorder (Gordon, Perez, & Joiner, 2002) and are the likely reason that African Americans were once thought to be protected from eating disorders (Perez & Joiner, 2003).

This bias is seen in the work of Gordon, Brattole, Wingate, and Joiner (2006) who found that clinicians were less likely to detect eating disorder symptoms in African Americans than in Hispanics or Whites. This was concluded after a random selection of clinicians was presented with three cases studies involving a patient named "Mary." In all three cases Mary met the DSM-IV-TR criteria for having an eating disorder. The cases differed only in the racial make-up of Mary (Caucasian, African American, and Asian). Clinicians who reviewed the case where Mary was African American were less likely to diagnose her with an eating disorder compared to the other two groups. If these biases possibly exist for women of color, one can argue that the same goes for men of color where the literature is virtually non-existent on the topic.

Franko, Becker, Thomas, and Herzog (2007) also dispelled the myth that eating disorders primarily affect Caucasian women. They administered a self-report questionnaire to a sample of 5,435 US college-aged individuals and also included feedback from an assessment facilitated by a college counselor. Findings from this study revealed that the frequency of binge-eating, restrictive eating, vomiting, and amenorrhea did not differ significantly across ethnic groups ($p > .05$). The study did report race-based differences in the mode by which individuals purged in bulimic type behavior (Franko et al., 2007).

Though studies of biases in eating disorder diagnosis may be lacking in the areas of male athletes (especially African American males), current literature on biases among prospective female patients across racial cultures strongly suggests that the body of literature on eating disorders lacks depth in studies investigating diverse populations and cultures. More research in varying racial demographics is needed to get an accurate depiction of the true prevalence rates of eating disorders in America.

Orthorexia Nervosa

General information about orthorexia nervosa. Steven Bratman (2001) defined orthorexia nervosa as an unhealthy obsession with eating healthy food. Bratman coined this eating disturbance from the Latin terms “orthos,” which means accurate, right, correct, and valid, and “orexsis,” which means hunger (Bağci Bosi et al., 2007). At the moment, orthorexia nervosa is not a recognized clinical disorder by the DSM-IV-TR; hence, it is classified as an EDNOS. Kinzl, Hauer, Traweger, and Kiefer (2006) labelled orthorexia as a precursor for clinical eating disorders.

Orthorexia nervosa is similar to bulimia and anorexia in that they are all mental disturbances that are centered with the mental preoccupation with food. What distinguishes orthorexia nervosa from anorexia nervosa and bulimia nervosa is the fact that orthorexics obsess over eating healthily, while bulimics and anorexics are focused on weight management and caloric intake. Therefore, the phobia of ingesting toxins in diet, as opposed to the fear of being fat, drives the disordered behavior (Bratman, 2001). Orthorexia nervosa, according to Donini and colleagues (2005), should only be considered when the food preoccupation is a long-term behavior that has a negative impact on an individual’s quality of life. Though long-term preoccupation with food is not explicitly defined in Donini’s work, his orthorexia nervosa instrument asks subjects if the “thought of food has worried them within the last three months”

(Donini et al., 2005). Therefore, it is safe to assume that 3 months is a threshold for long-term food preoccupation.

Epidemiology of orthorexia nervosa. To date, only two major studies have investigated orthorexia nervosa. Donini and colleagues' (2004) study involved 404 Italian volunteers (235 females and 196 males) in the city of Rome through use of the ORTO 15 instrument. Bağci Bosi et al.'s (2007) research was a cross-sectional study, which involved 318 Turkish medical officials (149 females and 169 males) also through use of the ORTO 15. In both studies, males and individuals with higher levels of education were determined to be at increased risk for orthorexia nervosa (Bağci Bosi et al., 2007; Donini et al., 2004). Middle-class people in their 20s and 30s were also at increased risk (Bağci Bosi et al., 2007). Though limited in generalizability due to population sampling limitations, previous studies conclude that orthorexia nervosa potentially has a greater presence in society than both anorexia and bulimia nervosa (Bağci Bosi et al., 2007). It was suggested by Bağci Bosi et al. that television media exposure heavily influenced food choices that lead some individuals into orthorexic behavior.

Risks associated with orthorexia nervosa. Though previous studies have not explicitly examined comorbidities associated with orthorexia nervosa, scholars have made statements about illnesses linked with the aberrant eating pattern. Obsessive compulsive disorder can be found in individuals with severe cases of orthorexia nervosa (Bratman, 2001). Due to malnutrition, orthorexia can also lead to metabolic syndrome (Bratman, 2001), increased risk of infection (Donini, 2004), and anemia (Bratman, 2001). Bağci Bosi et al. (2007) indicated that many symptoms and comorbidities associated with orthorexia nervosa are also found in the clinical eating disorders.

Although there are no published longitudinal studies that investigate long-term consequences of orthorexia, Bratman (2001) argued that orthorexia nervosa leads to results similar to anorexia nervosa. Mathieu (2005) commented how orthorexics are fascinated with extremely complex and restrictive diets designed to detoxify the body. Under extreme circumstances, these diets will result in physiological responses related to low calorie intake (Bratman, 2001). Conditions such as amenorrhea (Dadgostar, Razi, Aleyasin, Alenabi, & Dahaghin, 2009; Witkop & Warren, 2010) and premature signs of osteoporosis (Lambrinoudaki & Papadimitriou, 2010; Witkop & Warren, 2010) are common among female athletes who sustain a low-calorie diet for a long period of time. Low bone mineral density is a secondary danger among male athletes who have low energy availability.

Another commonality between orthorexia nervosa and DSM-IV-TR clinical-level eating disorders is the presence of obsessive compulsive behavior as a key symptom. Fisher (2004) stated that anorexics generally display frequent bouts of obsessive compulsive behavior. Through an extensive review of literature, they also concluded that up to 69% of anorexics have obsessive-compulsive disorder, and suffer from panic attacks from the phobia of being fat (Fisher, 2004).

In the book, *Health Food Junkies*, Bratman (2001) commented that orthorexia nervosa at times overlaps with obsessive compulsive disorder, with obsessive compulsive behavior occurring frequently throughout the tenure of orthorexia. Mathieu (2004) interviewed 12 healthcare professionals in America about orthorexia nervosa and discovered that many believed that orthorexia nervosa can also be diagnosed as obsessive compulsive disorder. At the moment, there are no published studies that empirically measure the relationship between orthorexia and obsessive compulsive behavior; but scholars are doing research on the topic (Cartwright, 2004; Donini et al., 2004).

Exercise Dependence

General information about exercise dependence. A vast amount of research details the physical and emotional benefits of exercise to many populations of people worldwide (Anderson & Brice, 2011; Cotman et al., 2007; Gulve, 2008; Lange-Asschenfeldt & Kojda, 2008; Terry et al., 2004). The literature depicts the benefits of exercise on chronic diseases such as obesity, cancer, coronary heart disease, and depression (Anderson & Brice, 2011; Ruby, Dunn, Perrino, Gillis, & Veil, 2011; Wise, 2010). However, there is sparse mention of circumstances where exercise is the cause of ailment.

When performed at too high of a frequency or intensity, exercise can develop into an addiction, which may also have severe negative consequences (Adams & Kirkby, 2002; Aidman & Woolard, 2003; Hausenblas & Downs, 2002a; O'Dea & Abraham, 2002). This unhealthy addiction to exercise is called exercise dependence. Hausenblas and Downs (2002a) defined exercise dependence as an immense longing for leisure physical activity, resulting in uncontrollable excessive exercise behavior, which manifests in physiological and/or psychological symptoms. Blaydon and Linder (2002) referred to exercise dependence as an obsessive compulsion to workout. For those who suffer from exercise dependence, exercising becomes a paramount activity that supersedes many other important aspects of their lives.

Exercise dependence and the DSM. Exercise dependence has yet to be recognized as a formal diagnosis in the DMS-IV-TR. Ogden, Veale, and Summers (1997) recognized exercise dependence as a disturbance that does fit closely with most of the criteria used to diagnose substance abuse and behavior addictions. Correlating characteristics include the following:

dominates one's thoughts; occurrence of euphoria when one engages in behavior; a routine pattern of behavior (i.e., rarely deviates from routine); compulsion to engage in behavior; increasing tolerance, which leads one to increase frequency of behavior; unpleasant feelings of withdrawal if one immediately stops behavior; and relapse into extreme and usual routine if after a period of discontinuance of behavior (Griffiths, 1997; Ogden et al., 1997).

Though the DSM-IV-TR does not explicitly recognize exercise dependence, it does provide criteria for making a diagnosis with dependence. In the context of this discussion, it is important to note that dependence is the term used for diagnosis whereas addiction is considered a description of a pattern of behavior in the field of psychology (Ruby, 2009). Scholars who argue that exercise dependence should be recognized as a clinical diagnosis point to the criteria for substance dependence (Hausenblas & Downs, 2002a; Ogden et al., 1997) established by the APA (2000).

The DSM IV-TR (APA, 2000) defined substance dependence as a maladaptive pattern of substance use, leading to clinically significant impairment, as manifested by three (or more) of the following occurring at any time in the same 12-month period: increased tolerance; characteristic withdrawal symptoms; substance taken in larger amount and for longer period than intended; persistent desire or repeated unsuccessful attempt to quit; substantial time appropriated or increased activities to obtain, use, recover; important social, occupational, or recreational activities given up or reduced; use continues despite knowledge of adverse consequences (e.g., failure to fulfill role obligation, use when physically hazardous).

According to the DSM-IV-TR, if tolerance and withdrawal are present, then it is dependence with physiologic dependence (APA, 2000). If tolerance and withdrawal are not present, then it is considered dependence without physiologic dependence. Based upon a literature review by Hausenblas and Downs (2002a), various scholars use the DSM-IV-TR criteria for dependence as the infrastructure for the theoretical rationale for exercise dependence.

Epidemiology of exercise dependence. There are few studies with a substantial sample size (N >200) that document epidemiological data related to exercise dependence. Zmijewski and Howard (2003) investigated the frequency of exercise dependence symptoms and the relationship of those symptoms to disordered attitudes toward eating among 237 college students. Disordered eating attitudes were operationalized through outcomes of the Eating Attitudes Test (EAT-26), and exercise dependence was measured through the Exercise Dependence Questionnaire. One of the major findings of their study was that women are more likely to suffer from more symptoms of exercise dependence than men. When evaluating the aggregate numbers of individuals who meet at least three out of the seven criteria for dependence, men were slightly more likely to suffer from exercise dependence than women. Roughly 46% of the individuals in Zmijewski and Howard's study met the DSM-IV-based criteria for exercise dependence. Though there were some athletes and minorities in this sample, there were not enough for comparison purposes in chi square analysis. This high proportion of Caucasian participants limits the generalizability of Zmijewski and Howard's results to other populations.

Exercise dependence and eating disorders. Exercise dependence has been found to co-exist with other disordered behaviors (O'Dea & Abraham, 2002; Zmijewski & Howard, 2003); especially disordered eating (Zmijewski & Howard, 2003). Zmijewski and Howard used a correlation analysis to discover a moderate statistically significant correlation (r (237) = .488, p < .01) between disordered eating and exercise dependence.

Similarly, O'Dea and Abraham (2002) also concluded that there is a positive statistical relationship between exercise dependence and disordered eating. They used the Eating Exercise Examination (EEE) to investigate eating attitudes and exercise behavior among 93 Australian male undergraduate students (O'Dea & Abraham, 2002). Though an exact number is not indicated, female undergraduates were also included for comparison purposes. O'Dea and Abraham discovered that 50 males from the sample self-reported both occurrences of excessive exercise and disordered eating greater than 14 times in a 1-month span (O'Dea & Abraham, 2002).

Exercise Dependence and Athletes

According to the literature, athletes are at increased risk for developing symptoms of exercise dependence (Blaydon & Lindner, 2002; Yates et al., 2003). Blaydon and Linder (2002) asked 203 Olympic-level triathletes to complete an exercise dependence instrument (Exercise Dependence Questionnaire) and an eating attitudes questionnaire (EAT-26). According to one of several criteria to be classified as exercise dependent, a minimum of 5 hours per week of training will increase a subject's risk (Ogden et al., 1997). Over 52% of Blaydon and Linder's reported training frequency five times the threshold recommended by Ogden and colleagues. Their research concluded that as athletic involvement increases, so does the severity of exercise dependence (Blaydon & Lindner, 2002).

Yates and colleagues (2003) administered the Exercise Orientation Questionnaire and a symptom checklist to American runners (n=99), cyclists (n=36), and paddlers (n=55) Through an ANOVA (p <.05), their study revealed that frequency of excessive exercise among competitive athletes was statistically higher than recreational athletes. Though not measured in the study, Yates and colleagues suggested that level of internal competitiveness moderates the aforementioned finding.

McNamara's work (2006) further illustrates that the frequency of exercise dependence increases with one's level of athletic involvement. He observed exercise addiction among a sample of elite Australian athletes and found that exercise dependence scores are positively correlated with quantity of sports of participation, prestige of sport (as considered by society), and frequency necessary to train at an elite level.

Another study conducted with ironman triathletes (Ruby, 2009) also found that exercise involvement was associated with increased exercise dependence scores. Ruby concluded that the level of exercise dependence was moderated by social attitudes toward appearance being internalized (i.e., the more they valued aesthetic benefits of exercise, the higher their chances of being exercise dependent).

Studies such as these provide evidence for the existence of exercise dependence among athletes. However, although there has been research performed on female athletes as the target population; like eating disorder research, the literature is lacking in the areas of minority athletic populations. Overall, the topic of exercise dependence is still relatively new compared to other health topics such as substance abuse dependence and eating disorders (Hausenblas & Downs, 2002a; Ruby, 2009).

Body Image

The literature shows that perception of distorted body stature and body image dissatisfaction has a relationship with disordered eating (Ackard, Croll, & Kearnedy-Cooke; 2002; Henriques, Calhoun, & Cann, 1996; Torres-McGehee, Monsma, Gay, Minton, & Mady-Foster, 2011). Significant differences between actual body stature and perceived body stature have been shown to correlate with increased frequency in disordered eating (Ackard et al., 2002; Torres-McGehee et al., 2011).

Often, scholars use figural drawings to measure body image dissatisfaction (Gardner & Brown, 2010). These figures, or silhouettes, are drawings that represent various body statures that range from underweight to obese humans. Variation in body statures is noticeable in waist, arms, legs, and facial differences between silhouettes. The body image scale most prevalent in body dissatisfaction literature is Stunkard, Sorensen, and Schulsinger’s (1983) Figure Rating Scale (Gardner & Brown, 2010; Napolitano, Zarcone, Nielson, Wang, & Caliendo, 2010). Stunkard and colleagues’ Figure Rating Scale displays nine silhouettes for each gender that parallel body statures underweight, normal weight, overweight, and obese individuals (Stunkard et al., 1983). Stunkard’s instrument has shown strong psychometric properties with reliability scores ranging from .81 and .92, and concurrent and convergent validity scores from .80 to .99 (Ackard et al., 2002; Bulik et al., 2001; Gardner & Brown, 2010; Napolitano et al., 2010).

In a study involving 16,728 Caucasian females and 11,366 Caucasian males, Bulik and colleagues (2001) used Stunkard and colleagues’ (1983) Figure Rating Scale to establish BMI norms for standard figural stimuli instruments. Participants in the study were asked, “Which figure do you look like?” Self-reported weight and height were used to calculate BMIs for subjects. Self-reported BMIs were matched with perceived body stature among the 30,000 Caucasian participants to establish a BMI anchor system that coincided with Stunkard and colleagues’ Figure Rating Scale. BMI anchor systems differ in gender and age.

Kim Pulvers and colleagues (2004) determined that Stunkard et al.’s (1983) and Bulik et al.’s (2001) figural stimuli instruments did not work well with African Americans. Therefore, in a study involving 238 African Americans, Pulvers and colleagues (2004) created a body image instrument that was valid and appropriate for African American populations. Pulvers and colleagues' instrument displayed good reliability scores ($\alpha = .95$), strong correlating with subjects' BMI ($r = .81$, $p < .001$), strong correlation with participants' body fat measurements ($r = 0.76$, $p = .024$), and adequate criterion validity with Stunkard and colleagues' figural stimuli and Bulik and colleagues' BMI anchor system. In Pulvers and colleagues' study, African American females displayed significant differences between perceived and desired body stature ($p = .032$), while male subjects lacked statistical significance between perceived and desired body stature.

In a study involving 138 female collegiate athletes from seven US academic institutions, Torres-McGehee and colleagues (2001) investigated the relationship between body image differences and disordered eating. With use of the EAT-26 to measure eating disorder risk and Stunkard et al.'s (1983) and Bulik et al.'s (2001) figural stimuli instruments, Torres-McGehee and colleagues found that eating disorder risk level increased with the magnitude of body image differences between selected perceived and ideal body silhouettes. Overall, subjects wanted to be significantly smaller than their perceived body stature (Torres-McGehee et al., 2011).

The Theory of Planned Behavior

The Theory of Planned Behavior (TPB) is rooted from the development of Fishbein and Ajzen's Theory of Reasoned Action (TRA) in 1975. The theory was developed to understand the relationship between attitudes, intentions, and behavior (Montaño & Kasprzyk, 2008). Better put, the TRA was born largely out of frustration with traditional attitude-behavior research, much of which found weak correlations between attitude measures and performance of volitional behaviors (Hale, Householder, & Greene, 2003). Prior studies focused attitudinal research toward an object, where Ajzen and Fishbein after 1967 focused their research on attitude towards behavior (Montaño & Kasprzyk, 2008).

Theory constructs. The TRA posits that intentions are the most important determinants of behavior. Major constructs include attitude (overall evaluation of behavior), behavioral belief (belief that behavior performance is related with particular attributes or outcomes), evaluation of outcome (value attached to behavior outcome or attribute), subjective norm (belief about whether most people approve or disapprove behavior), normative belief (belief about whether referent approves or disapproves behavior), motivation to comply (motivation to do what each referent thinks), and intention (perceived likelihood of performing behavior).

Research leading to the development of the TPB as an extension of the TRA began as Ajzen (Ajzen, 1985) attempted to address an acknowledged weakness of TRA (Montaño and Kasprzyk, 2008): that it did not explain behaviors which were not under volitional control. There was a need to understand why attitudes did not always prompt behaviors. Hence, Ajzen's research (1991) led to the addition of the construct perceived behavioral control to account for factors or issues beyond the control of the individual which affect intention and behavior (Montaño & Kasprzyk, 2008).

Perceived behavioral control is an independent determinant of behavioral intention (along with attitudes and social norms). Thus, if attitudes and social norms are statistically controlled, perceived behavioral control will directly affect behavioral intention, which will then impact occurrence of the behavior (Montaño & Kasprzyk, 2008). Indirect constructs that affect perceived behavior control are control beliefs (perceived likelihood of occurrence of each facilitating or constraining condition) and perceived power (perceived effect of each condition in making behavioral performance difficult or easy). It is important to highlight that perceived behavior control differs from Albert Bandura's self-efficacy, because self-efficacy is concerned with one's perception of ability to perform a behavior. Behavioral control is concerned with perceived control over that behavior (Ajzen, 2003). External factors are assumed to operate thorough the model constructs, but do not independently contribute to explaining the likelihood of intention to perform a behavior. A diagram of the TRA and TPB's constructional relationship can be seen in Figure 1.

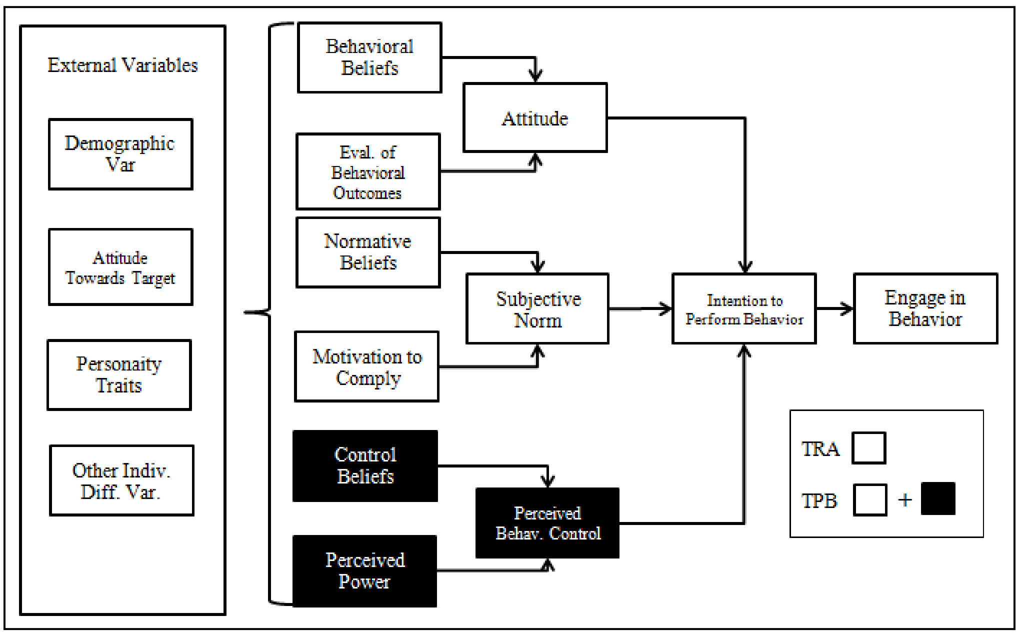

Figure 1. Figural summary of Ajzen and Fishbein's (Fishbein & Icek, 1975) Theory of Reasoned Action and Ajzen's (1991) Theory of Planned Behavior.

Strengths of the TPB. A strength of both the TRA and TPB is that beliefs held by individuals do not have to be rational, logical, or correct by an objective stance (Montaño & Kaspryzk, 2008). Another strength of the TRA and TPB is that both theories provide a framework to discern the reasons for beliefs; and to decipher individuals' actions by identifying, measuring, and combining beliefs relevant to individuals or groups. This allows a health educator to understand the reasons that motivate the behavior of interest (Montaño & Kaspryzk, 2008). A final major strength of both the TRA and TPB is that they are applicable to behavior across varying cultures and populations (Montaño & Kaspryzk, 2008). A strength that is unique to the TPB is that due to the perceived behavioral control construct, the TPB can be applied to behaviors where volitional control is not present.

Past use of the TPB. The TPB is one of the most widely used social cognition models for predicting and explaining health behaviors (Ogden, 2003) and has been applied in studies focusing on smoking (Van De Ven, Engels, Otten, & Van Den Eijnden, 2007), binge drinking (Collins & Carey, 2007), health screening (Norman & Conner, 1996), dieting practices (Garcia & Mann, 2003; Nejad, Wertheim, & Greenwood, 2004, 2005; Norman & Conner, 1996), and exercise (Chatzisarantis, Hagger, Biddle, & Karageorghis, 2002). A meta-analysis conducted by Godin and Kok (1996) revealed that when the TPB was applied to health behavior problems, models created in analyses explained an average of 41% of variance in intentions and 31% of variance for behavior.

There are several instances in which TPB was applied to studies where diet was viewed as a risky behavior (Garcia & Mann, 2003; Nejad et al., 2004, 2005; Norman & Conner, 1996). It was the goal of these studies to understand influences of intentions to engage in risky dieting behaviors (Garcia & Mann, 2003; Nejad et al., 2004, 2005; Norman & Conner, 1996). Nejad et al. (2005) commented that the current dieting and eating disorder literature has a plethora of studies that explores prevalence of dieting behavior, but lacks sufficient theoretical understanding about why individuals engage in maladaptive dieting behavior. In two studies where public health theories comparison occurred (Garcia & Mann, 2003; Nejad et al., 2005), TPB variables predicted disordered eating and dieting behaviors the best.

In a study involving 373 female undergraduate psychology students in Australia (Nejad et al 2005), TPB variables accounted for 67% of the variation in intentions to diet and 58% of the variation for fasting. The model in this study accounted for 35% of dieting behavior and 14.5% of fasting behavior. The constructs attitude and perceived behavioral control best predicted intention to fast and diet ($p = .01$) (Nejad et al., 2005).

Garcia and Mann (2003) found similar findings among 159 female psychology undergraduates in the US, with a hybrid of the TPB and Health Belief Model predicting intentions to fast when compared to other models ($R^2 = 55\%$). It is important to note that TPB constructs best predicted intentions to fast. When TPB was investigated without self-efficacy, TPB alone explained 48% of the variability to engage in fasting behavior.

TPB measurement. According to Francis et al. (2004), it is imperative that a question measuring a direct construct of the TPB use a bipolar adjective (e.g., harmful-beneficial). Montaño and Kasprzyk (2008) added that questions measuring direct constructs of the TPB must use either a 5- or 7-point scale to evaluate the bipolar adjective. The process of measuring a bipolar adjective through a 5- or 7-point scale is called a semantic differential. Francis et al. (2004) stated that direct measures should have a numerical rubric range starting at 1 and progressing to 7 with the negative and positive end points mixed throughout the questionnaire to force the respondent to read each question carefully (Francis et al, 2004).

The indirect measures' semantic differential should utilize a numeric range that starts at -3 then progresses to +3, with 0 representing a neutral stance. Francis and colleagues (2004) contend that, based on the purposes of research, that it is not absolutely necessary to have a comprehensive questionnaire that includes both direct and indirect constructs. A brief questionnaire addressing only direct constructs of the TPB is sufficient when conducting an exploratory analysis to understand the explained variation behind a generalized behavioral intention (Ajzen, 2003; Francis et al., 2004). A brief questionnaire addressing only direct constructs must contain at least 3 questions for each direct construct, comprising of a total of at least 12 questions (Francis et al., 2004). An example of this situation would be if a researcher is interested in assessing the variation and influences on intentions to engage in an eating disorder. If the researcher is interested in identifying specific beliefs that influence a direct construct (i.e., why an individual has a particular attitude, level of behavioral control, etc.), then measurement of both indirect and direct constructs is necessary (Francis et al., 2004). A comprehensive questionnaire addressing both direct and indirect constructs must contain at least 3 questions for each direct and indirect construct, comprising of a total of at least 30 questions (Francis et al., 2004).

Ajzen (2003) commented that the use of indirect constructs is best when either substantial prior research exists as to which specific beliefs are pertinent to the direct construct or in-depth elicitation surveys are conducted to determine beliefs pertinent for the target population. This is because listing a lot of beliefs with hopes of finding something statistically significant will be laborious to the subject and inefficient for the researcher.

Ajzen (2003) reported that, in a questionnaire incorporating the TPB, the cumulative product between a particular direct and indirect measure comprises the overall score of said construct. The overall score for attitude, subjective norm, and perceived behavioral control should then be regressed on the outcome variable of intention. The beta weights among each predictor construct help decipher which construct has the largest influence on the intentions to engage in a particular behavior (Francis et al., 2004).

Eating Disorders Survey Instrument: EAT-26 Questionnaire

Garner and Garfinkel’s Eating Attitudes Test (EAT) is one of the most frequently used self-report eating disorder instruments currently in the literature. Originally designed for anorexia nervosa diagnosis, the survey instrument is also used as a screening tool in non-clinical settings (Mintz & O'Halloran, 2000). Derived from the initial 40 item EAT, the EAT-26 question survey is also validated on non-clinical populations (Anstine & Grinenko, 2000) as a screening method for anorexia nervosa and bulimia nervosa, displaying a low number of false positives (i.e., categorizing individuals as at-risk when, in fact, they are not). As posited by Garner and colleagues (1982), the EAT-26 works best when trying to identify the possibility of disordered eating attitudes and behaviors that could potentially lead to the development of an eating disorder. Hence, it should not be used as a diagnostic tool for clinical eating disorders.

Garner and colleagues (1982) utilized exploratory factor analysis to compartmentalize the EAT-26 into three distinct dimensions. The Dieting Subscale includes items related to food avoidance and preoccupation with body image (Garner, Olstead, Bohr, & Garfinkel, 1982). The Bulimia Food Preoccupation Subscale involves questions linked with eating binges, vomiting, and preoccupation with food (Garner, Olstead et al., 1982). The last dimension, labeled the Oral Control Subscale, includes items measuring eating behaviors and social pressure to gain weight (Garner, Olstead et al., 1982). Questionnaire items grouped within each factor dimension can be seen in Figure 2.

Doninger, Enders, and Burnett (2005) suggested that the EAT-26 can be broken down into five dimensions: Drive for Thinness, Food Preoccupation Subscale, Others' Perceptions, Purging Behavior, and Dieting Behavior. They proposed that Garner, Olstead, and colleagues' (1982) factors were too broad; resulting in multiple theoretical constructs explaining individual factors. The variability in the factor dimensions between the two studies exist because most studies assessing eating disorders through use of the EAT-26 conduct exploratory factor analysis instead of confirmatory factor analysis. Both Doninger et al.'s (2005) study and Garner, Olstead et al.’s (1982) showed adequate convergent validity to the Eating Disorder Inventory. Doninger et al.’s factors can be seen in Figure 3.

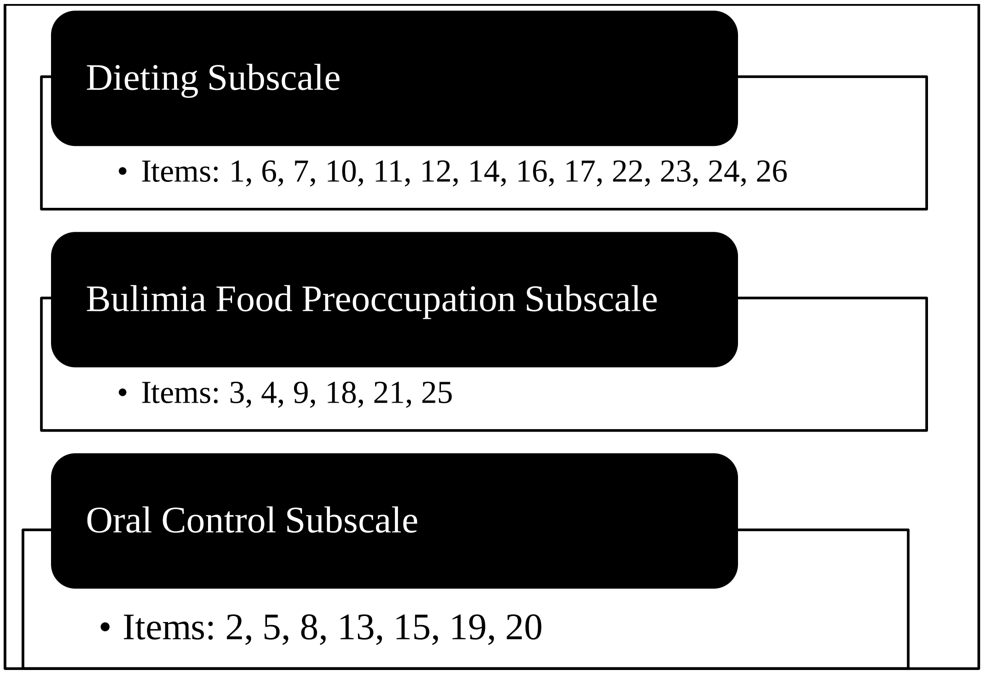

Figure 2. EAT-26 subscale items proposed by Garner, Olstead et al. (1982).

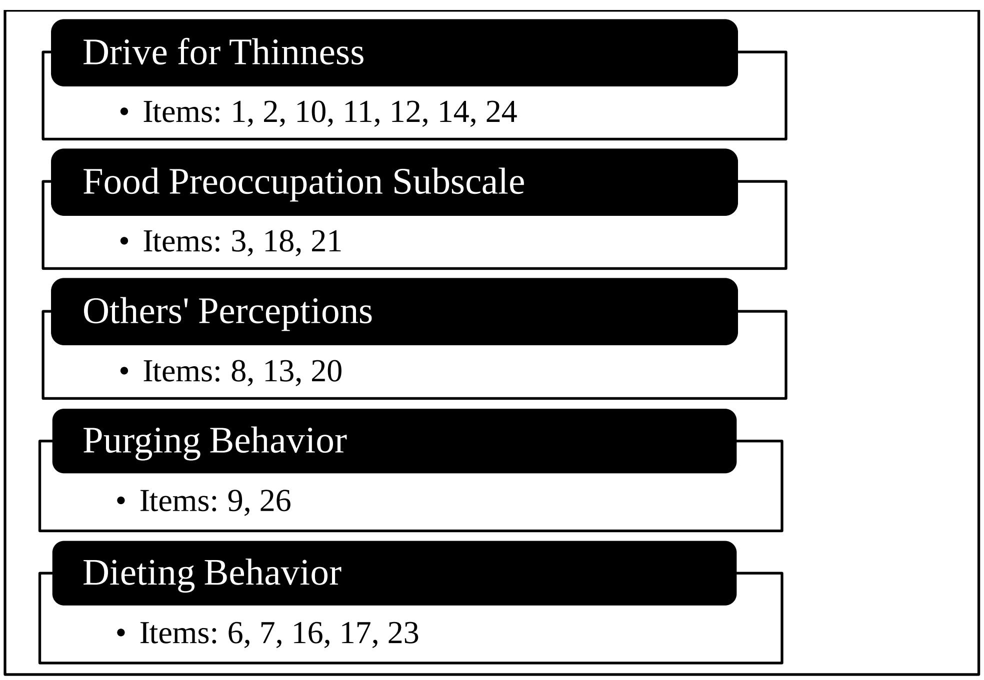

Figure 3. EAT-26 subscale items proposed by Doninger et al. (2005).

Orthorexia Survey Instrument: ORTO 15 Questionnaire

Donini and colleagues' (2005) ORTO 15 test (Appendix A) is the most frequently used self-report orthorexia nervosa instrument. It is based on Bratman's (2001) 10-item yes/no questionnaire designed to assess risk of orthorexia nervosa (as seen in Table 2). According to the logistics of Bratman's (2001) 10-item instrument, a yes to two or three of these questions indicates signs of orthorexia nervosa. Yes responses to four or more questions reflects clinical orthorexia nervosa. Due to increased demand for an orthorexia nervosa instrument that can be validated mathematically, Donini and colleagues (2004) created and validated the ORTO 15 test as a tool used for the diagnosis of orthorexia nervosa.

Table 2

Bratman's (2000) Orthorexia Nervosa 10-Item Instrument

Item	Yes	No
1. Do you spend more than 3 hours a day thinking about your diet?		
2. Do you plan your meals several days ahead?		
3. Is the nutritional value of your meal more important than the pleasure of eating it?		
4. Has the quality of your life decreased as the quality of your diet has increased?		
5. Have you become stricter with yourself lately?		
6. Does your self-esteem get a boost from eating healthily?		
7. Have you given up foods you used to enjoy in order to eat the 'right' foods?		
8. Does your diet make it difficult for you to eat out, distancing you from family and friends?		
9. Do you feel guilty when you stray from your diet?		
10. Do you feel at peace with yourself and in total control when you eat healthily?		

The 15 multiple choice items on the ORTO 15 follow a response statement of Always, Often, Sometimes, and Never. Due to the wording of the ORTO 15, particular questions follow a specific scoring rubric. The grading rubric for the ORTO 15 can be seen in Table 3. Scores on the ORTO 15 range from 15 to 60, with scores below 40 signifying presence of orthorexia nervosa.

Table 3

Scoring Rubric for ORTO 15

Items	Responses			
	Always	Often	Sometimes	Never
2, 5, 8, 9	4	3	2	1
3, 4, 6, 7, 10, 11, 12, 14, 15	1	2	3	4
1, 13	2	4	3	1

Exercise Dependence Instrument: EDS-21 Questionnaire

The exercise dependence scale or EDS-21 (Appendix B) as stated by Hausenblas and Downs (2002b), provides an empirical tool for exercise dependence based on the DSM-IV-TR criteria for substance abuse. The EDS-21 also provides clinicians with an overall score for exercise dependence symptoms; differentiates if an individual is at risk for exercise dependence, nondependent-symptomatic, and nondependent-asymptomatic; and specifies if individuals have evidence of physiological dependence or non-physiological dependence (Hausenblas & Downs, 2002b, Hausenblas & Fallon, 2002).

Statistical Models

Regression Analysis. According to Urdan (2005), regression analysis allows researchers to investigate the nature and magnitude of the relationship between continuous quantitative variables, the predictive power of predictor variables on an outcome, and even the relationship and level of prediction between independent and dependent variables after controlling for covariates that can compromise the quality of statistical analysis. Regression analysis is dichotomized into parametric regression analysis and nonparametric regression analysis. Proper use of parametric regression analysis must include a normal and independent distribution among the residual differences between an actual observation point and the predicted observation point provided by a statistical model (i.e., regression equation). If an asymmetric distribution among the residual terms is present, one must use a nonparametric regression analysis method or perform some form of transformation among relevant variables (Norman & Streiner, 2000). Urdan stated that parametric statistical models are more robust and easier to interpret when compared to nonparametric measures. The regression analysis models that are used in this study are listed below.

Simple linear regression versus multiple linear regression. In simple linear regression, a parametric model, there is a single continuous independent variable and a continuous dependent variable. The primary assumptions necessary for the use of simple linear regression is that a normal and independent distribution among the residual differences between an actual observation point and the predicted observation point provided by a statistical model must be present. The sensitivity of a predictor variable on the outcome variable is measured through what is called a beta weight (Norman & Streiner, 2000). The beta weight determines the amount of units necessary for the independent variable to influence a unit change in the dependent variable (Urdan, 2005). The beta weight can be either positive or negative.

The difference between simple and multiple linear regression is that the multiple linear regression model allows more than one predictor variable. Urdan (2005) stated that multiple linear regression is a more powerful analysis tool when compared to simple linear regression because you can account for more than one independent variable in analysis. The beta weights in multiple linear regression analysis are different in that the interpretation must be regarded as "the strength of the relationship between each predictor variable and dependent variable while controlling for the other predictor variables in the model" (Urdan, 2005, p. 152).

Logistical regression. Logistic regression is a regression model that has a categorical outcome variable (Norman & Streiner, 2000). Logistic regression also does not entail many of the key assumption necessary for simple and multiple linear regression. Logistic regression does not require a linear relationship between the predictor and outcome variables; and the residual terms in the model do not have to be independent or have a normal distribution (Norman & Streiner, 2000). Nemes, Jonasson, Genell, and Steineck (2009) stated that logistic regression models tend to systematically overestimate odds ratios and beta weights in small sample sizes, which they defined as less than 250 observations.

Chi-square analysis. According to Urdan (2005), a chi square test is used to determine if distributions of nominal variables significantly differ from one another. In this statistical analysis, counts from categorical variables of interest are arranged in a contingency table (Villeneuve, 2002). The test statistic in this analysis, χ^2, tests the null hypothesis that there is no statistical association between the rows and columns in the contingency table. The hypothesis test is mathematically determined by comparing observed counts in each cell of the contingency table to the expected counts of the contingency table. The calculations of the aforementioned values from a two-by-two contingency table perspective can be seen in Table 4 and Table 5. The larger the difference between expected count and observed counts, the larger the chi square statistic (χ^2); which means that it is more likely that the null hypothesis is false (Urdan, 2005). The chi square statistic is calculated by the following formula:

Table 4

Observed Values for Data in a Two Way Contingency Table in Chi Square Analysis.

	Variable 1		
Variable 2	Nominal Group 1	Nominal Group 2	Total
Nominal Group 1	a	B	a+b
Nominal Group 2	c	D	c+d
Total	a+c	b+d	n

Table 5

Expected Values for Data in a Two Way Contingency Table in Chi Square Analysis.

	Variable 1		
Variable 2	Nominal Group 1	Nominal Group 2	Total
Nominal Group 1			a+b
Nominal Group 2			c+d
Total	a+c	b+d	N

After a chi square statistic is calculated, it is then compared to an a priori statistic, which comes from a χ^2 distribution table. If the $\chi^2_{\text{calculated}}$ is greater than $\chi^2_{\text{distribution table}}$, then the null hypothesis of the statistical analysis is false. Another way to make a conclusion about the null hypothesis is to compare the *p*-value of the chi square test to the researcher's alpha value (Villeneuve, 2002). If the *p*-value is less than the alpha value, there is a strong probability that the association of the categorical variables are not due to random chance. One of the primary assumptions with chi square analysis is that the expected count for each cell in the contingency table must be greater than or equal to five (Urdan, 2005). This assumption is important because most statistical software available uses the normal distribution to approximate the multinomial distribution of the chi square analysis. According to Urdan, use of the normal distribution is appropriate when the sample size of the test is large enough (i.e., the expected count of each cell exceeds five).

T-tests and ANOVA. This section of the literature review will describe detail regarding t-tests and ANOVA models.

T-test. Created by William Gosset around 1908 under the pseudonym “Student,” the *t*-test is used to mathematically compare the means of two samples. For the purposes of this research, the Student’s *t*-test will be referred to as a t-test (Urdan, 2005). Paired *t*-tests will not be used in this research’s analyses.

The *t*-test is appropriate when you have one dichotomous nominal independent variable and a continuous dependent variable. The null hypothesis of this statistical test is that the means of the dependent variable are relatively equal for both categories of the independent variable. The *t*-test statistic is calculated by using the following formula:

ANOVA. The ANOVA, or analysis of variance, test is similar to the Student's *t*-test in that it involves the analysis of a nominal independent variable and continuous dependent variable (Vaughn & Corballis, 1969). The major difference between the *t*-test and an ANOVA analysis is that the independent variable in ANOVA must have at least three groups within the nominal independent variable. Only one-way and two-way ANOVA will be used in this analysis.

The null hypothesis of this statistical test is that the means of the dependent variable are relatively equal for all categories of the independent variable (Urdan, 2005). The mathematical calculation of the *F* statistic in the ANOVA analysis is fairly comprehensive and complicated. Thus, the description of this analysis will proceed through a discussion of output produced from statistical software. The global statistic of interest in an ANOVA test is the *F* statistic. This statistic determines if there is at least a difference of two means between groups in the nominal independent variable (Vaughn & Corballis, 1969). The origin of the *F* statistic can be seen in Table 6.

Table 6

ANOVA Table Used to Determine Significance of Global F Statistic

	Sum of Squares	*Df*	Mean Square	F
Between Groups	SS_{BG}	Number of Groups -1		
Within Groups	SS_{WG}	n - Number of Groups		
Total	SS_{Total}	n-1		

To pinpoint exactly which means differ, one must conduct post-hoc tests. Post-hoc tests that will be used in this research are as follows: Fisher's Least Significant Difference (LSD) test, Tukey's Honestly Significant Difference (HSD) test, Scheffe's test, and Bonferroni test. All post-hoc analyses will occur if the ANOVA *F* statistic is deemed significant because all the previously mentioned tests have strengths and weaknesses. Significance of difference in at least two of the four tests will increase the robustness of the researcher's analysis.

The two major assumptions of ANOVA are normality among the dependent variable within each nominal group; and homoscedasticity, which is homogeneity of the within group variances (Urdan, 2005). Urdan also commented that ANOVA and ANCOVA models are robust to normality if it is the only assumption that fails.

Power transformation of continuous variables. Many of the robust parametric statistical models follow the assumption that the population being sampled follows a normal distribution, a stable variance structure, and involve variables that are independent of each other (Urdan, 2005).To maintain the robustness of parametric models and assure appropriateness of use, power transformations are necessary to correct variance and normality issues. Box and Cox (1964) introduced a mathematical procedure to estimate the needed power to stabilize volatility in responses associated with common research. They labeled the parameter lambda (λ), where it serves as a power function on a variable (i.e., X^{λ}) that distorts equal variances or normality of residuals. It is important to note that a constant, preferably 1, must be added to all observations where a substantive amount of the responses are 0 (Box & Cox, 1964).

CHAPTER III

METHODOLOGY

The purpose of this study was to determine attitudes and frequency of eating and exercise behaviors commonly associated with eating disorders and exercise dependence among African American athletes. The target population for this study was athletes enrolled at Historically Black Colleges and Universities (HBCUs). The proposed study involved participants from four HBCUs in the southeastern region of the US.

This study consisted of a cross-sectional analysis using non-probability convenience sampling procedures. Regression analysis (Logistical and Linear Regression Analysis), reliability analysis, ANOVA, ANCOVA, chi-square analysis, and simple descriptive statistics served as the primary quantitative means of investigating the study's research questions. All statistical analyses were calculated by SPSS 18.0© software. Successful investigation of the research questions was accomplished through application of the EAT-26, EDS-21, ORTO 15 and Pulvers and colleagues' figural stimuli instruments; as well as additional demographic question items addressing key covariates for the purposes of control and investigation.

Successful deployment of the study's instruments to its target population, occurred in a series of steps as described below.

1. Examined the EAT-26 and determine which questions closely fit the constructs of the TPB.

2. Examined the ORTO 15 to determine adequate rewording of several questions that fits the essence of the original instrument, which was in Italian.

3. Had experts look at instruments for face validity purposes.

4. Disseminated letters of support to potential HBCUs.

5. Confirmed support for participation in this study.

6. Organized timeline for implementation process of study.

7. Executed study.

Target Population

As stated earlier, the target population for this study was student-athletes enrolled at HBCUs. Athletes are defined as students with full-time academic enrollment status, who have participated in NCAA or NAIA sanctioned athletic events within the study's academic calendar year. Four HBCU institutions from the southeastern US region were recruited for this study (institution 1: n = 165; institution 2: n = 90; institution 3: n = 119; institution 4: n = 53) Survey responses of participants that completed the demographic questions in this study were used in statistical analyses (N = 427). Subjects that did not complete demographic questions were excluded because there was no way to classify their responses with appropriate groups (e.g., gender, sport, etc.)

Data Collection

When the data collection process began, prospective participants were recruited through communication with Certified Athletic Trainers (ATs) at each school. This was done through flyers detailing the study, emails, and one-on-one discussion with potential participants. Afterward, athletes who chose to participate were given a time and date to complete the survey.

The two previously mentioned steps took place in a 1- to 3-day time frame during pre-participation physical examinations or pre-season team meetings.

Once participants arrived at study, the researcher verbally reviewed the purpose of this study, the consent form, and survey instructions with each subject. This step took 10-15 minutes. Subjects then completed the surveys in pencil and paper format with the researcher available for assistance as needed. This process took approximately 12-18 minutes. To help maintain anonymity, subjects submitted their surveys in a designated area on the opposite side of the room from the researcher.

Instruments

Eating Attitudes Test (EAT-26). The EAT-26 (Appendix C) has 26 questions with six possible choices for each question. The possible responses are based on a 6-point Likert-type scale ranging from "Never" to "Always." Items marked as "Always" are scored as 3. Items that are marked "Usually" or "Often" are scored as 2 and 1, respectively; and questions marked as "Never," "Rarely," or "Sometimes" are scored as 0 (Milligan & Pritchard, 2006). The possible score range is between 0 and 78. Scores of 20 and higher are considered to reflect risk for a clinical eating disorder. Mann and colleagues (1983) reported that a score of 20 or higher in the EAT-26 has a sensitivity score of 88% and specificity score of 96% in diagnosing individuals with eating disorders.

The EAT-26 has been established in the literature as a reliable and valid instrument with a Cronbach's alpha coefficient ranging from 0.79 to 0.94 (Brannan & Petrie, 2008; Garner, Garfinkel, & Olmstead, 1983; Lane, Lane, & Matheson, 2004; Rogers & Petrie, 2001); and acceptable convergent validity with the Eating Disorders Inventory-2 and Eating Disorders Questionnaire (Dotti & Lazzari, 1998; Johnson & Bedford, 2004; Lane et al., 2004; Pereira et al., 2008; Rivas, Bersabé, Jiménez & Berrocal, 2010). The EAT-26 reported an overall Cronbach alpha score of .926 in this study.

Exercise Dependence Scale (EDS-21). According to Hausenblas and Downs (2002b), the exercise dependence scale or EDS-21 (Appendix B) provides an empirical tool for exercise dependence based on the DSM-IV-TR criteria for substance abuse. The EDS-21 also provides clinicians with an overall score for exercise dependence symptoms; differentiates if an individual is at risk for exercise dependence, nondependent-symptomatic, and nondependent-asymptomatic; and specifies if individuals have evidence of physiological dependence or non-physiological dependence (Hausenblas & Downs, 2002b, Hausenblas & Fallon, 2002).

The 21-item questionnaire follows the same 6-point response statement of “Never” (score of 1) to “Always” (score of 6). Since the EDS-21 was designed based on the DSM-IV-TR criteria for substance abuse, the 21-item questionnaire is broken down into those seven constructs. Exercise dependence is operationalized as an average score between 5 and 6 on at least three of the EDS-21’s seven constructs (Hausenblas & Fallon, 2002). The EDS-21 has satisfactory psychometric properties when compared to other exercise dependence questionnaires; and has reported subscale reliabilities with a Cronbach’s alpha ranging from .71 to .92 (Hausenblas & Symons Downs, 2002). The EDS-21 reported an overall Cronbach score of .929 in this study.

ORTO 15. The 15 multiple-choice items on the ORTO 15 (Appendix A) follow a response statement of “Always,” “Often,” “Sometimes,” and “Never.” Due to the wording of the ORTO 15, particular questions follow a specific scoring rubric. Scores on the ORTO 15 range from 15 to 60, with scores below 40 signifying presence of orthorexia nervosa.

The ORTO 15 is considered valid for Turkish physicians and Italian citizens with an efficacy percentage of 75%, a sensitivity score of 100%, specificity percentage of 74%, and a negative predictive value of 100%. The ORTO 15 reported an overall Cronbach alpha score of .803 in this study.

Pulvers and colleagues' Figural Stimuli. The Pulvers and colleagues' (2004) Figural Stimuli (Appendix D) is a body image instrument that gauges perceptions and differences in body image among respondents. The 5-question survey, details nine male and female figures that parallel Stunkard and colleagues' (1983) body image survey. The figures represent male and female body statures with BMIs between 16

Table 7

Criteria to be Categorized as Having Intentions to Engage in Disordered Eating

Within the next 6 months:	Never	Once a month or less	2-3 times a month	Once a week	2-6 times a week	Once a day or more
I intend on going on eating binges where I feel that I may not be able to stop?			X	X	X	X
I intend on making myself sick (vomited) to control my weight or shape?		X	X	X	X	X
I intend on using laxatives, diet pills or diuretics (water pills) to control my weight or shape?		X	X	X	X	X
I intend on exercising more than 60 minutes a day to lose or to control your weight?						X
I intend on losing 20 pounds or more in the past 6 months	Yes	X		No		

Attitude. A construct similar to Ajzen's (1991) TPB Attitude construct was created for this study. Attitudinal questions from the EAT-26 survey were operationalized through recoding the questions listed below. These questions come from the Dieting Subscale from the EAT-26 survey. Attitude questions operationalized from the Dieting Subscale are items dealing with shape preoccupation and body image. The mental conditions of people suffering from anorexia and bulimia nervosa are similar with regard to issues of body image and shape preoccupation (Garner, Garfinkel, & O'Shaughnessy, 1985).

Attitudinal questions derived from the EAT-26 were recoded based on recommendations from Francis and colleagues (2004) and Ajzen (2003). This was done by compressing *Usually* and *Often* to generate a 5-point scale ranging from Always (-2) to Never (2), with Never symbolizing the positive endpoint. These polarized endpoints allowed the researcher to mathematically determine if a construct had a positive or negative relationship with eating disorder risk or engagement in disordered eating. Since the proposed measurement of attitude in this context is novel to the literature, an expert panel of three scholars with expertise in eating disorder research reached a consensus on the three EAT-26 items that reflected attitudes toward intention to engage in disordered eating. Grouped together, the attitude items reported an adequate reliability score ($\alpha = .752$). Therefore, the attitude construct was sufficient for quantitative analysis. Listed below are items used to measure attitude.

Question 1. Am terrified about being overweight.

Question 10. Feel extremely guilty after eating.

Question 24. Like my stomach to be empty.

Norms. A construct similar to Ajzen's (1991) TPB Subjective Norms construct was created for this study. Normative questions from the EAT-26 survey were operationalized through recoding the questions listed below. These questions come from the Oral Control Subscale of the EAT-26 survey. Normative questions operationalized from the Oral Control subscale are items dealing with social pressures that affect dietary behavior.

As previously mentioned, normative questions derived from the EAT-26 were recoded based on recommendations from Francis and colleagues (2004) and Ajzen (2003). This was done by compressing *Usually* and *Often* to generate a 5-point scale ranging from Always (-2) to Never (2), with Never symbolizing the positive endpoint. These polarized endpoints allowed the researcher to empirically determine if a construct has a positive or negative relationship with eating disorder risk or engagement in disordered eating. Since the proposed measurement of norms in this context is novel to the literature, an expert panel of three scholars with expertise in eating disorder research reached a consensus on three EAT-26 items that reflected norms associated with intentions to engage in disordered eating. As a group, the norms subscale reported an adequate reliability score (α = .726). Hence, the norms construct was sufficient for quantitative analysis. Listed below are items used to measure norms.

Question 8. Feel that others would prefer if I ate more.

Question 13. Other people think that I am too thin.

Question 20. Feel that others pressure me to eat.

Behavioral Control. A construct similar to Ajzen's (1991) TPB Perceived Behavioral Control construct was created for this study. Behavioral control questions from the EAT-26 survey were operationalized through recoding the questions listed below. These questions come from the Oral Control Subscale of the EAT-26 survey. Behavioral control questions operationalized from the Oral Control Subscale are items dealing with an individual's self-control for food.

Again, control questions derived from the EAT-26 were recoded based on recommendations from Francis and colleagues (2004) and Ajzen (2003).. This was done by compressing *Usually* and *Often* to generate a 5-point scale ranging from Always (-2) to Never (2), with Never symbolizing the positive endpoint. These polarized endpoints allowed the researcher to quantitatively determine if a construct had a positive or negative relationship with eating disorder risk or engagement in disordered eating. Since the proposed measurement of control in this context is novel to the literature, an expert panel of three scholars with expertise in eating disorder research reached a consensus on three EAT-26 items that reflected control behaviors associated with intentions to engage in disordered eating. The proposed control subscale did not group together in the factor analysis, and reported a subpar reliability score (α = .419). Further investigation determined that the items did not group together because question 2 and question 4 did not query the same type of behavioral control. Question 2 measured the ability to control oneself from avoiding food (paralleled to anorexic behaviors); while question 4 measured control of binge eating (paralleled with bulimic and/or binge behaviors). Therefore the items listed below are measured separately as differing types of control.

Question 2. Avoid eating when I am hungry

Question 4. Have gone on eating binges where I feel that I may not be able to stop.

Question 19. Display self-control around food.

Operationalization of Outcomes of Interest

This section details how each dependent variable of interest was operationalized in this study.

Categorical outcomes. This section of the methodology chapter of this dissertation describes nominal dependent variables used in this study.

At risk for an eating disorder. At risk for an eating disorder is categorized through the EAT-26 instrument. Participants who received a score of 20 or higher will be deemed at risk for an eating disorder (Garner, Garfinkel, & Bemis, 1982). Subjects who score below 20 are not considered at risk for an eating disorder.

At risk for exercise dependence. At risk for exercise dependence was measured through the EDS-21 questionnaire. Based on the scoring procedures used by Hausenblas and Downs (2002b), participants deemed as dependent must be categorized as such in at least three of the seven DSM criteria for substance dependence (Tolerance, Withdrawal, Intention Effect, Lack of Control, Time, Reduction in Other Activities, and Continuance).

At Risk for Orthorexia Nervosa. At risk for orthorexia nervosa was measured through the ORTO 15 instrument. A raw score at or below 40 for each participant indicates risk for orthorexia nervosa (Donini et al., 2004). Hence, subjects who scored at or below 40 were considered at risk for orthorexia nervosa, and individuals who score higher than 40 were not considered at risk of suffering from the non-clinical eating disorder.

Engagement in Disordered Eating. Behavior was measured through a binary outcome of yes/no from Part C of EAT-26 survey. If a respondent selects any of the cells marked in Table 8, they were categorized as having engaged in disordered eating. There are several studies in eating disorder literature that uses Part C of the EAT-26 survey to measure engagement of disordered eating (Hoerr et al., 2002; Milligan & Pritchard, 2006).

Intentions to Engage in Disordered Eating. Operationalization of subjects' intent to engagement in disordered eating is located in the "Behavior" section under Operationalization of TPB Constructs within this chapter.

Table 8

Criteria to be Categorized as Having Engaged in Disordered Eating

	Never	Once a month or less	2-3 times a month	Once a week	2-6 times a week	Once a day or more
Gone on eating binges where you feel that you may not be able to stop?			X	X	X	X
Ever made yourself sick (vomited) to control your weight or shape?		X	X	X	X	X
Ever used laxatives, diet pills or diuretics (water pills) to control your weight or shape?		X	X	X	X	X
Exercised more than 60 minutes a day to lose or to control your weight?						X
Lost 20 pounds or more in the past 6 months	Yes	X		No		

Continuous outcomes. This section of the methodology chapter of this dissertation describes ratio level dependent variables used in this study.

Eating disorder risk level. Eating disorder risk level was calculated from the aggregate scores of respondent's EAT-26 overall score. Scores on the EAT-26 can range from 0 to 37 with higher scores indicating increased risk for have an eating disorder.

Orthorexia nervosa risk level. Orthorexia nervosa risk level was measured from aggregate scores of the respondent's overall ORTO 15 score. Scores on the ORTO 15 can range from 4 to 60 with lower scores indicating increased risk for having orthorexia nervosa.

Operationalization of Predictors and Other Covariates of Interest

This section will detail how each independent variable or covariate of interest will be operationalized in this study.

Categorical Predictors and Covariates. This section of the methodology chapter of this dissertation describes nominal and ordinal independent variables used in this study.

Race. Race refers to the ethnicity and racial identity of the participant. In some analyses, race was grouped as a nominal binary variable (Black, Non-Hispanic/Other). In other analyses, race was nominally grouped as Black, White, and Other. The use of the different grouping was based on whether a sport had enough Caucasian Americans to mathematically justify use of the aforementioned race variable.

Location. Location refers to the distinct universities and colleges that participated in this study. The researcher chose not to include this question in the survey to ease any potential fears that participant's responses would be linked to their identity. The researcher assigned a nominal code (1, 2, 3… etc.) to identify each school. Only the researcher knows the code that corresponds to each school.

Year of eligibility. Year of eligibility refers to the amount of years that the participant has been enrolled in college as a varsity level athlete. Since this ordinal variable is highly correlated with academic classification, it was not used in analyses where academic classification was included.

Academic classification. Academic classification refers to the class standing of the participant (freshman, sophomore, junior, senior/grad). Since this ordinal variable is highly correlated with year of eligibility, it was not used in analyses where year of eligibility was included.

***Continuous predictors and covariates*.** This section of this chapter describes ratio level dependent variables used in this study.

Attitude level. Operationalization of attitude level can be found in the “Attitude” section under Operationalization of TPB Constructs within this chapter.

Avoid control level. Operationalization of avoidance control level can be found in the “Behavioral Control” section under Operationalization of TPB Constructs within this chapter.

Binge control level. Operationalization of binge control level can be found in the “Behavioral Control” section under Operationalization of TPB Constructs within this chapter.

Self-control level. Operationalization of self- control level can be found in the “Behavioral Control” section under Operationalization of TPB Constructs within this chapter.

Social norm level. Operationalization of social norm influence can be found in the “Norms” section under Operationalization of TPB Constructs within this chapter.

Body mass index level. BMI is a number calculated from an individual’s height and weight, which serves as an indicator for body fatness (CDC, 2011). The formula for BMI is

Analysis of Research Questions

1. What is the prevalence rate among athletes enrolled at HBCUs for eating disorder risk, exercise dependence risk, and orthorexia nervosa risk?

The investigation of this research question utilized prevalence rate analysis. Therefore, the frequency of participants at risk for an eating disorder, exercise dependence, and orthorexia nervosa were divided by all subjects involved in the study (*N*=270).

The key variable of choice for part one of research question 1 involved the outcome "at risk for eating disorder," which was operationalized through the EAT-26 survey. A raw score at or above 20 for each participant in Part B of the EAT-26 indicates risk for an eating disorder; and thus, according to Garner, Olmstead et al. (1982) serves as a cue for referral for professional clinical assessment. Hence, if a participant received a score of 20 or higher in Part B of the EAT-26, that participant was deemed at risk for an eating disorder. The prevalence rate was tallied and calculated through percentages based on aggregate EAT-26 scores of respondents.

The key variable of choice for part two of research question 1 involved the outcome "at risk for exercise dependence," which was operationalized through the EDS-21 survey. Participants who were categorized as dependent in at least three of the seven DSM criteria for dependence (Tolerance, Withdrawal, Intention Effect, Lack of Control, Time, Reduction in Other Activities, and Continuance) were classified as exercise dependent (Hausenblas & Fallon, 2002). The prevalence rate was tallied and calculated through percentages based from aggregate scores of respondents.

The key variable of choice for part three of research question 1 involved the outcome "at-risk for orthorexia nervosa," which was operationalized through the ORTO 15 survey. A raw score at or below 40 for each participant indicated risk for orthorexia nervosa. The prevalence rate represented percentages based on ORTO 15 aggregate scores of respondents.

2. Are there relationships between HBCU student-athletes' prevalence for being at risk for an eating disorder, exercise dependence, and orthorexia nervosa?

The key variable of choice for this research question 2 involved the outcomes "at risk for eating disorder," "at risk for exercise dependence," and "at risk for orthorexia nervosa." A log linear regression model revealed relationships between the three aforementioned outcomes. From this analysis, odds ratios and significance levels determined the increased and decreased likelihood of being at risk for one disorder from another. The null hypothesis for this research question is as follows: The prevalence rate of HBCU student-athletes at risk for an eating disorder, exercise dependence, and orthorexia nervosa does not have a relationship. The alternative hypothesis for this research question states: The prevalence rate of HBCU athletes at risk for an eating disorder, exercise dependence, and orthorexia nervosa does indeed have a relationship. Listed below is the scientific hypothesis notation and tested alpha level for this research question:

H0: β Eating Disorder = β Exercise Dependence= β Orthorexia Nervosa = 0

H1: β Eating Disorder$\neq$ β Exercise Dependence$\neq$ β Orthorexia Nervosa $\neq 0$

$\alpha = 0.05$

3. Are there between group differences within the HBCU athletic population for prevalence rates of eating disorder risk, exercise dependence risk, and orthorexia nervosa risk?

The key variable of choice for part (a) of research question 3 involved the outcome "at risk for eating disorder." Chi-square analysis determined whether there was a significant difference among participants at risk for an eating disorder between the differing subpopulations.

Subpopulations of interest within the HBCU athlete population included gender, location, and size of institution, BMI, and sport. The null hypothesis for part (a) of this research question states: The prevalence rate of HBCU student-athletes at risk for an eating disorder does not differ between varying groups within the HBCU athletic population. The alternative hypothesis for this research question goes as follows: The prevalence rate of HBCU student-athletes at risk for an eating disorder does indeed differ between varying groups within the HBCU athletic population.

The key variable of choice for part (b) of research question 3 involved the outcome “at-risk for exercise dependence,” which was operationalized through the EDS-21 survey. The prevalence rate for each population represented percentages based from EDS 21 aggregate scores of respondents. Thereafter, chi-square analysis determined whether there were significant differences among differing subpopulations of participants at risk for exercise dependence. Subpopulations of interest within the HBCU athlete population include gender, location, and size of institution, BMI, and sport. The null hypothesis for part B of this research question states: The prevalence rate of HBCU student-athletes at risk for exercise dependence does not differ between varying groups within the HBCU athletic population. The alternative hypothesis for part B of this research question states: The prevalence rate of HBCU student-athletes at risk for exercise dependence does indeed differ between varying groups within the HBCU athletic population.

The key variable of choice for part C of research question 3 involved the outcome “at risk for orthorexia nervosa,” which was operationalized through the ORTO 15 survey. The prevalence rate for each population represented percentages from ORTO 15 aggregate scores of respondents. Thereafter, chi-square analysis determined if there were significant differences among differing subpopulations of participants at risk for orthorexia nervosa. Subpopulations of interest within the HBCU athlete population included gender, location, and size of institution, BMI, and sport. The null hypothesis for part C of this research question is as follows: The prevalence rate of HBCU student-athletes at risk for orthorexia nervosa does not differ between varying groups within the HBCU athletic population. The alternative hypothesis for part C of this research question is as follows: The prevalence rate of HBCU student-athletes at risk for orthorexia nervosa does indeed differ between varying groups within the HBCU athletic population. Listed below is the scientific hypothesis notation and tested alpha level for this research question:

Chi-Square

H_0: $f_{\text{Group 1}} = f_{\text{Group 2}} = f_{\text{Group 3}}$

H_1: $f_{\text{Group 1}} \neq f_{\text{Group 2}} \neq f_{\text{Group 3}}$

$\alpha = 0.05$

4. Are there between group differences within each sport among the HBCU athletic population for risk of eating disorders? If so, is the relationship between sport and eating disorder risk level influenced by BMI or age?

The key variable of choice for the first part of research question 4 involved the continuous outcome “eating disorder risk level,” which was operationalized through the EAT-26 survey. Eating disorder risk level for each individual represented aggregate EAT-26 scores of respondents. These aggregate scores of each sport were grouped and compared to other subpopulations within the respective sport. Subpopulations of interest within each HBCU sport included location, year of eligibility, academic classification, and race. BMI and age were added as covariates if found to be statistically significant with the eating disorder risk level of each sport. When investigating all categorical predictors of interest to determine if eating disorder risk level differed within groups of HBCU student-athletes, initial one-way ANOVA analyses revealed variables that exhibited significance. This helped determine parsimonious combinations of groups thereby mitigating failure of key diagnostics that are sensitive to large factorial designs. If multiple groups were statistically significant with eating disorder risk level, then factorial ANOVA was the model of choice. If covariates dwelled in the statistical model, then ANCOVA was the model of choice. If groups failed to determine statistical significance, but the covariates determined variation of the outcome, then linear regression was the model of choice. Otherwise, one-way ANOVA was the best possible means of investigating group differences. The null hypothesis for part one of this research question is as follows: The risk level of eating disorders from HBCU student-athletes does not differ between varying groups within the HBCU athletic population. The alternative hypothesis for part one of this research question states: The risk level of eating disorders from HBCU student-athletes does indeed differ between varying groups within the HBCU athletic population.

5. Are there between group differences within each sport among the HBCU athletic population for risk of eating disorders? If so, is the relationship between sport and eating disorder risk level influenced by BMI or age?

The key variable of choice for part two of question 4 involved the outcome "orthorexia nervosa risk level," which was operationalized through the ORTO 15 survey. The risk level (ORTO 15 score) for each sport was calculated based on respondents' aggregate scores. Next, comparisons of subpopulations within each sport took place. Subpopulations of interest within each HBCU sport included location, year of eligibility, academic classification, and race. BMI and age were added as covariates if found to be statistically significant with the orthorexia nervosa risk level of each sport. When investigating all categorical predictors of interest to determine if orthorexia risk level differed within groups of HBCU student-athletes, initial one-way ANOVA analyses revealed variables that exhibited significance. This helped determine parsimonious combinations of groups thereby mitigating failure of key diagnostics that are sensitive to large factorial designs. If multiple groups were statistically significant with orthorexia nervosa risk level, then factorial ANOVA was the model of choice. If covariates dwelled in the statistical model, then ANCOVA was the model of choice. If groups failed to determine statistical significance, but the covariates determined variation of the outcome, then linear regression was the model of choice. Otherwise, one-way ANOVA was the best possible means of investigating group differences. Discussion of post-hoc analyses in this part of the research question involved use of ORTO 15 scores, as opposed to orthorexia nervosa risk level. This eliminated confusion since an increase in ORTO 15 scores decreased orthorexia nervosa risk. The null hypothesis for part two of this research question states: The risk level of orthorexia nervosa from HBCU student-athletes does not differ among varying groups within the HBCU athletic population. The alternative hypothesis for part two of this research question goes as follows: The risk level of orthorexia nervosa from HBCU student-athletes does indeed differ among varying groups within the HBCU athletic population. Listed below is the scientific hypothesis notation and tested alpha level for research questions four and five:

ANOVA and T-Tests

H_0: $\mu_{\text{Group 1}} = \mu_{\text{Group 2}} = \mu_{\text{Group 3}}$

H_1: $\mu_{\text{Group 1}} \neq \mu_{\text{Group 2}} \neq \mu_{\text{Group 3}}$

$\alpha = 0.05$

6. Are African American HBCU athletes' attitudes toward disordered eating dietary behavior related to their intention to engage in disordered eating behavior?

This question answered whether participants of this study perceived behaviors related to eating disorders as either positive of negative. The researcher tackled this question by measuring several key *Attitude* questions from the EAT-26 survey instrument.

Logistic regression was the empirical model chosen to investigate this research question. This question analyzed and interpreted the beta weight of the Attitude variable from the logistic regression analysis. The outcome variable of interest for this research question was "intention to engage in disordered eating." Age and BMI served as covariates to determine if the relationship between attitude and intent to engage in disordered eating was influenced by weight stature and time. The null hypothesis for this research question states: After statistically controlling for BMI, age, subjective norms, and perceived behavioral control, HBCU student-athletes' attitude does not influence their intention to engage in disordered eating. The alternative hypothesis for this research question states: After statistically controlling for BMI, age, subjective norms, and perceived behavioral control, HBCU student-athletes' attitude influences their intention to engage in disordered eating. Listed below is the scientific hypothesis notation and tested alpha level for this research question:

<u>Logistic Regression</u>

H_0: $\beta_{\text{Attitude}} = 0$

H_1: $\beta_{\text{Attitude}} \neq 0$

$\alpha = 0.05$

7. Are African American HBCU athletes' norms related to intention to engage in disordered eating behavior related to their intention to engage in disordered eating behavior?

This question measured participants' perception on the beliefs of their significant others. The researcher addressed this question by measuring several key *normative* questions from the EAT-26 survey instrument.

Logistic regression was the statistical model chosen to address this research question. This question analyzed and interpreted the beta weight of the norms variable from the logistic regression analysis. The outcome variable of interest for this research question was "intention to engage in disordered eating". Age and BMI served as covariates to determine if the relationship between norms and intent to engage in disordered eating was influenced by weight stature and time. The null hypothesis for this research question states: After statistically controlling for BMI, age, attitude, and perceived behavioral control, HBCU student-athletes' subjective norms do not influence their intention to engage in disordered eating. The alternative hypothesis for this research question states: After statistically controlling for BMI, age, attitude, and perceived behavioral control, HBCU student-athletes' subjective norms influence their intention to engage in disordered eating. Listed below is the scientific hypothesis notation and tested alpha level for this research question:

<u>Logistic Regression</u>

H^0: $\beta_{SN} = 0$

H_1: $\beta_{SN} \neq 0$

$\alpha = 0.05$

8. Are African American HBCU athletes' perceived control toward intention to engage in disordered eating behavior related to their intention to engage in disordered eating behavior?

This question answered whether participants of this study perceived that they could control dietary behaviors related to eating disorders. The researcher tackled this question by measuring several key *control belief* questions from the EAT-26 survey instrument.

Logistic regression was the model chosen to investigate this research question. This question analyzed and interpreted the beta weight of the Behavioral Control variable from the logistic regression analysis. The outcome variable of interest for this research question was "intention to engage in disordered eating." Age and BMI served as covariates to determine if the relationship between attitude and intent to engage in disordered eating was influenced by weight stature and time. The null hypothesis for this research question states: After statistically controlling for BMI, age, attitude, and subjective norms, HBCU student-athletes' perceived behavioral control does not influence their intention to engage in disordered eating. The alternative hypothesis for this research question states: After statistically controlling for BMI, age, attitude, and, subjective norms, HBCU student-athletes' perceived behavioral control influences their intention to engage in disordered eating. Listed below is the scientific hypothesis notation and tested alpha level for this research question:

<u>Logistic Regression</u>

H_0: $\beta_{PBC} = 0$

H_1: $\beta_{PBC} \neq 0$

$\alpha = 0.05$

9. Are there significant differences between participants' ideal body stature and their perceived body stature? Are there group differences between the HBCU student-athlete population with respect to ideal body stature and perceived body stature?

This question examined whether participants' perceived body stature closely matched their ideal body stature through use the Pulvers and colleagues' (2004) Figural Stimuli Instrument (Appendix D).

Questions 1 and 2 (listed below) of Pulvers and colleagues' instrument were compared to measure significant differences between ideal and perceived body stature among participants. Figures A through I in this questionnaire represented individuals with BMIs roughly between 16 and 40 in increments of 3 for African Americans. Non-African Americans were compared using Bulik and colleagues' (2001) BMI anchoring system that was validated for their age and gender. The anchor system will be used as an informal validity measure. If subjects' perceived silhouette's BMI (as classified in the anchor system) corresponds to their actual BMI, then the instrument is considered relatively valid. Table 9 displays the anchor system used in this study.

Table 9

Anchor System Used for Figural Stimuli

Pulvers and colleagues' (2004) Anchors	A	B	C	D	E	F	G	H	I
Recoded Anchors Using Likert	1	2	3	4	5	6	7	8	9
Pulvers and colleagues' (2004) African American BMI	16	19	22	25	28	31	34	37	40
Bulik and colleagues' (2001) non-African American Male BMI	18.8	20.2	21.4	22.9	25.4	28.2	33.1	35.8	49.4
Bulik and colleagues' (2001) non-African American Female BMI	17.8	18.8	20.3	22.6	26.4	31.3	36.7	40.8	44.1

Based on current practices in body image literature, figures selected by participants utilized a recoded Likert-type system to decrease error. Therefore, the outcome variable in research question 9's statistical tests is the recoded Likert-type, which ranged from 1 to 9.

Dependent *t*-tests were used to measure differences among African American males, non-African American males, African American females, and non-African American females.

Question 1. Write down your ideal figure. ___

Question 2. Select a figure that best reflects how you think you look. ___

The null hypothesis for this part of the research question states, Participants' perceived body stature does not differ from their ideal body stature. The alternative hypothesis for this part of the research question goes as follows: Participants' perceived body stature does indeed differ from their ideal body stature. Listed below is the scientific hypothesis notation and tested alpha level for this portion of the research question:

<u>T-Tests</u>

H_0: $\mu_{\text{Ideal Body Stature}} - \mu_{\text{Perceived Body Stature}} = 0$

H_1: $\mu_{\text{Ideal Body Stature}} - \mu_{\text{Perceived Body Stature}} \neq 0$

$\alpha = 0.05$

ANOVA and *t*-tests determined if there were significant differences in participants' perceived body stature and their ideal body stature among groups within the HBCU athlete population. The outcome variable in this analysis is the recoded Likert-type scale. Predictors include location, BMI, year of eligibility, and academic classification. The null hypothesis for this part of the research question states, Differences between participants' perceived body stature does not significantly differ from their ideal body stature among groups within the HBCU population. The alternative hypothesis for this portion of the research question goes as follows: Differences between participants' perceived body stature does indeed differ from their ideal body stature among groups within the HBCU population. Listed below is the scientific hypothesis notation and tested alpha level for this portion of the research question:

ANOVA and *t*-tests

H_0: $\mu_{\text{Body stature difference Group 1}} = \mu_{\text{Body stature difference Group 2}} = \mu_{\text{Body stature difference Group 3}}$

H_1: $\mu_{\text{Body stature difference Group 1}} \neq \mu_{\text{Body stature difference Group 2}} \neq \mu_{\text{Body stature difference Group 3}}$

CHAPTER IV

RESULTS

This chapter presents findings from this study through discussion of key demographic analyses, and an empirical analysis of each research question.

Demographics

Six hundred and one student-athletes enrolled at five Historically Black Colleges and Universities (HBCUs) located in the Southeastern US completed a battery of surveys used for analysis in this study. Among the 601 subjects, 427 completed the sufficient number of questions (i.e., completed demographic questions) necessary for quantitative analysis. Thus, the results of this study encompassed responses from participants who completed all questions. This section of the report will provide empirical information about those 427 athletes.

Demographics. Two hundred thirty-nine male (56.0%) and 188 female (44.0%) varsity HBCU student-athletes between the ages of 18 and 23 (M = 20.50, SD = 1.21) volunteered as subjects. Three hundred and thirty-two participants were African American (77.8%), with 53 Caucasians (12.4%), and 42 (9.8%) who did not identify as Caucasian or African American.

Over 60% of all participants were academically classified as either freshmen (n = 98, 23%) or sophomores (n = 159, 37.2%). The other 40% included 104 juniors (24.4%) and 66 seniors and graduate students (15.5%).

Most of the participants were football athletes (*n* = 168, 39.3%). Softball athletes were the second largest group (n=52, 12.2%). Other men's sports represented in this study were 19 (4.4%) track participants, 31 (7.3%) baseball participants, and 21 (4.9%) participants that did not play football, baseball, or track. Other female sports represented in this study include 37 (8.7%) track participants, 40 (9.4%) soccer participants, 21 (4.9%) volleyball participants, and 38 (8.9%) female athletes who did not participate in track, soccer, softball, or volleyball.

Subjects who volunteered for this study were enrolled in one of four Southeastern US colleges and universities. Within the total sample, 165 (38.6%) participants were from Institution 1, 90 (21.1%) represented Institution 2, 119 (27.9%) participants were enrolled at Institution 3, and 53 (12.4%) were from Institution 4.

With respect to BMI (*N* = 427, *M* = 26.76, *SD* = 5.09), most participants were classified as having a normal BMI (*n* = 183, 42.9%). Two participants (0.5%) were underweight and the remaining 57% included subjects were classified as overweight (n=152, 35.6%) and obese (n=90, 21.1%) by BMI standards. Table 10 shows key demographics for study participants.

Comparison of self-reported weight (*M* = 209.71, *SD* = 40.64) and ideal weight (*M* = 214.02, *SD* = 35.66) among male subjects, revealed that males, on average, wanted to gain weight. The differences between self-reported weight and ideal weight were not significantly different among male participants because there is overlap in the 95% confidence intervals. There were significant differences in self-reported weight (*M* = 156.09, *SD* = 34.34) and ideal weight among (*M* = 143.14, *SD* = 23.70) female participants. Female subjects, on average, desired to lose weight. Table 11 displays weight differences and other continuous variables used in this study's analyses as a function of gender.

Table 10

Demographic Description of Participants

		N = 427	%
Gender			
	Male	239	56.0
	Female	188	44.0
Race			
	Black	332	77.8
	White	53	12.4
	Other	42	9.8
Classification			
	Freshman	98	23.0
	Sophomore	159	37.2
	Junior	104	24.4
	Senior/Graduate	66	15.5
Sport			
	Men's Track	19	4.4
	Football	168	39.3
	Baseball	31	7.3
	Other Men’s Sports	21	4.9
	Women's Track	37	8.7
	Women's Soccer	40	9.4
	Softball	52	12.2
	Women's Volleyball	21	4.9
	Other Women’s Sports	38	8.9
Institution			
	Institution 1	165	38.6
	Institution 2	90	21.1
	Institution 3	119	27.9
	Institution 4	53	12.4
BMI Category			
	Underweight	2	.5
	Normal	183	42.9
	Overweight	152	35.6
	Obese	90	21.1

Table 11

Gender Differences in Weight and Other Variables Used in Study's Analyses

	Gender							
	Male (n = 239)				Female (n = 188)			
			95% CI				*95% CI-*	
	M	*SD*	*LL*	*UL*	*M*	*SD*	*LL*	*UL*
Self-Reported Weight (lbs)	209.71	40.64	204.56	214.86	156.09	34.34	151.18	161.00
Ideal Weight (lbs)	214.02	35.66	209.50	218.54	143.14	23.70	139.75	146.53
Highest Weight (lbs)	217.14	42.04	211.81	222.47	159.89	34.62	154.94	164.84
Lowest Weight (lbs)	192.87	36.15	188.29	197.45	138.79	27.17	134.91	142.67
Self-Reported Height (in)	72.51	2.87	72.15	72.87	65.94	3.30	65.47	66.41
Self-Reported BMI (kg/m^2)	28.00	4.97	27.37	28.63	25.18	4.82	24.49	25.87
Age (years)	20.68	1.26	20.52	20.84	20.28	1.12	20.12	20.44
ED Risk Level	7.81	7.44	6.87	8.75	10.62	9.51	9.27	11.97
ON Risk Level	38.56	3.35	38.13	38.99	38.67	3.79	38.12	39.22
Ideal Silhouette	3.97	.58	3.89	4.05	3.36	.55	3.28	3.44
Perceived Silhouette	3.92	1.05	3.78	4.06	4.09	.97	3.95	4.23

Analysis of Research Questions

This study applied various statistical models, tested at an alpha level of .05, to seven of the eight research questions in this study. Research question one required prevalence analysis. Most assumptions associated with each statistical model were sufficient at the appropriate alpha levels. Therefore, discussion of diagnostic statistics only took place if there was a violation. Several research question analyses included the usage of several statistical models. The following section details the findings for each research question

Research question one: What is the prevalence rate among athletes enrolled at HBCUs for eating disorder risk, exercise dependence risk, and orthorexia nervosa risk? This research question's purpose was to discover the overall prevalence rates for HBCU athletes at risk for eating disorder (ED), exercise dependence (ExD), and orthorexia nervosa (ON). Overall, 10.8% (n = 46, 95% CI [8.07%, 14.20%]) of participants were deemed at risk for an ED based on their EAT 26 responses. Similarly, 10.3% (n = 44, 95% CI [7.66%, 13.68%]) of all subjects were classified as being at risk for ExD. Based on ORTO 15 responses in this study, 283 participants (66.3%, 95% CI [61.55%, 70.71%]) were considered at risk for ON.

Research question two: Are there relationships between HBCU student-athletes' prevalence for being at risk for an eating disorder, exercise dependence, and orthorexia nervosa? Among the 46 participants deemed at risk for an ED, 36 (78.3%, 95% CI [63.24%, 88.55%]) were also at risk for ON and 15 (32.6%, 95% CI [19.97%, 48.14%]) were also at risk for ExD. Among the 283 participants considered at risk for ON, only 12.7% (n = 36, 95% CI [9.18%, 17.30%]) were also at risk for an ED and dependence 12.0% (n = 34, 95% CI [8.57%, 16.51%]) were also at risk for ExD. Of the 44 subjects considered at risk for ExD, 34.1% (n =

15, 95% CI [20.93%, 50.00%]) were also at risk for an ED and 34 (77.3%, 95% CI [61.78%, 88.01%]) were also at risk for ON.

A hierarchical log linear regression model determined if there was a three-way interaction between being at risk for an ED, ON, and ExD. Results revealed that the three-way interaction was not statistically significant, therefore the saturated comparison model was removed from the model, $\chi^2(1) = .215$, $p = .639$. After four iterations, only the partial associations with main effects and one 2 x 2 interaction were deemed to have a significant relationship and remained in the log linear model.

With respect to two-way interactions, at risk for ED and ExD was the only interaction with statistical significance, $\chi^2(1) = 3.313$, $p < .001$. Participants at risk for an ED were almost six times more likely to be at risk for ExD as those not at risk for an ED. Table 12 shows the two-way comparisons of each condition.

Research question three: Are there between group differences within the HBCU athletic population for prevalence rates of eating disorder risk, exercise dependence risk, and orthorexia nervosa risk? The purpose of this research question was to determine group differences within the HBCU student-athlete population at risk for an ED, ExD, and ON. Categorical predictor variables applied in the analyses were gender, institution, race, sport, academic classification, and year of eligibility. Only the statistically significant findings for the 30 chi-square analyses calculated to address this research question are presented here.

Eating disorder group differences. With reference to ED, the three outcomes of interest were being at risk for an ED, engaged in disordered eating, and intentions to engage in disordered eating. This section of the document describes differences in the ED outcome variables when cross-tabulated with grouping predictor variables.

Table 12

Chi-Square Matrix Comparing Those at Risk for an Eating Disorder, Orthorexia Nervosa, and Exercise Dependence

		At Risk for Eating Disorder	At Risk for Orthorexia Nervosa	At Risk for Exercise Dependence
At Risk for Eating Disorder				
	$\chi 2$	a.	3.313	27.749
	Df		1	1
	OR		1.953	5.873
	P		.069	<.001[b]
At Risk for Orthorexia Nervosa				
	$\chi 2$	3.313	a.	2.654
	Df	1		1
	OR	1.953		1.830
	P	.069		.103
At Risk for Exercise Dependence				
	$\chi 2$	27.749	2.654	a.
	Df	1	1	
	OR	5.873	1.830	
	P	<.001[b]	.103	

a. The $\chi 2$test =was not performed for this sub-table because row and column variables are identical.

b. Fisher's exact test performed because 25% of cells has an expected count less than 5.

At Risk for an Eating Disorder. With respect to being at risk for an ED, only year of eligibility lacked statistical significance, χ^2 (3, N = 427) = 7.252, p = .064. Hence, the prevalence rates of being at risk for an ED did not significantly vary among subjects at differing years of athletic eligibility.

The percentage of participants at risk for an ED did differ by gender, $\chi 2$ (1, N = 427) = 11.419, p = .001, with females being at greater risk. The frequency of male subjects at risk for an ED, 15 (6.3%, 95% CI [3.68%, 10.35%]), was significantly lower than expected because the adjusted residual (-3.4) was less than -1.96. Frequency of female subjects at risk for having an ED, 31 (16.5%, 95% CI [11.64%, 22.75%]) was significantly higher than expected because the adjusted residual (3.4) was larger than the Z-value of 1.96. Odds ratio calculations reveal that female participants were 2.95 times more likely than male subjects to be at risk for an ED compared to males.

Also differing by institution (χ^2 (3, *N* = 427) = 8.486, *p* = .037) was the proportion of participants at risk for an ED. The frequency of subjects from Institution 1 at risk for an ED, 26 (15.8%, 95% CI [10.73%, 22.43%]), was significantly higher than expected because the adjusted residual (2.6) was positive and above the *a priori* threshold of 1.96. The frequency of Institution 3 participants at risk for an ED, 9 (5%, 95% CI [3.73%, 14.26%]), was significantly lower than expected because the adjusted residual (-2.4) is negative and below -1.96. Institution 2 (10% at risk) and Institution 4 (9.4% at risk) met calculated expectations for being at risk for an ED because their adjusted residuals were within the *a priori* thresholds of 1.96 and -1.96.

Percentage of participants at risk for an ED also differed by race, χ^2 (2, *N* = 427) = 8.901, *p* = .012. The percentage of Caucasian participants at risk for an ED, 20.8% (95% CI [11.29%, 34.49%]), was significantly higher than expected because the adjusted residual (2.5) is positive and above 1.96. Proportion of African American subjects at risk for an ED, 8.4% (95% CI [5.77%, 12.09%]), was significantly lower than expected because the adjusted residual (-2.4) is negative and below the reference Z value of -1.96. The participants classified in other racial groups had a prevalence rate, 16.7%, that was reasonably close to what is expected.

The percentage of participants at risk for an ED also differed by sport, χ^2 (8, *N* = 427) = 16.966, *p* = .031. Proportion of football athletes, 5.4% (95% CI [2.64%, 10.24%]), who were at risk for an ED was significantly lower than expected because the adjusted residual (-2.9) was negative and below the *a priori* threshold of -1.96. The percentage of female soccer athletes, 25% (95% CI [13.25%, 41.52%]), who were at risk for an ED, was significantly higher than expected because the adjusted residual (3.0) was positive and above 1.96. Other sports subjects participated in displayed prevalence rates relatively close to expected calculations.

The proportion of participants at risk for an ED also differed by academic classification, $\chi2$ (3, N = 427) = 9.089, p = .028. Percentage of sophomore subjects at risk for an ED, 5.7% (95% CI [2.79%, 10.80%]), was significantly lower than expected because the adjusted residual (-2.6) is negative and below the reference Z value of -1.96. The percentage of junior participants at risk for an ED, 17.3% (95% CI [10.85%, 26.25%]), was significantly higher than expected because the adjusted residual (2.5) was positive and above 1.96. Table 13 displays the significant findings between groups for being at risk for an eating disorder.

Engaged in disordered eating. Examination of subjects who engaged in disordered eating led to the conclusion that none of the predictor variables; gender [$\chi2$ (1, N = 427) = 1.905, p = .167], institution [$\chi2$ (3, N = 427) = .953, p = .813], race [$\chi2$ (2, N = 427) = 1.258, p = .533], sport [$\chi2$ (8, N = 427) = 12.184, p = .028], academic classification [$\chi2$ (3, N = 427) = .752, p = .861], and year of eligibility [$\chi2$ (3, N = 427) = .253, p = .969] reached statistical significance.

Intend to engage in disordered eating. Concerning subjects who intended to engage in disordered eating; sport, academic classification, and year of eligibility were statistically significant. The predictors gender [$\chi2$ (1, N = 427) = 2.213, p = .137], institution [$\chi2$ (3, N = 427) = 1.726, p = .631], and race [$\chi2$ (2, N = 427) = 2.049, p = .359] lacked statistical significance.

Percentage of participants who intended to engage in disordered eating differed by sport, $\chi2$ (8, N = 427) = 20.085, p = .010. The frequency of female track subjects who intended to engage in disordered eating, 8 (21.6%, 95% CI [10.42%, 38.66%]), was significantly lower than expected because the adjusted residual (-2.5) is negative and below -1.96. The number of softball participants who intended to engage in disordered eating, 30 (57.7%, 95% CI [43.26%,

Table 13

Significant Group Differences with Eating Disorder Risk as an Outcome

Independent Variables (IV)		Total *n* (%)	At-Risk *n* (IV%)	Not At-Risk *n* (IV%)	χ^2	*p*
Gender					11.149	.001
	Male	239 (56.0)	15 (6.3)	224 (93.7)		
	Female	188 (44.0)	31 (16.5)	157 (83.5)		
Race					8.901	.012
	Black	332 (77.8)	28 (8.4)	304 (91.6)		
	White	53 (12.4)	11 (20.8)	42 (79.2)		
	Other	42 (9.8)	7 (16.7)	35 (83.3)		
Academic Classification					9.089	.028
	Freshman	98 (23.0)	11 (11.2)	87 (88.8)		
	Sophomore	159 (37.2)	9 (5.7)	150 (94.3)		
	Junior	104 (24.4)	18 (17.3)	86 (82.7)		
	Senior/Graduate	66 (15.5)	8 (12.1)	58 (87.9)		
Sport					16.966	.031
	Men's Track	19 (4.4)	1 (5.3)	18 (94.7)		
	Football	168 (39.3)	9 (5.4)	159 (94.6)		
	Baseball	31 (7.3)	2 (6.5)	29 (93.5)		
	Other Men's Sports	21 (4.9)	3 (14.3)	18 (85.7)		
	Women's Track	37 (8.7)	5 (13.5)	32 (86.5)		
	Women's Soccer	40 (9.4)	10 (25.0)	30 (75.0)		
	Softball	52 (12.2)	7 (13.5)	45 (86.5)		
	Women's Volleyball	21 (4.9)	3 (14.3)	18 (85.7)		
	Other Women's Sports	38 (8.9)	6 (15.8)	32 (84.2)		
Institution					8.486	.037
	Institution 1	165 (38.6)	26 (15.8)	139 (84.2)		
	Institution 2	90 (21.1)	9 (10.0)	81 (90.0)		
	Institution 3	119 (27.9)	6 (5.0)	113 (95.0)		
	Institution 4	53 (12.4)	5 (9.4)	48 (90.6)		

Note: IV% represents percent of independent variable's group

70.99%]), was significantly higher than expected because the adjusted residual (2.6) was positive and above the *a priori* threshold of 1.96. Female subjects from other sports who intended to engage in disordered eating reached a frequency that was significantly higher than expected because the adjusted residual (2.5) was positive and above 1.96.

The prevalence of participants with intentions to engage in disordered eating among male sports was reasonably close to forecasted crosstabulation calculations. This was the conclusion because all adjusted residuals were between the reference points of -1.96 and 1.96.

The percentage of participants who intended to engage in disordered eating also differed by academic classification, $\chi2$ (3, N = 427) = 10.227, p = .017. The proportion of sophomore athletes with intentions to engage in disordered eating, 32.1% (n = 51, 95% CI [25.03%, 40.01%]), was significantly lower than expected because the adjusted residual (-3.0) was negative and below the reference statistic of -1.96. Other academic classifications' prevalence met calculated expectations.

Participants who intend to engage in disordered eating also differed by year of eligibility, $\chi2$ (3, N = 427) = 15.757, p = .001. The prevalence rate of second-year athletes with intentions to engage in disordered eating, 32.0% (n = 48, 95% CI [24.76%, 40.18%]), was significantly lower than expected because the adjusted residual (-2.8) was negative and below the *a priori* threshold of -1.96. The prevalence of third-year athletes, that intended to engage in disordered eating, 57.4% (n = 54, 95% CI [46.83%, 67.45%]), was significantly higher than expected because the adjusted residual (3.6) was positive and above 1.96. Table 14 displays the significant findings between groups for intentions to engage in disordered eating.

Exercise dependence group differences. Investigation of participants at risk for ExD determined that none of the predictor variables; gender [$\chi2$ (1, N = 427) = 1.353, p = .245], institution [$\chi2$ (3, N = 427) = 3.765, p = .288], race [$\chi2$ (2, N = 427) = 1.158, p = .561], sport [$\chi2$

Table 14

Significant Group Differences with Intentions to Engage in Disordered Eating as an Outcome

Independent Variables (IV)		Total *n* (%)	At-Risk *n* (IV%)	Not At-Risk *n* (IV%)	χ^2	*p*
Academic Classification					10.227	.017
	Freshman	98 (23.0)	41 (41.8)	57 (58.2)		
	Sophomore	159 (37.2)	51 (32.1)	108 (67.9)		
	Junior	104 (24.4)	51 (49.0)	53 (51.0)		
	Senior/Graduate	66 (15.5)	33(50.0)	33 (50.00		
Sport					20.085	.010
	Men's Track	19 (4.4)	9(47.7)	10 (52.6)		
	Football	168 (39.3)	64 (38.1)	104 (61.9)		
	Baseball	31 (7.3)	12 (38.7)	19 (61.3)		
	Other Men’s Sports	21 (4.9)	6 (28.6)	15 (71.4)		
	Women's Track	37 (8.7)	8 (21.6)	29 (78.4)		
	Women's Soccer	40 (9.4)	16 (40.0)	24 (60.0)		
	Softball	52 (12.2)	30 (57.7)	22 (42.3)		
	Women's Volleyball	21 (4.9)	8 (38.1)	13 (61.9)		
	Other Women’s Sports	38 (8.9)	23 (60.5)	15 (39.5)		
Year of Eligibility					15.575	.001
	First	120 (28.1)	47 (39.2)	73 (60.8)		
	Second	150 (35.1)	48 (32.0)	102 (68.0)		
	Third	94 (22.0)	54 (57.4)	40 (42.6)		
	Fourth or Higher	63 (14.8)	27 (42.9)	36 (57.1)		

Note: IV% represents percent of independent variable’s group

(8, N = 427) = 11.126, p = .195], academic classification [χ2 (3, N = 427) = 4.222, p = .239], and year of eligibility [χ2 (3, N = 427) = 3.544, p = .315]; were statistically significant.

Orthorexia nervosa group differences. Examination of subjects at risk for ON revealed that four predictors; race, institution, sport, and year of eligibility were statistically significant. The independent variables gender (χ2 (1, N = 427) = .287, p = .592), and academic classification (χ2 (3, N = 427) = 6.004, p = .111) lacked statistical significance.

Participants at risk for ON differed by race, $\chi2$ (3, *N* = 427) = 10.365, *p* = .006. The percentage of African American subjects at risk for ON, 62.3% (*n* = 207, 95% CI [56.87%, 67.54%]), was significantly lower than expected because the adjusted residual (-3.2) was negative and below the reference point of -1.96. Caucasian participants at risk for ON reported a prevalence rate, 81.1% (*n* = 43, 95% CI [67.59%, 90.11%]), significantly higher than expected because the adjusted residual (2.4) was positive and above 1.96.

Participants at risk for ON also differed by sport, $\chi2$ (8, *N* = 427) = 19.048, *p* = .015. Softball subjects at risk for ON reported a prevalence rate, 50.0% (*n* = 26, 95% CI [35.99%, 64.01%]), significantly lower than expected because the adjusted residual (-2.6) was negative and below the *a priori* threshold of -1.96. The number of female volleyball participants at risk for an ON, 19 (90.5%, 95% CI [68.18%, 98.33%]), was significantly higher than expected because the adjusted residual (2.4) was positive and above 1.96. The prevalence rate of female track participants at risk or ON, 51.4% (*n* = 19, 95% CI [34.66%, 67.76%]), was significantly lower than expected because the adjusted residual (-2.0) was negative and below the reference statistic of -1.96. Participants belonging to other sports who were at risk for ON reached a frequency that was reasonably close to forecasted crosstabulation calculations.

The percentage of participants at risk for ON also differed by year of eligibility, $\chi2$ (3, *N* = 427) = 12.105, *p* = .007. Third-year participants at risk for ON reach a prevalence, 78.7% (*n* = 74, 95% CI [68.82%, 86.22%]), that was significantly higher than expected because the residual (2.9) was positive and above 1.96. The percentage of fourth-year or higher athletes at risk for ON, 52.4% (*n* = 33, 95% CI [39.51%, 64.96%]), was significantly lower than expected because the adjusted residual (-2.5) was negative and below the *a priori* threshold of -1.96.

Participants at risk for ON also differed by institution, $\chi2$ (3, N = 427) = 8.808, p = .032. The prevalence rate of athletes from Institution 2 at risk for ON, 53.3% (n = 48, 95% CI [42.56%, 63.81%]), was significantly lower than expected because the adjusted residual (-2.9) was negative and below -1.96. Adjusted residual calculations of the three other institutions revealed that prevalence rates were reasonably close to expectations. Table 15 displays the significant findings between groups for being at risk for orthorexia nervosa. Table 16 displays a summary of all analyses calculated to report research question three.

Research questions four and five: Are there between group differences within each sport among the HBCU athletic population for risk of eating disorders and orthorexia nervosa? The purpose of these research questions was to analyze group differences within each HBCU sport when measuring risk levels of ED and ON. Predictor variables utilized were race, institution, year of eligibility, and academic classification. ED risk level and ORTO 15 score were the outcome variables of interest. Subjects' ORTO 15 scores were interpreted to eliminate confusion, because lower ORTO 15 scores increase risk of ON. If age or BMI was significantly associated with each sport's risk level, an ANCOVA model was used for analysis. Otherwise, ANOVA was the statistical model of choice. Table 17 displays a summarization of the calculated means for ED and ON risk levels among each sport.

Table 15

Significant Group Differences with Orthorexia Nervosa Risk as an Outcome

Independent Variables (IV)		Total *n* (%)	At-Risk *n* (IV%)	Not At-Risk *n* (IV%)	χ^2	*p*
Race					10.356	.006
	Black	332 (77.8)	207 (62.3)	125 (37.7)		
	White	53 (12.4)	43 (81.1)	10 (18.9)		
	Other	42 (9.8)	33 (78.6)	9 (21.4)		
Sport					19.048	.015
	Men's Track	19 (4.4)	15 (78.9)	4 (21.1)		
	Football	168 (39.3)	111 (66.1)	57 (33.9)		
	Baseball	31 (7.3)	21 (67.7)	10 (32.3)		
	Other Men's Sports	21 (4.9)	14 (66.7)	7 (33.3)		
	Women's Track	37 (8.7)	19 (51.4)	18 (48.6)		
	Women's Soccer	40 (9.4)	30 (75.0)	10 (25.0)		
	Softball	52 (12.2)	26 (50.0)	26 (50.0)		
	Women's Volleyball	21 (4.9)	19 (90.5)	2 (9.5)		
	Other Women's Sports	38 (8.9)	28 (73.7)	10 (26.3)		
Institution					8.808	.032
	Institution 1	165 (38.6)	114 (69.1)	51 (30.9)		
	Institution 2	90 (21.1)	48 (53.3)	42 (46.7)		
	Institution 3	119 (27.9)	85 (71.4)	34 (28.6)		
	Institution 4	53 (12.4)	36 (67.9)	17 (32.1)		
Year of Eligibility					12.105	.007
	First	120 (28.1)	78 (65.0)	42 (35.0)		
	Second	150 (35.1)	98 (65.3)	52 (34.7)		
	Third	94 (22.0)	74 (78.7)	20 (21.3)		
	Fourth or Higher	63 (14.8)	33 (52.4)	30 (47.6)		

Note: IV% represents percent of independent variable's group

Table 16

Chi-Square Matrix Comparing Groups Versus Binary Dependent Variables of Interest

		At Risk for Eating Disorder	Engaged in Disordered Eating	Intend to Engage in Disordered Eating	At Risk for Orthorexia Nervosa	At Risk for Exercise Dependence
Gender	χ^2 (*df*)	11.419 (1)	1.905 (1)	2.213 (1)	.287 (1)	1.353 (1)
	OR [a]	2.949	.749	1.342	.896	1.447
	P	.001	.167	.137	.709	.245
Institution	χ^2 (*df*)	8.486 (3)	.953 (3)	1.726 (3)	8.808 (3)	3.765 (3)
	P	.037	.813	.631	.032	.288
Race	χ^2 (*df*)	8.901 (2)	1.258 (2)	2.049 (2)	10.365 (2)	1.158 (2)
	P	.012	.533	.359	.006	.561
Sport	χ^2 (*df*)	16.966 (8)	12.184 (8)	20.085 (8)	19.048 (8)	11.126 (8)
	P	.031[b]	.143	.010	.015	.195 [b]
Academic Classification	χ^2 (*df*)	9.089 (3)	.752 (3)	10.227 (3)	6.004 (3)	4.222 (3)
	P	.028	.861	.017	.111	.239
Year of Eligibility	χ^2 (*df*)	7.252 (3)	.253 (3)	15.757 (3)	12.105 (3)	3.544 (3)
	P	.064	.969	.001	.007	.315

Note: a = Odds ratios (*OR*) were calculated for 2 x 2 tables (Gender). Statistic describes female's increase/decrease of likelihood compared to males.
b = Fisher's exact test performed because > 20% of cells had an expected value lower than 5

Table 17

Eating Disorder and Orthorexia Nervosa Mean Risk Levels for Each Sport

	Eating Disorder Risk Level				Orthorexia Nervosa Risk Level				
			95% Confidence Interval				95% Confidence Interval		
	M	*SD*	*LL*	*UL*	*M*	*SD*	*LL*	*UL*	*n*
Men's Track	5.47	4.82	3.30	7.64	38.11	2.77	36.86	39.36	19
Football	8.19	7.25	7.09	9.09	38.74	3.13	38.27	39.21	168
Baseball	8.19	9.19	4.95	11.43	37.74	4.66	36.10	39.38	31

Table 17 (con't)

	Eating Disorder Risk Level				Orthorexia Nervosa Risk Level				
			95% Confidence Interval				95% Confidence Interval		
	M	*SD*	*LL*	*UL*	*M*	*SD*	*LL*	*UL*	*n*
Other Men's Sports	6.33	7.91	2.95	9.71	38.76	3.33	37.34	40.18	21
Women's Track	9.05	10.04	5.81	12.29	39.76	2.98	38.80	40.72	37
Women's Soccer	13.73	10.32	10.53	16.93	37.40	4.57	35.98	38.82	40
Softball	9.54	8.82	7.14	11.94	39.69	3.57	38.72	40.66	52
Volleyball	10.38	11.19	5.59	15.17	36.38	3.73	34.78	37.98	21
Other Women's Sports	10.50	7.56	8.10	12.90	38.82	3.08	37.84	39.80	38
Total (*N*=427)	9.05	8.52			38.61	3.55			

Note: For eating disorder risk level, 20 and above is the threshold that determines one to be at risk for an eating disorder. For orthorexia nervosa, 40 and below is the threshold that determines one to be at risk for orthorexia nervosa.

Research question four: eating disorder risk level group differences. This section of the research report details findings of research question three with reference to ED risk level.

Men's Track. The predictor variables race [F (1, 17) = .020, p = .888], institution [F (2, 16) = 2.144, p = .113], year of eligibility [F (3, 15) = .514, p = .679], and academic classification [F (3, 15) = 1.185, p = .349] all lacked statistical significance. Thus, ED risk level among groups within each aforementioned predictor did not differ in one-way ANOVA models. Table 18 displays the results of the one-way analyses.

Table 18

Men's Track Eating Disorder One-Way ANOVA Analyses

Variable	*F*	(df_{btw}, $df_{w/in}$)	*p*	$R^2_{Adj.}$	*Power*
Race	.020	(1, 17)	.888	.058	.052
Institution	2.144	(2, 16)	.150	.113	.374
Year of eligibility	.514	(3, 15)	.679	.088	.131
Academic classification	1.185	(3, 15)	.349	.030	.255

Examination of the data revealed that BMI and ED risk are positively correlated, r (17) = .613, p = .005. A linear regression model showed a statistically significant positive relationship between BMI and ED risk level among male track participants, $F(1, 17) = 10.429$, $p = .005$. BMI explained 38% ($R^2_{\text{Adjusted}} = .339$) of the variance in ED risk level among male track subjects. Among male track participants, a 1-unit increase in BMI increased level of ED risk .839 units. Table 19 shows the simple linear regression results.

Table 19

Regression ANOVA Table: BMI Versus Eating Disorder Risk Level Among Track Athletes

Model	*SS*	*df*	*MS*	*F*	*p*
Regression	157.496	1	157.496	10.249	.005
Residual	261.241	17	15.367		
Total	418.737	18			

Note: ED Risk Level = .893(BMI) – 14.671

Football. The predictor variables institution [F (3, 164) = 7.145, p = < .001] and year of eligibility [F (3, 164) = 5.272, p = .002] were both significantly associated with ED risk level in one-way statistical models among football participants. Thus, the ED risk level of football subjects did differ between groups. Table 20 displays the one-way ANOVA results.

Table 20

Football Eating Disorder One-Way ANOVA Analyses

Variable	*F*	(df_{btw}, $df_{w/in}$)	*p*	$R^2_{Adj.}$	*Power*
Race	.971	(1, 166)	.326	<.001	.165
Institution	7.145	(3, 164)	<.001	.099	.980
Year of eligibility	5.272	(3, 164)	.002	.071	.925
Academic classification	2.307	(3, 164)	.060	.030	.661

ANCOVA was used because BMI and ED risk were positively correlated [*r* (166) = .174, *p* = .024], with football participants' ED risk level. The predictor variables in this model included institution and year of eligibility. The outcome variable was ED risk, with BMI added as a covariate for control purposes. See Table 21 for the means and standard deviations for ED risk level as a function of year of eligibility and institution.

Table 21

Means and Standard Deviations of Football Eating Disorder Risk Level

	1st Year		2nd Year		3rd Year		4th Year +	
	M (*SD*)	*n*	*M* (*SD*)	*n*	*M* (*SD*)	*n*	*M* (*SD*)	*n*
Institution 1	4.50 (4.44)	4	12.35 (10.48)	26	13.00 (9.17)	7	8.36 (6.35)	11
Institution 2	1.00 (0.00)	1	9.75 (5.93)	16	13.50 (0.71)	2	11.00 (0.00)	2
Institution 3	4.66 (3.52)	29	6.67 (5.06)	21	5.50 (4.65)	10	5.29 (3.25)	14
Institution 4	a	0	10.58 (9.64)	19	7.33 (1.53)	3	6.97 (5.12)	3

a = not observed

The test for homogeneity of variance was found to be significant [*F* (14, 153) = 3.177, *p* = < .001] indicating that a key assumption of ANCOVA was not met. Therefore, a Box-Cox power transformation occurred to correct this diagnostic. With use of the transformed outcome variable, test for homogeneity of variance was not statistically significant [*F* (14, 153) = 1.238, *p* = .243], ensuring the appropriateness of ANCOVA.

The ANCOVA model with the transformed variable was found to be significant, *F* (15, 152) = 2.221, *p* = .008 (see Table 22) and accounted for 10% ($R^2_{Adjusted}$ = .099) of the variance in ED risk level among football participants.

Since the interaction between year of eligibility and institution was not significant [*F* (8,152) = 3.917, *p* = .521], the main effect of eligibility was investigated, *F* (3,152) = 2.882, *p* =

Table 22

ANCOVA Model for Groups Within Football Participants Regarding Eating Disorder Risk Level

Source	*SS*	*df*	*MS*	*F*	*p*	η^2	*Power*
Model	18.199[a]	15	1.213	2.221	.008	.180	.970
Intercept	8.506	1	8.506	15.573	.000	.093	.975
BMI	1.078	1	1.078	1.974	.162	.013	.287
Eligibility (E)	4.723	3	1.574	2.882	.038	.054	.679
Institution (L)	3.380	3	1.127	2.063	.108	.039	.520
E x L	3.917	8	.490	.896	.521	.045	.406
Error	83.025	152	.546				
Total	729.277	168					
Corrected Total	101.225	167					

Note: Outcome variable = ln(y + 1)

.038. The ANCOVA model with the transformed outcome variable displayed conservative significance levels compared to the non-transformed model. Since year of eligibility remained as the only significant main effect, interpretation of original ED risk level was appropriate. Follow-up tests using the Bonferroni post-hoc procedure showed that second-year football participants (M = 9.98) had a higher (*p* = .023) ED risk level than first-year football subjects (*M* = 4.53).

Baseball. The predictor variables race [*F* (1, 29) = .006, *p* = .937], institution [*F* (1, 29) = .246, *p* = .624], year of eligibility [*F* (3, 27) = .909, *p* = .450], and academic classification [*F* (3, 27) = 1.026, *p* = .397] all lacked statistical significance. Thus, the ED risk level of the groups within each predictor did not differ among baseball participants in this study. BMI and age also failed to display significance with respect to ED risk level among baseball subjects.

An extensive examination of all possible factorial designs indicated that one-way ANOVA was the best possible model of investigating ED risk level among baseball participants. Therefore, the preselected predictors and covariates failed to exhibit statistical significance with ED risk level baseball participants. Table 23 shows the results of the one-way analyses.

Table 23

Baseball Eating Disorder One-Way ANOVA Analyses

Variable	*F*	(df_{btw}, $df_{w/in}$)	*P*	$R^2_{Adj.}$	*Power*
Race	.006	(1, 29)	.937	.034	.051
Institution	.246	(1, 29)	.624	.026	.077
Year of eligibility	.909	(3, 27)	.450	.009	.222
Academic classification	1.026	(3, 27)	.397	.003	.247

Males in Other Sports. The predictors institution [*F* (3, 17) = 8.193, *p* = .001], year of eligibility [*F* (3, 17) = 3.518, *p* = .038], and academic classification [*F* (3, 17) = 3.518, *p* = .038] were statistically significant in one-way models with ED risk level as an outcome. Year of eligibility and academic classification posed variance issues because of empty cells. Therefore, a recorded academic classification comparing freshmen with upperclassmen substituted for the original academic classification. The ED risk level of male subjects who did not participate in track, football, and baseball differed between groups Table 24 displays the results of the one-way analysis.

ANCOVA was used to determine variation of ED risk within groups because BMI and ED risk were positively correlated, r (21) = .916, p < .001. Institution was the only predictor in this model because academic classification posed a threat to the variance assumption. Dunnett's non-assumed equal variance diagnostic revealed no significant differences between

Table 24

Males in Other Sports One-Way ANOVA Analyses

Variable	F	$(df_{btw}, df_{w/in})$	p	$R^2_{Adj.}$	*Power*
Race	.622	(1, 19)	.440	.019	.166
Institution	8.193	(3, 17)	.001	.529	.975
Year of eligibility	3.518	(3, 17)	.038	.274	.677
Academic classification	3.518	(3, 17)	.038	.274	.677
Academic classification recoded	3.942	(1, 19)	.062	.128	.470

year of eligibility and academic classification. ED risk level was the outcome variable in this statistical model, with BMI added as a covariate for control. See Table 25 for the means and standard deviations of ED risk level as a function of institution.

The ANCOVA model was statistically significant, F (4, 16) = 32.097, p < .001 (see Table 26), and accounted for 88.9% ($R^2_{Adjusted}$ = .861) of the variance in ED risk level among male participants in sports other than football, baseball, and track.

Since the main effect, institution [F(3,16) = 2.450, p = .101], lacked statistical significance, the relationship between BMI and ED risk level among male participants from other sports was investigated, F(1,16) = 41.783, p < .001.

Table 25

Means and Standard Deviations of Males in Other Sports Eating Disorder Risk Level

	M	*SD*	*N*
Institution 1	3.33	2.50	6
Institution 2	3.80	4.97	5
Institution 3	24.50	6.36	2
Institution 4	5.63	6.87	8

Table 26

ANCOVA Model for Groups Within Other Male Participants Versus Eating Disorder Risk Level

Source	*SS*	*df*	*MS*	*F*	*p*	η^2	*Power*
Model	1112.077[a]	4	278.019	32.097	<.001	.889	1.000
Intercept	219.486	1	219.486	25.339	<.001	.613	.997
BMI	361.919	1	361.919	41.783	<.001	.723	1.000
Institution	63.677	3	21.226	2.450	.101	.315	.501
Error	138.590	16	8.662				
Total	2093.000	21					
Corrected Total	1250.667	20					

Follow-up tests using a simple linear regression showed a statistically significant positive relationship between BMI and ED risk level among male subjects from other sports, $F(1, 19) = 98.482$, $p < .001$. BMI explained 84% ($R^2_{Adjusted} = .830$) of the variance due to ED risk level among male athletes from other sports. Among male participants from other sports, a 1-unit increase in BMI increases level of ED risk 2.024 units. Table 27 displays the results of the simple linear regression model.

Women's Track. Race was not considered in this analysis because all female track participants (N = 37) were African American. The predictor variables institution [F (3, 33) = .344, p = .793], year of eligibility [F (3, 33) = 1.362, p = .271], and academic classification [F (3, 33) = 1.807, p = .165] all lacked statistical significance. Thus, the ED risk level of the groups within each aforementioned predictor did not differ among female track subjects in this study. BMI and age also lacked significance with respect to female track participants' ED risk level. After an extensive examination of all possible factorial designs, one-way ANOVA analyses were

Table 27

Regression ANOVA Table: BMI Versus Eating Disorder Risk Level Among Track Athletes

Model	*SS*	*df*	*MS*	*F*	*P*
Regression	1048.400	1	1048.400	98.482	<.001
Residual	202.266	19	10.646		
Total	1250.667	20			

Note: ED Risk Level = 2.024(BMI) – 45.637

the best model of investigation among female track participants. Hence, the preselected predictors and covariates failed to exhibit statistical significance with ED risk level among female track subjects. Table 28 shows the results of the one-way analyses.

Table 28

Women's Track Eating Disorder One-Way ANOVA Analyses

Variable	*F*	(df_{btw}, $df_{w/in}$)	*p*	$R^2_{Adj.}$	*Power*
Institution	.344	(3, 33)	.793	.058	.110
Year of eligibility	1.362	(3, 33)	.271	.029	.328
Academic classification	1.807	(3, 33)	.165	.063	.426

Women's Soccer. The predictor variables race [F (1, 38) = .098, p = .756] and institution [F (1, 38) = .360, p = .552] both lacked statistical significance. Year of eligibility [F (3, 36) = 4.776, p = .007] and academic classification [F (3, 36) = 4.776, p = .007] were both considered statistically significant. Thus, the ED risk level of the groups within year of eligibility and academic classification differed among female soccer participants in this study.

BMI and age were not statistically significant with reference to female soccer subjects' ED risk level. An extensive examination of all possible factorial designs concluded that the one-way ANOVA analyses were the best model for investigating ED risk level among female soccer participants. There was a perfect correlation between year of eligibility and academic classification. As a result, discussion of only academic classification occurs. Table 29 displays the results of the one-way analyses.

Table 29

Women's Soccer One-Way ANOVA Analyses

Variable	F	$(df_{btw}, df_{w/in})$	p	$R^2_{Adj.}$	*Power*
Race	.098	(1, 38)	.756	.024	.061
Institution	.360	(1, 38)	.552	.017	.090
*Year of eligibility	4.776	(3, 36)	.007	.225	.866
*Academic classification	4.776	(3, 36)	.007	.225	.866

* Unequal Variances Assumed

The predictor variable of this one-way ANOVA model was academic classification and the outcome variable was ED risk. See Table 30 for the means and standard deviations for eating disorder risk level as a function of year of eligibility and institution.

The test for homogeneity of variance was found to be significant [F (3, 36) = 3.235, p = .033], indicating that a key assumption of ANOVA was not met. Therefore, Dunnett's post hoc analysis was utilized.

Table 30

Means and Standard Deviations of Women's Soccer Eating Disorder Risk Level

Class	*M*	*SD*	*n*
Freshman	4.67	2.07	6
Sophomore	11.38	8.27	16
Junior	17.88	11.21	16
Senior/Grad	26.50	6.36	2

Academic classification [F (3, 36) = 4.776, p = .007] explained approximately 22.5% of female soccer subjects' ED risk level variance in this study. Dunnett's post hoc procedure revealed that freshmen female soccer athletes have significantly lower ED risk levels compared their sophomore ($M_{i\text{-}j}$ = -6.71, $SE_{i\text{-}j}$ = 2.23, p = .043) and junior ($M_{i\text{-}j}$ = -13.21, $SE_{i\text{-}j}$ = 2.93, p = .002) cohorts.

Softball. The predictor variables institution [F (2, 49) = .211, p = .810] and academic classification [F (3, 48) = 2.638, p = .060] both lacked statistical significance. However, year of eligibility [F (3, 48) = 3.473, p = .023] and race [F (2, 49) = 17.073, p < .001] were both significant. Thus, the ED risk level of the groups within each aforementioned predictor did differ among softball subjects in this study.

Due to inadequate sample sizes of several factorial groups, a custom ANOVA model was created to account for both race and academic classification without its interaction term. Age [r(52) = .114, p = .421] and BMI [r(52) = .052, p = .712] were not statistically significant predictors of ED risk level among softball participants. Therefore, there were no covariates in this statistical model. Table 31 shows the results of the one-way analyses.

Table 31

Softball Eating Disorder One-Way ANOVA Analyses

Variable	F	$(df_{btw}, df_{w/in})$	p	$R^2_{Adj.}$	*Power*
Race	17.073	(2, 49)	<.001	.387	1.000
Institution	.211	(2, 49)	.810	.032	.081
*Year of eligibility	3.473	(3, 48)	.023	.127	.742
Academic classification	2.638	(3, 48)	.060	.088	.610

* Homogeneity of variance assumption failed

The predictor variables in this model included race and academic classification and the outcome variable was ED risk. See Table 32 and Table 33 for the means and standard deviations for ED risk level as a function of academic classification and race separately.

Table 32

Means and Standard Deviations of Softball Eating Disorder Risk Level by Class

	M	*SD*	*n*
Freshman	3.33	4.583	9
Sophomore	8.29	6.450	14
Junior	11.63	10.576	16
Senior/Grad	12.62	9.206	13
Total	9.54	8.817	52

Table 33

Means and Standard Deviations of Softball Eating Disorder Risk Level by Race

	M	*SD*	*n*
Black	6.91	5.786	34
White	22.63	10.623	8
Other	8.00	7.008	10
Total	9.54	8.817	52

The custom ANOVA model was statistically significant, F (5, 46) = 7.747, p < .001 (see Table 34) and accounted for 46% ($R^2_{Adjusted}$ = .398) of the variance in ED risk level among female softball subjects.

Table 34

ANOVA for Groups within Female Softball Participants Regarding Eating Disorder Risk Level

Source	*SS*	*df*	*MS*	*F*	*p*	η^2	*Power*
Model	1812.514[a]	5	362.503	7.747	.000	.457	.999
Intercept	4189.349	1	4189.349	89.532	.000	.661	1.000
Race	1251.275	2	625.637	13.371	.000	.368	.996
Class	184.201	3	61.400	1.312	.282	.079	.327
Error	2152.410	46	46.792				
Total	8696.000	52					
Corrected Total	3964.923	51					

The main effect race [F (2, 46) = 13.371, p < .001] was statistically significant, while academic classification [F (3, 46) = 1.312, p = .282] lacked significance. Examination of the Bonferroni post-hoc tests revealed that Caucasian softball participants' ED risk level was statistically higher than both African Americans ($M_{i\text{-}j}$ = 15.71, *SE* = 2.69, *p* < .001) and participants of other races ($M_{i\text{-}j}$ = 14.63, *SE* = 3.25, *p* < .001).

Women's Volleyball. The predictors race [*F* (1, 19) = 4.274, *p* = .053], institution [*F* (2, 18) = .069, *p* = .943], year of eligibility [*F* (2, 18) = 3.086, *p* = .396], and academic classification [*F* (3, 17) = 1.982, *p* = .155] all lacked statistical significance with regard to women's volleyball subjects' ED risk level. Year of eligibility and academic classification posed statistical problems due to inadequate sample size among subgroups. Hence, a recoded academic classification comparing freshmen with upperclassmen substituted for the original academic classification. The recoded variable was statistically significant, F (1, 19) = 6.493, p = .020. Since none of the female volleyball participants perceived themselves as Caucasian, the race variable was binary (African American and Other). Therefore, ED risk level among groups within academic classification differed among female volleyball subjects in this study.

The combination of race and recoded academic classification explained most of the variance in ED risk level among female volleyball participants. Table 35 displays the results of the one-way analyses.

Table 35

Women's Volleyball Eating Disorder One-Way ANOVA Analyses

Variable	*F*	(df_{btw}, $df_{w/in}$)	*p*	$R^2_{Adj.}$	*Power*
Race	4.274	(1, 19)	.053	.141	.501
Institution	.069	(2, 18)	.934	.103	.059
Year of eligibility	3.086	(2, 18)	.369	.009	.262
Academic classification	1.982	(3, 17)	.155	.128	.420
Academic class recoded	6.493	(1, 19)	.020	.215	.676

Because age and the outcome variable were significantly correlated, $r(21)=-.687$, $p=.001$, an ANCOVA model with a factorial design determined variation of ED risk level within groups. The predictor variables in this model included race and academic classification with ED risk level as the outcome variable. Age was added as a covariate for control purposes. See Table 36 for the means and standard deviations of eating disorder risk level as a function of academic classification and race.

Table 36

Means and Standard Deviations of Female Volleyball Eating Disorder Risk Level

	Freshman		Upperclassmen	
	M *(SD)*	*n*	*M* *(SD)*	*n*
Black	8.38 (5.26)	8	5.33 (1.97)	6
Other	35.00 (6.93)	3	3.50 (1.00)	4

The ANCOVA model was statistically significant, $F(4, 16) = 38.531$, $p < .001$ (see Table 37) and accounted for 91% ($R^2_{Adjusted} = .882$) of the variation in ED risk level among female volleyball participants.

Table 37

ANCOVA for Groups within Female Volleyball Participants Regarding Eating Disorder Risk Level

Source	*SS*	*df*	*MS*	*F*	*p*	η^2	*Power*
Model	2269.364a	4	567.341	38.531	.000	.906	1.000
Intercept	65.147	1	65.147	4.424	.052	.217	.507
Age	76.620	1	76.620	5.204	.037	.245	.573
Class (C)	348.206	1	348.206	23.649	.000	.596	.995

Table 37 (con't)

Source	SS	df	MS	F	p	η2	Power
Race (R)	671.527	1	671.527	45.607	.000	.740	1.000
C x R	744.351	1	744.351	50.553	.000	.760	1.000
Error	235.588	16	14.724				
Total	4768.000	21					
Corrected Total	2504.952	20					

Since the interaction between race and academic classification was statistically significant [F (1, 16) = 50.553, $p < .001$], the main effects race [F (1, 16) = 45.607, $p < .001$] and academic classification [F (1, 16) = 23.649, $p < .001$] were ignored. Investigation of the marginal means determined that freshman female volleyball subjects of other racial groups had significantly higher levels of ED risk than African American female volleyball participants. The data displays no overlap among the 95% confidence interval of estimated marginal means among African American freshman 95% CI [7.61, 16.64] and freshman belonging to other racial groups 95% CI [34.83, 58.20]. Table 38 shows the estimated marginal means.

Table 38

Female Volleyball Estimated Marginal Means: Academic Classification versus Race

			95% CI	
Race	*M*	*SE*	*LL*	*UL*
		Freshman		
Black	12.12[a]	2.13	7.61	16.64
Other	46.51[a]	5.51	34.83	58.20
		Upperclassmen		
Black	-.77[a]	3.10	-7.34	5.80
Other	-3.48[a]	3.61	-11.13	4.18

a. Covariates appearing in the model are evaluated at the following values: Age (Years) = 19.75.

Observation of the profile plots shows that freshmen from other racial groups were significantly higher in ED risk level than all other groups. There was also a decreasing trend between both racial groups with regard to ED risk level among female volleyball participants. Figure 4 displays the interaction profile plot.

Females in Other Sports. Institution [F (3, 34) = 2.121, p = .116], year of eligibility [F (3, 34) = 1.615, p = .204], and academic classification [F (3, 34) = 2.794, p = .055] all lacked statistical significance with respect to ED risk level. The predictor race [F (2, 49) = 17.073, p < .001] was statistically significant. Thus, from a one-way perspective, the ED risk level of the groups within race differed among females from other sports.

Due to inadequate sample sizes of several factorial groups, a custom ANOVA model was created to control for both race and academic classification without its interaction term. Age [r(38) = .238, p = .158] and BMI [r(38) = .034, p = .838] were not statistically significant predictors of ED risk level among females that participate in other sports. Therefore, there were no covariates in this statistical model. Table 39 shows the results of the one-way analyses.

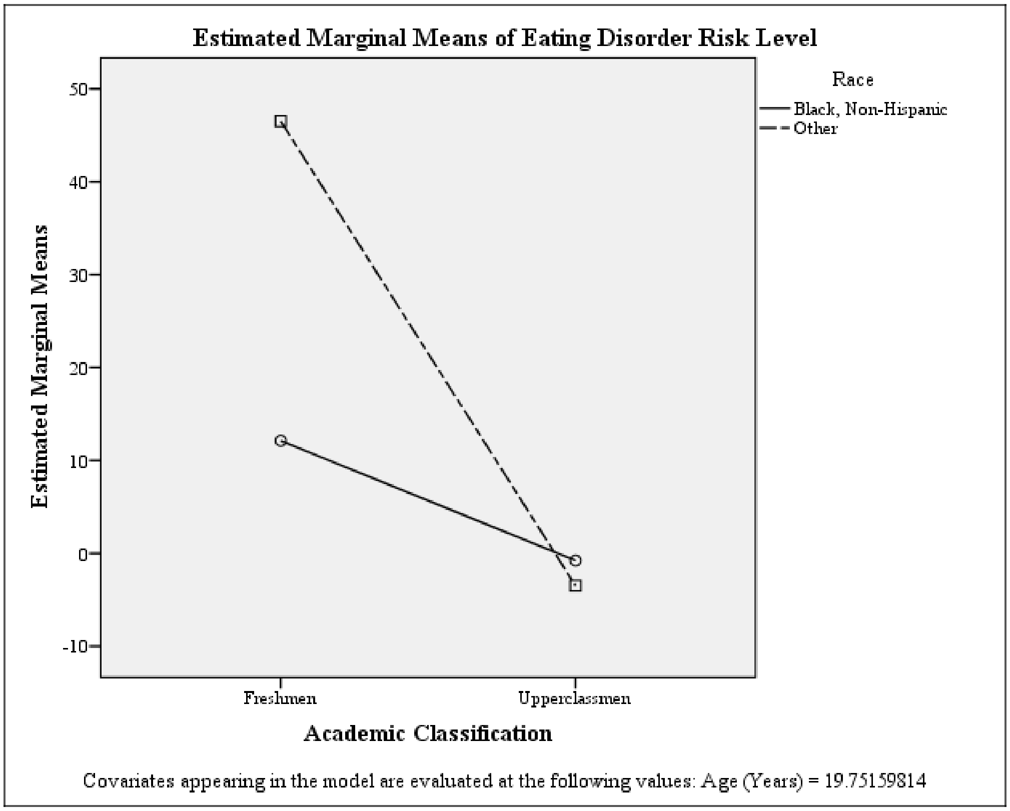

Figure 4. Race x academic classification profile plot for female volleyball participants

Table 39

Females in Other Sports One-Way ANOVA Analyses

Variable	F	$(df_{btw}, df_{w/in})$	p	$R^2_{Adj.}$	*Power*
Race	4.138	(2, 35)	.024	.145	.693
Institution	2.121	(3, 34)	.116	.083	.494
Year of eligibility	1.615	(3, 34)	.204	.047	.385
Academic classification	2.794	(3, 34)	.055	.127	.621

The predictor variables in this model included race and academic classification, with ED risk level as an outcome variable. See Table 40 and Table 41 for the means and standard deviations for ED risk level as a function of academic classification and race separately.

Table 40

Means and Standard Deviations of Females in Other Sports Eating Disorder Risk Level by Class

	M	*SD*	*n*
Freshman	12.17	7.709	12
Sophomore	6.55	3.804	11
Junior	10.00	8.809	11
Senior/Grad	17.75	6.397	4
Total	10.50	7.561	38

Table 41

Means and Standard Deviations of Females in Other Sports Eating Disorder Risk Level by Race

	M	*SD*	*n*
Black	10.13	7.274	31
White	20.67	6.351	3
Other	5.75	3.775	4
Total	10.50	7.561	38

The custom ANOVA model was statistically significant, F (5, 32) = 4.640, p = .003 (see Table 42), and accounted for 42% ($R^2_{Adjusted}$ = .330) of the variance in ED risk level among female participants from other sports.

Table 42

ANOVA for Groups within Other Female Participants Regarding Eating Disorder Risk Level

Source	*SS*	*df*	*MS*	*F*	*p*	η^2	*Power*
Model	889.083[a]	5	177.817	4.640	.003	.420	.947
Intercept	2468.679	1	2468.679	64.413	.000	.668	1.000
Class	484.484	3	161.495	4.214	.013	.283	.811

Table 42 (con't)

Source	*SS*	*df*	*MS*	*F*	*p*	η2	*Power*
Race	470.727	2	235.364	6.141	.006	.277	.858
Error	1226.417	32	38.326				
Total	6305.000	38					
Corrected Total	2115.500	37					

The main effects race [F (2, 32) = 6.141, p = .006] and academic classification [F (3, 32) = 4.214, p = .013] were both statistically significant. With regard to female subjects that participate in other sports, Caucasians have significantly higher levels of ED risk level than both African Americans ($M_{i\text{-}j}$ = 10.54, $SE_{i\text{-}j}$ = 3.75, p = .026) and participants of other races ($M_{i\text{-}j}$ = 14.92, $SE_{i\text{-}j}$ = 4.74, p = .011). With respect to academic classification, senior and graduate participants had significantly higher ED risk levels than ($M_{i\text{-}j}$ = 11.20, $SE_{i\text{-}j}$ = 3.62, p = .025) sophomores.

Research question five: orthorexia nervosa risk level group differences. This section of the research report detail findings of research question three with respect to participants ORTO 15 score.

Men's Track. The predictor variables race [F (1, 17) = 1.051, p = .321], institution [F (2, 16) = 2.123, p = .152], year of eligibility [F (3, 15) = 2.517, p = .506], and academic classification [F (3, 15) = 1.603, p = .231] all lacked statistical significance. Thus, the ON risk level among groups within male track participants failed to differ. BMI and age also failed to explain variation in male track subjects' ON risk level. After an examination of all possible factorial designs, one-way ANOVA analyses were the best model of investigation among male track participants. As a result, the preselected predictors and covariates failed to exhibit statistical significance with male track participants' ON risk level. Table 43 shows the results of the one-way analyses.

Table 43

Men's Track Orthorexia Nervosa One-Way ANOVA Analyses

Variable	F	$(df_{btw}, df_{w/in})$	p	$R^2_{Adj.}$	*Power*
Race	1.051	(1, 17)	.320	.003	.162
Institution	2.123	(2, 16)	.152	.111	.371
Year of eligibility	2.517	(3, 15)	.098	.202	.506
Academic classification	1.603	(3, 15)	.394	.010	.231

Football. Race [F (1, 166) = .620, p = .432], institution [F (3, 164) = .679, p = .555], and year of eligibility [F (3, 164) = 1.382, p = .002], and academic classification [F (3, 164) = .894, p = .469] all lacked significance in one-way ANOVA models with respect to ON risk level. BMI and age also failed to explain variation in male football participants' ON risk level. An extensive examination of all possible factorial designs concluded that one-way ANOVA analyses were the best possible model of investigation among football participants. Therefore, the preselected predictors and covariates failed to exhibit statistical significance with football participants' ON risk level. Table 44 displays the results of the one-way analyses.

Baseball. The predictors race [F (2, 28) = .382, p = .686], institution [F (1, 29) = 1.060, p = .312], year of eligibility [F (3, 27) = 1.094, p = .396], and academic classification [F (3, 27) = 1.439, p = .253] all lacked statistical significance indicating that ON risk level of the groups among baseball subjects did not differ.

An examination of possible combinations for the factorial design revealed that the combination of race and academic classification explained most of the variance in ON risk level

Table 44

Football Orthorexia Nervosa One-Way ANOVA Analyses

Variable	F	(df_{btw}, $df_{w/in}$)	p	$R^2_{Adj.}$	*Power*
Race	.620	(1, 166)	.432	.002	.123
Institution	.679	(3, 164)	.555	.005	.196
Year of eligibility	1.382	(3, 164)	.250	.007	.362
Academic classification	.894	(3, 164)	.469	.003	.280

among baseball participants. Since the interaction term was the only statistical significant effect in the model, and too few observations resided in certain factorial groups, the model was not practical for interpretation. Therefore, one-way ANOVA models were the best method of investigating group differences for ON level among HBCU baseball subjects. Table 45 shows the results of the one-way analyses.

Table 45

Baseball Orthorexia Nervosa One-Way ANOVA Analyses

Variable	F	(df_{btw}, $df_{w/in}$)	p	$R^2_{Adj.}$	*Power*
Race	.382	(2, 28)	.686	.043	.105
Institution	1.060	(1, 29)	.312	.002	.169
Year of eligibility	1.094	(3, 27)	.369	.009	.262
Academic classification	1.439	(3, 27)	.253	.042	.337

Males in Other Sports. The predictor variables race [F (1, 19) = .422, p = .524], institution [F (3, 17) = .085, p = .967], year of eligibility [F (3, 17) = 1.366, p = .287], and academic classification [F (3, 17) = 1.366, p = .287] all lacked statistical significance. Thus, the ON risk level of male participants in sports other than track, football, and baseball failed to differ among groups.

BMI and age also failed to explain variation in male subjects from other sports' ON risk level. Hence, one-way ANOVA analyses were the best model of investigation among male participants from other sports. The preselected predictors and covariates failed to exhibit statistical significance with other male athlete participants' ON risk level. Table 46 shows the results of the one-way analyses.

Table 46

Males in Other Sports Orthorexia Nervosa One-Way ANOVA Analyses

Variable	F	(df_{btw}, $df_{w/in}$)	p	$R^2_{Adj.}$	*Power*
Race	.422	(1, 19)	.524	.030	.095
Institution	.085	(3, 17)	.967	.159	.062
Year of eligibility	1.366	(3, 17)	.287	.052	.298
Academic classification	1.366	(3, 17)	.287	.052	.298

Women's Track. The predictor variables institution [F (3, 33) = 1.210, p = .321], year of eligibility [F (3, 33) = 1.114, p = .357], and academic classification [F (3, 33) = .312, p = .817] all lacked statistical significance in one-way ANOVA models examining female track participants' ON risk level. Race was not considered in this analysis because all female track subjects (N = 37) were African American. As a result, the ON risk level did not differ among groups in the study's female track population.

BMI and age also failed to explain variation in male track subjects' ON risk level. It was concluded that the one-way ANOVA analyses were the best possible model for examining female track participants' orthorexia nervosa risk level. As a result, the preselected predictors and covariates failed to exhibit statistical significance with female track participants' ON risk level. Table 47 displays the results of the one-way analyses.

Table 47

Women's Track Orthorexia Nervosa One-Way ANOVA Analyses

Variable	*F*	(df_{btw}, $df_{w/in}$)	*p*	$R^2_{Adj.}$	*Power*
Institution	1.210	(3, 33)	.321	.017	.294
Year of eligibility	1.114	(3, 33)	.357	.009	.273
Academic classification	.312	(3, 33)	.817	.061	.104

Women's Soccer. Race [*F* (1, 38) = .030, *p* = .865] and institution [*F* (1, 38) = .105, *p* = .747] both lacked statistical significance with respect to ON risk level. The predictors year of eligibility [*F* (3, 36) = 5.183, *p* = .005] and academic classification [*F* (3, 36) = 5.183, *p* = .005] were both considered statistically significant with women soccer subjects' ON risk level. Therefore, the female soccer participants' ON risk level differed among groups.

The factorial combination of race and academic classification explained most of the variation in ON risk level among female soccer subjects; but, due to low sample sizes among factorial groups, the factorial ANOVA was not analyzed. BMI and age also failed to explain variation in female soccer subjects' ON risk level. Hence, one-way ANOVA was the best method of capturing group differences in ON level among soccer participants. Table 48 shows the results of the one-way analyses.

Academic classification was the model interpreted because there was a perfect correlation between it and year of eligibility. See Table 49 for the means and standard deviations of female soccer participants' ORTO 15 score as a function of academic classification.

Table 48

Women's Soccer Orthorexia Nervosa One-Way ANOVA Analyses

Variable	F	(df_{btw}, $df_{w/in}$)	p	$R^2_{Adj.}$	*Power*
Race	.030	(1, 38)	.865	.026	.053
Institution	.105	(1, 38)	.747	.023	.062
Year of eligibility	5.183	(3, 36)	.005	.241	.892
Academic classification	5.183	(3, 36)	.005	.241	.892

Table 49

Means and Standard Deviations of Women's Soccer ORTO 15 Score

	M	SD	n
Freshman	38.67	5.24	6
Sophomore	39.38	4.47	16
Junior	36.00	2.97	16
Senior/Grad	29.00	1.41	2
Total	37.40	4.57	40

The one-way ANOVA with academic classification as a predictor variable explained 30% ($R^2_{Adjusted}$ = .241) of the variance in ON risk level among female soccer participants. Bonferroni's post hoc test revealed that senior HBCU soccer participants had significantly lower ORTO 15 scores than sophomores (M_{i-j} = -10.38, SE_{i-j} = 2.99, p = .008) and freshmen (M_{i-j} = -9.67, SE_{i-j} = 3.25, p = .031). Therefore, sophomore female subjects were at higher risk for ON than freshman soccer participants.

Softball. The predictor variable institution [F (2, 49) = .816, p = .448] lacked statistical significance. Year of eligibility [F (3, 48) = 5.009, p = .004], race [F (2, 49) = 22.195, p < .001], and academic classification [F (3, 48) = 4.380, p = .008] were all statistically significant with respect to softball subjects' ON risk level. Thus, the ON risk level of the groups within years of eligibility, race, and academic classification differed among female softball participants in this study.

The factorial combination of race and academic classification explained most of the variance in ON risk level among female softball participants. To mitigate empty cells, race and academic classification were recoded in the analysis. Academic classification was preferred over year of eligibility due to an increased number of empty cells in the factorial design using race and year of eligibility. BMI and age also failed to explain variation in softball participants' ON risk level. Table 50 displays the results of the one-way analyses.

Table 50

Softball Orthorexia Nervosa One-Way ANOVA Analyses

Variable	F	$(df_{btw}, df_{w/in})$	p	$R^2_{Adj.}$	*Power*
Race	23.615	(2,49)	<.001	.470	1.000
[a]Race_recoded	22.195	(1, 50)	<.001	.294	.996
Institution	.816	(2, 49)	.448	.007	.182
[b]Year of eligibility	5.009	(3, 48)	.004	.191	.892
Academic classification	4.380	(3, 48)	.008	.166	.844
[c]Class_recoded	13.504	(1, 50)	.001	.197	.950

Note: a = Race recoded to black vs. other
b = Homogeneity of variance assumption failed
c = Academic classification recoded to underclassmen vs. upperclassmen

Factorial ANOVA's predictor variables included race (black and other) and academic classification (underclassmen and upperclassmen). The outcome variable in this statistical model was ON risk as operationalized by ORTO 15 score. See Table 51 for the means and standard deviations of softball subjects' ORTO 15 score as a function of academic classification and race.

Table 51

Means and Standard Deviations of Softball ORTO 15 Scores

	Underclassmen		Upperclassmen	
	M (*SD*)	*n*	*M* (*SD*)	*n*
Black	41.21 (2.49)	19	41.00 (2.30)	15
Other	43.00 (3.83)	4	35.29 (1.64)	14

The factorial ANOVA model was statistically significant, F (3, 48) = 23.336, p < .001 (see Table 52), and accounted for 59.3% ($R^2_{Adjusted}$ = .568) of the variance in ON risk level among female softball participants.

Table 52

ANOVA for Groups Within Female Softball Participants Regarding Orthorexia Risk Level

Source	*SS*	*df*	*MS*	*F*	*p*	η^2	*Power*
Model	385.062[a]	3	128.354	23.336	.000	.593	1.000
Intercept	58446.734	1	58446.734	10626.074	.000	.996	1.000
Class (C)	142.498	1	142.498	25.907	.000	.351	.999
Race (R)	34.952	1	34.952	6.354	.015	.117	.695
C x R	127.758	1	127.758	23.227	.000	.326	.997
Error	264.015	48	5.500				
Total	82574.000	52					
Corrected Total	649.077	51					

Since the interaction between race and academic classification was statistically significant [F (1, 48) = 23.227, p < .001], the main effects race [F (1, 48) = 6.345, p = .015] and academic classification [F (1, 48) = 25.907, p < .001] were ignored. After investigation of the marginal means, it was determined that non-African American upperclassmen have a significantly lower ORTO 15 score than all other factorial groups. This was because (as shown in Table 53) there was no overlap among the 95% confidence intervals of estimated marginal means among non-African American upperclassmen and all other groups. Hence, non-African American upperclassmen are at higher risk for ON than all other factorial groups in the statistical model.

Table 53

Softball ORTO 15 Estimated Marginal Means: Academic Classification Versus Race

			95% Confidence Interval	
	M	*SE*	Lower Bound	Upper Bound
		Underclassmen		
Black	41.211	.538	40.129	42.292
Other	43.000	1.173	40.642	45.358
		Upperclassmen		
Black	41.000	.606	39.782	42.218
Other	35.286	.627	34.025	36.546

The profile plots detail a decreasing ORTO 15 score among softball athletes belonging to racial groups other than Blacks. Estimated marginal means among African American softball athletes resided right at the risk level deemed to be at risk for ON. Figure 5 shows the interaction profile plot.

Women's Volleyball. The predictor variables race [F (1, 19) = 3.761, p = .067], institution [F (2, 18) = .553, p = .585], year of eligibility [F (2, 18) = 1.081, p = .360], and academic classification [F (1, 19) = 2.151, p = .159] all lacked statistical significance. Thus, the ON risk level did not differ among groups within the female volleyball population from a one-way perspective in this study.

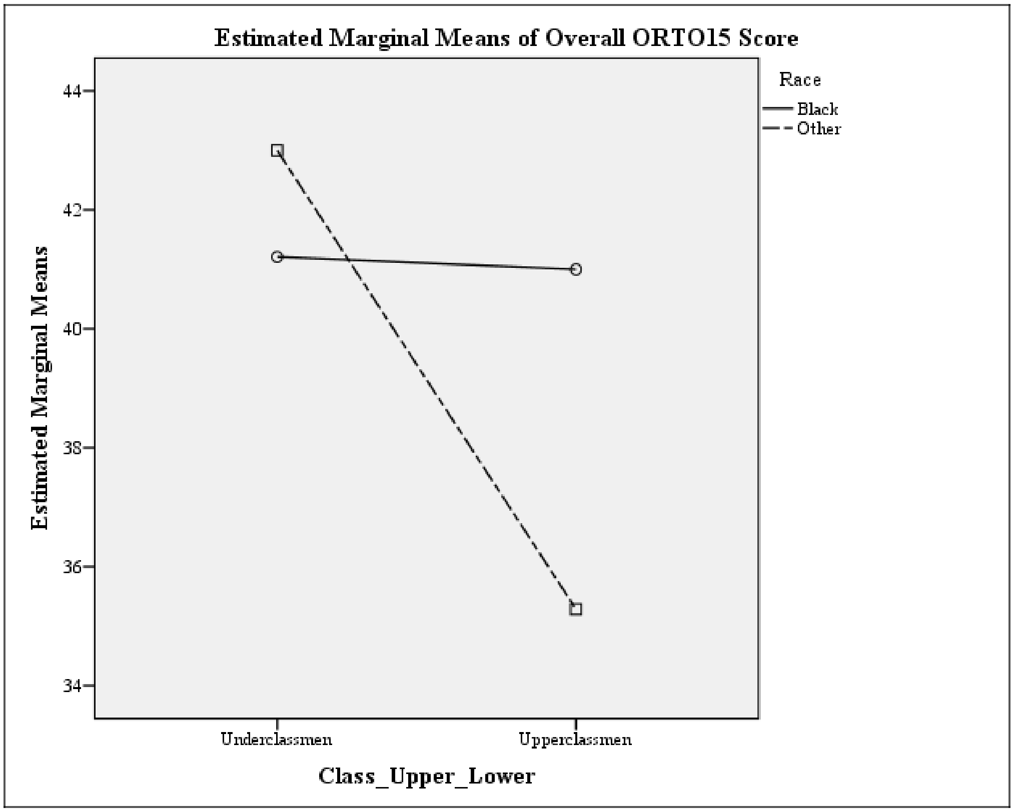

Figure 5. Race x academic classification profile plot for female softball participants

After an extensive examination of variables, the combination of race and academic classification explained most of the variation in ON risk level among female volleyball participants. Interpretation of the factorial design did not take place because of inadequate factorial group sample sizes. Table 54 shows the results of the one-way analyses.

Table 54

Women's Volleyball Orthorexia Nervosa One-Way ANOVA Analyses

Variable	*F*	(df_{btw}, $df_{w/in}$)	*p*	$R^2_{Adj.}$	*Power*
Race	3.761	(1, 19)	.067	.121	.453
Institution	.553	(2, 18)	.585	.047	.127
Year of eligibility	1.081	(2, 18)	.360	.008	.210
Academic classification	2.151	(1, 19)	.159	.054	.286

Regression is the statistical model of choice to determine variation of ON risk level among female volleyball participants because age [r (21) = .531, p = .017] and BMI [r (21) = -.717, p < .001] were significantly correlated with women volleyball participants' ORTO 15 score. Therefore, the predictor variables investigated were BMI and age. The outcome variable in this statistical model was ON risk level.

The statistical model showed a statistically significant negative relationship with age and a significantly positive relationship with BMI, F (2, 18) = 22.397, p <.001. According to the regression model, a 1-unit increase in BMI lowers ON risk level 1.83 units' and 1 unit increase in age increases ON risk level 5.54 units. This model explained 71% (R^2_{Adjusted} = .681) of the variance in ON risk level among female volleyball participants. Table 55 shows the results of the linear regression.

Table 55

Regression ANOVA Table: BMI and Age Versus Orthorexia Nervosa Risk Level Among Volleyball Athletes

Model	*SS*	*df*	*MS*	*F*	*p*
Regression	1786.906	2	893.453	22.397	<.001
Residual	718.046	18	39.891		
Total	2504.952	20			

Note: ON Risk Level = 1.829(BMI) -5.544(Age) + 76.813

*Females in Other Sports***.** The predictor variables race [F (1, 36) = .248, p = .621] and institution [F (3, 34) = 1.842, p = .158] both lacked statistical significance. Year of eligibility [F (3, 34) = 3.219, p = .035] and academic classification [F (3, 34) = 3.247, p = .034] were both statistically significant with the ON risk level among females that participate in sports other than track, soccer, softball, and volleyball. Thus, the ON risk level of the groups within year of eligibility and academic classification differed among female subjects this study.

After an examination of all possible factorial designs, the one-way ANOVA analyses were the best model of investigation among female participants from other sports. Discussion of a one-way ANOVA with academic classification was preferred over year of eligibility due to its marginal increase of statistical significance. Table 56 shows the results of the one-way analyses.

Table 56

Females in Other Sports Orthorexia Nervosa One-Way ANOVA Analyses

Variable	*F*	$(df_{btw}, df_{w/in})$	*p*	$R^2_{Adj.}$	*Power*
Race	.248	(1, 36)	.621	.021	.077
Institution	1.842	(3, 34)	.158	.064	.435
Year of eligibility	3.219	(3, 34)	.035	.152	.690
Academic classification	3.247	(3, 34)	.034	.154	.694

The predictor variable of this one way ANOVA model was academic classification and the outcome variable in this statistical model was ON risk. See Table 57 for the means and standard deviations of ORTO 15 score as a function of year of eligibility and institution.

Table 57

Means and Standard Deviations of Females in Other Sports ORTO 15 Score

Class	*M*	*SD*	*n*
Freshman	37.33	3.939	12
Sophomore	38.36	1.120	11
Junior	39.73	2.832	11
Senior/Grad	42.00	1.826	4

Academic classification [F (3, 34) = 3.247, p = .034] explained approximately 22% of the variance in ON risk level among female subjects that participate in other sports. Bonferroni post hoc analysis revealed that senior female athletes had significantly higher ORTO 15 scores compared to freshmen ($M_{i\text{-}j}$ = 4.67, $SE_{i\text{-}j}$ = 1.64, p = .044). Therefore, senior female subjects who participate in sports other than track, soccer, softball, and volleyball are at lower risk for ON than freshman subjects who participate in sports other than track, soccer, softball, and volleyball. Table 58 and Table 59 display a summary of all analyses calculated to report research question four.

Table 58

Reported p Values for Research Question Three With Eating Disorder Risk Level as Outcome

	Main Effects				Covariates		
Sport	Race (R)	Location (L)	Eligibility (E)	Classification (C)	Age	BMI	Interaction
Men's Track	n.s.	n.s	n.s.	n.s.	n.s.	.005	n.s.
Football	n.s.	n.s.	.038	n.s.	n.s.	n.s.	n.s.
Baseball	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Men's Other	n.s.	n.s.	n.s.	n.s.	n.s.	<.001	n.s.
Women's Track	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Women's Soccer	n.s.	n.s.	.007	.007	n.s.	n.s.	n.s.
Softball	<.001	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

Table 58

Sport	Race (R)	Location (L)	Eligibility (E)	Classification (C)	Age	BMI	Interaction
	Main Effects				Covariates		
Women's Volleyball	<.001	n.s.	n.s.	<.001	.037	n.s.	R x C
Women's Other	.006	n.s.	n.s.	.013	n.s.	n.s.	n.s.

Note: n.s. = not statistically significant

Table 59

Reported p values for Research Question Three with Orthorexia Risk Level as Outcome

Sport	Race (R)	Location (L)	Eligibility (E)	Classification (C)	Age	BMI	Interaction
	Main Effects				Covariates		
Men's Track	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Football	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Baseball	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Men's Other	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Women's Track	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Women's Soccer	n.s.	n.s	.005	.005	n.s	n.s	n.s.
Softball	.015	n.s.	n.s.	<.001	n.s.	n.s.	R x C

Table 59 (con't)

	Main Effects				Covariates		
Sport	Race (R)	Location (L)	Eligibility (E)	Classification (C)	Age	BMI	Interaction
Women's Volleyball	n.s.	n.s.	n.s.	n.s.	<.001	<.001	n.s.
Women's Other	n.s.	n.s.	.035	.034	n.s.	n.s.	n.s.

Note: n.s. = not statistically significant

Research questions six through eight: Are African American HBCU athletes' attitudes, norms, and perceived control toward disordered eating dietary behavior related to their intention to engage in disordered eating behavior? The purpose of these research questions was to determine influences on HBCU athletes' intentions to engage in disordered eating. Predictors of interest included attitude, social norms, food avoidance control, binge eating control, and self-control. Covariates analyzed were age and BMI. Though a previous chi square analysis [$\chi 2$ (1, N = 427) = 2.213, p = .137] revealed that there were no significant differences between gender and intentions to engage in disorder eating; differences were examined among influences of intentions to engage in disordered eating. Therefore, there were separate statistical models for male participants and female participants. Logistic regression was the statistical model used for these three research questions.

Male Athletes. The null model (without predictors or covariates) successfully predicted 62% of male participants' intention to engage in disordered eating. Inclusion of predictors and covariates accurately predicted 67% of participant's intention to engage in disordered eating status. Thus, the predictors added an additional 5% value to the logistical model.

The logistic regression omnibus tests of model coefficients revealed [χ^2 (7) = 27.290, p < .001] that at least one predictor or covariate was significantly related to male subjects' intentions to engage in disordered eating. As shown in Table 60, attitude was the only predictor significantly related to intention to engage in disordered eating, χ^2_{Wald} (1) = 7.911, p = .005. The negative sign on attitude's beta weight showed that male participants that conveyed an attitude more paralleled with unhealthy dietary behavior were more likely to have intentions to engage in disordered eating.

Table 60

Male Athlete's Logistic Analysis for Intentions

							Odds 95% CI	
	β	*SE*	χ^2_{Wald}	*df*	*p*	*Odds*	*LL*	*UL*
Attitude	-.253	.090	7.911	1	.005	.776	.651	.926
Norms	.067	.066	1.015	1	.314	1.069	.939	1.217
Avoid Control	.172	.212	.661	1	.416	1.188	.784	1.799
Binge Control	-.318	.187	2.895	1	.089	.727	.504	1.050

Table 60 (con't).

							Odds 95% CI	
	β	*SE*	χ^2_{Wald}	*df*	*p*	*Odds*	*LL*	*UL*
Self-control	-.027	.107	.065	1	.799	.973	.789	1.200
Age	.080	.114	.493	1	.483	1.083	.866	1.355
BMI	.043	.031	1.859	1	.173	1.044	.981	1.110
Constant	-2.657	2.650	1.005	1	.316	.070		

Females. The null model (without predictors or covariates) successfully predicted 55% of female subjects' intention to engage in disordered eating. Inclusion of predictors and covariates accurately predicted 79% of female participants' intention to engage in disordered eating.

Therefore, the predictors added an additional 24% value to the statistical model without any predictors.

The logistic regression omnibus tests of model coefficients revealed that at least one predictor or covariate was significantly related to the female participants' intentions to engage in disordered eating, χ^2 (7) = 92.178, p < .001. As displayed in Table 61, attitude [χ^2_{Wald} (1) = 10.250, p = .001], avoidance control [χ^2_{Wald} (1) = 9.547, p = .002], binge control [χ^2_{Wald} (1) = 3.907, p = .048], BMI [χ^2_{Wald} (1) = 32.626, p < .001], and age [χ^2_{Wald} (1) = 4.170, p = .041] were significantly related to intention to engage in disordered eating.

Table 61

Female Athlete's Logistic Analysis for Intentions

							Odds 95% CI	
	β	*SE*	χ^2_{Wald}	*df*	*p*	*Odds*	*LL*	*UL*
Norms	-.167	.123	1.837	1	.175	.846	.664	1.077
Attitude	-.371	.116	10.250	1	.001	.690	.550	.866
Binge control	-.530	.268	3.907	1	.048	.589	.348	.996
Avoid control	.997	.323	9.547	1	.002	2.710	1.440	5.101
Self-control	-.168	.169	.989	1	.320	.845	.606	1.178
BMI	.348	.061	32.626	1	.000	1.416	1.257	1.596
Age	.365	.179	4.170	1	.041	1.440	1.015	2.043
Constant	-15.479	4.152	13.901	1	.000	.000		

Attitude and binge control's beta weight shows that female participants' attitudes more aligned with unhealthy dietary habits were more likely to engage in disordered eating. The opposite was true with avoidance control where those who avoided consumption of food when hungry were less likely to engage in disordered eating. A 1-unit increase in BMI increased the likelihood of female participants engaging in disordered eating by 41.6%. A 1-unit increase in age increased the likelihood of female participants engaging in disordered eating by 44.0%.

Figure 6 and Figure 7 provide visual depictions of research question five through seven's results.

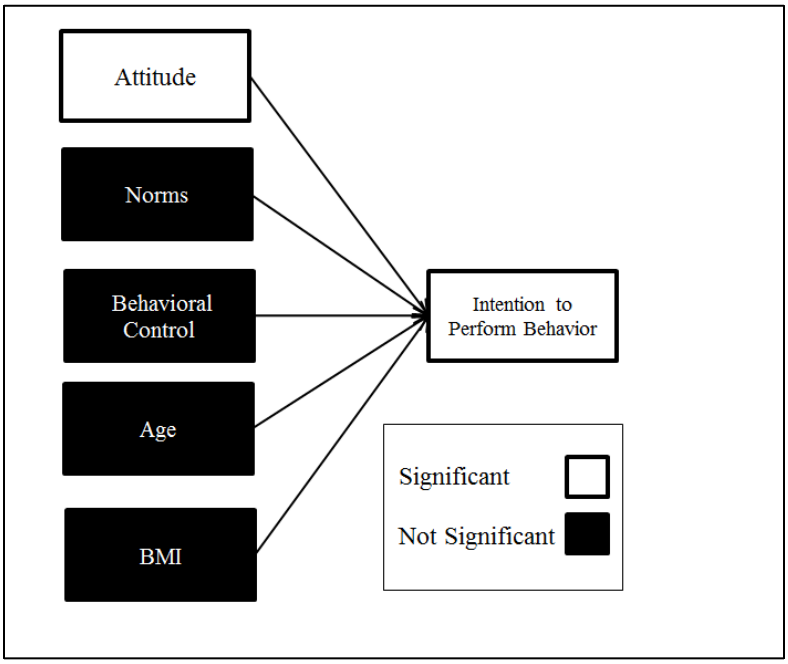

Figure 6. Male participants' TPB logistic regression results.

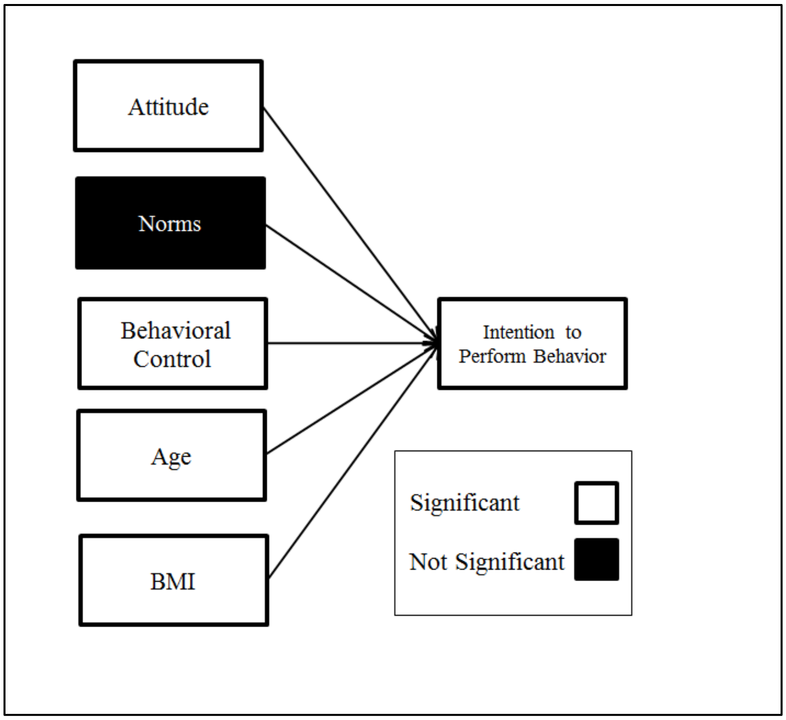

Figure 7. Female participants' TPB logistic regression results.

Research question nine: Are there significant differences between participants' ideal body stature and perceived body stature? Are there group differences between the HBCU student-athlete population with respect to ideal body stature and perceived body stature?

Before analysis of body stature differences was conducted, self-reported BMI and perceived BMI were compared to determine if there were differences between the two. Significant differences between the 95% confidence intervals of self-reported BMI and perceived BMI occurred among African American males [t(201) = 14.940, p < .001], non-African-American males [t(36) = 4.994, p < .001], and non-African American females [t(57) = 5.978, p < .001]. As a group, African American females accurately selected silhouettes on the figural stimuli that represented their self-reported BMI, t(129) = -.127, p = .889. Table 62 displays the comparison of self-reported BMI and perceived BMI among subjects.

Table 62

Comparison of Self-Reported BMI to Perceived BMI

	Gender								
	Self-Reported BMI				Perceived BMI				
	M	*SD*	*LL*	*UL*	*M*	*SD*	*LL*	*UL*	*n*
African American Males	28.26	4.74	27.61	28.91	24.87	3.11	24.44	25.30	202
Non-African American Males	26.57	5.98	24.64	28.50	22.89	2.18	22.19	23.59	37
African American Females	25.42	5.43	24.49	26.35	25.46	3.27	24.90	26.02	130
Non-African American Females	24.65	3.03	23.87	25.43	22.71	1.84	22.24	23.18	58

Note: BMI calculated from self-reported weight and height. Perceived BMI Represents selected silhouette in figural stimuli.

An outcomes-samples *t*-test determined differences between participants' perceived body stature and their ideal body stature within the HBCU population. For African American male participants, the results were not statistically significant [t (201) = .322, p = .748], indicating that their selected perceived silhouette (M = 3.96, SD = 1.04) was marginally lower than their ideal body stature (M = 3.98, SD = .57). The 95% confidence interval for the mean difference between the two body statures was [-.10, .14].

The non-African American male subjects' results were also not statistically significant [t (36) = 1.540, p = .132], indicating that their selected perceived silhouette (M = 3.76, SD = 1.09) was marginally lower than their ideal body stature (M = 3.97, SD = .64). The 95% confidence interval for the mean difference between the two body statures was [-.06, .50].

For African American female participants, the results indicated that perceived body silhouette (*M* = 4.15, *SD* = 1.09) was significantly higher [*t* (129) = -8.127, *p* < .001] than their ideal body silhouette (*M* = 3.46, *SD* = .60). The 95% confidence interval for the mean difference between the two body statures was [-.86, -.52]. The non-African American female subjects' results also indicated that perceived body silhouette (*M* = 3.95, *SD* = .60) was significantly higher [*t* (57) = -9.734, *p* < .001] than their ideal body silhouette (*M* = 3.14, *SD* = .08). The 95% confidence interval for the mean difference between the two body statures was [-.98, -.64].

A repeated measures ANOVA was used to investigate group differences between African American male participants' selected perceived and ideal body silhouettes. Groups of interest included institution, year of eligibility, academic classification, and BMI. Among male participants, institution [*F* (3, 198) = 1.168, *p* = .323], year of eligibility [*F* (3, 198) = 2.280, *p* = .081], and academic classification [*F* (3, 198) = 2.569, *p* = .056] all lacked statistical significance. The predictor BMI [*F* (2, 199) = 28.214, *p* < .001] was statistically significant. Table 63 shows the repeated measures analyses calculated.

Table 63

African American Male Body Stature Differences Repeated Measures ANOVA Analyses

Variable	*F*	$(df_{btw}, df_{w/in})$	*p*	η^2	*Power*
Institution	1.168	(3, 198)	.323	.017	.311
Year of eligibility	1.280	(3, 198)	.081	.041	.516
Academic classification	2.569	(3, 198)	.056	.037	.626
BMI	28.214	(2, 199)	<.001	.222	.998

Investigation of the marginal means and confidence intervals determined that normal weight and obese African American male subjects reported significant differences between ideal and perceived body silhouettes. Normal weight African American male participants desired to have a significantly larger body stature, while obese African American male subjects desired to have a significantly smaller body stature. The data display no overlap among the 95% confidence interval of estimated marginal means among overweight African American males' ideal body silhouette and perceived body silhouette. Table 64 shows the estimated marginal means. Observation of the profile plots (Figure 8) shows a visual of the aforementioned results.

Table 64

African American Male Estimated Marginal Means: BMI Versus Silhouette Differences

			95% CI	
Silhouette	*M*	*SE*	*LL*	*UL*
		Normal (n = 53)		
Ideal	3.755	.070	3.617	3.892
Perceived	3.264	.110	3.048	3.480
		Overweight (n = 91)		
Ideal	3.846	.053	3.741	3.951
Perceived	3.714	.084	3.549	3.879
		Obese (n = 58)		
Ideal	4.379	.067	4.248	4.511
Perceived	4.966	.105	4.759	5.172

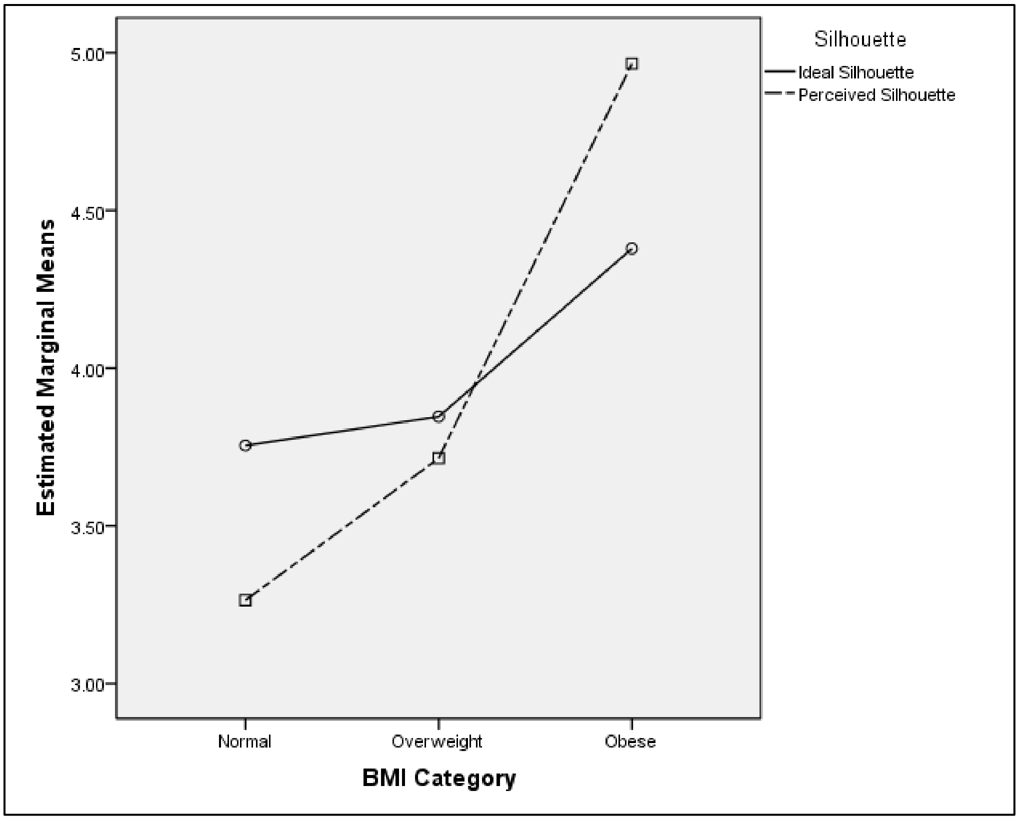

Figure 8. BMI versus silhouette differences profile plot for African American male participants.

A repeated measures ANOVA was used to investigate group differences between non-African American male participants' selected perceived and ideal body silhouettes. Groups of interest included institution, year of eligibility, academic classification, and BMI. Among male participants, institution [F (3, 33) = .574, p = .636], year of eligibility [F (3, 33) = .282, p = .838], and academic classification [F (3, 33) = .407, p = .749] all lacked statistical significance. The predictor BMI [F (2, 199) = 28.214, p < .001] was statistically significant. Table 65 shows the repeated measures analyses calculated.

Table 65

Non-African American Male Body Stature Differences Repeated Measures ANOVA Analyses

Variable	*F*	*(df btw, df w/in)*	*p*	η^2	*Power*
Institution	.574	(3, 33)	.636	.050	.155
Year of eligibility	.282	(3, 33)	.838	.025	.098
Academic classification	.407	(3, 33)	.749	.036	.122
BMI	12.868	(2, 34)	<.001	.431	.995

Investigation of the marginal means and confidence intervals determined that normal weight non-African American male subjects reported significant differences between ideal and perceived body silhouettes. Normal weight non-African American male participants desired to have a significantly larger body stature. The data display no overlap among the 95% confidence interval of estimated marginal means among overweight and obese non-African American males' ideal body silhouette and perceived body silhouette. Table 66 shows the estimated marginal means. Observation of the profile plots (Figure 9) shows a visual of the aforementioned results.

Table 66

Non-African American Male Estimated Marginal Means: BMI versus Silhouette Differences

			95% CI	
Silhouette	*M*	*SE*	*LL*	*UL*
		Normal (*n* = 16)		
Ideal	3.875	.137	3.596	4.154
Perceived	3.062	.185	2.686	3.439
		Overweight (*n* = 17)		
Ideal	3.824	.133	3.553	4.094
Perceived	3.941	.180	3.576	4.306

Table 66 (con't)

			95% CI	
Silhouette	*M*	*SE*	*LL*	*UL*
		Obese (*n* = 4)		
Ideal	5.000	.274	4.443	5.557
Perceived	5.750	.370	4.998	6.502

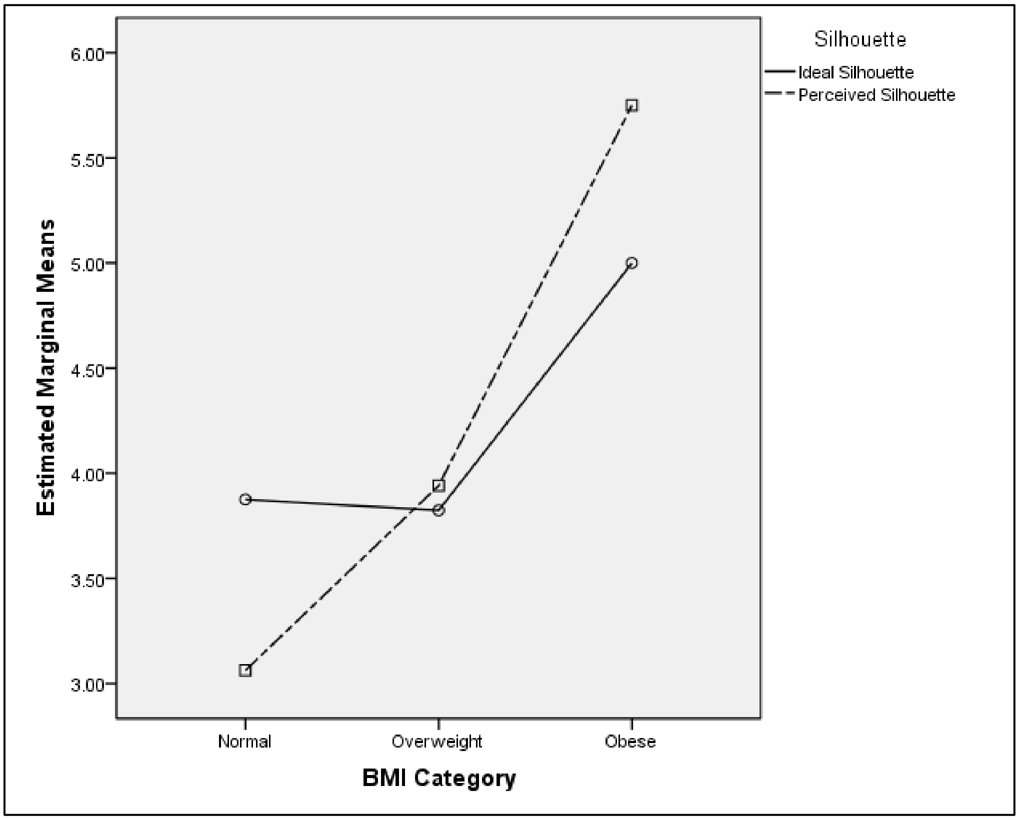

Figure 9. BMI versus silhouette differences profile plot for non-African American male participants

Among African American female participants, institution [*F* (3,126) = 1.154, *p* = .330] lacked statistical significance as a function of the outcome variable. Year of eligibility [*F* (3, 126) = 5.110, *p* = .008], academic classification [*F* (3, 126) = 3.949, *p* = .010], and BMI [*F* (2, 126) = 51.924, *p* < .001] were statistically significant. Table 67 shows the repeated measures analyses calculated.

Table 67

African American Female Body Stature Differences Repeated Measures ANOVA Analyses

Variable	*F*	(df_{btw}, $df_{w/in}$)	*p*	η^2	*Power*
Institution	1.154	(3, 126)	.330	.027	.305
Year of eligibility	5.110	(3, 126)	.008	.089	.839
Academic classification	3.949	(3, 126)	.010	.086	.822
*BMI	51.924	(2, 126)	<.001	.452	1.000

Note: Analysis excluded the only underweight observation in the model to permit further analysis

Investigation of the marginal means and confidence intervals determined that 1st-year and 4th-year or higher African American female subjects reported significant differences between ideal and perceived body silhouettes. First-year and 4th-year or higher African American female participants desired to have a significantly smaller body stature. The data display no overlap among the 95% confidence interval of estimated marginal means among second and third year African American females' ideal body silhouette and perceived body silhouette. Table 68 shows the estimated marginal means. Observation of the profile plots (Figure 10) shows a visual of the aforementioned results.

Table 68

African American Female Estimated Marginal Means: Year of Eligibility Versus Silhouette Differences

			95% CI	
Silhouette	*M*	*SE*	*LL*	*UL*
		First Year (*n* = 55)		
Ideal	3.473	.081	3.313	3.633
Perceived	4.109	.143	3.826	4.392
		Second Year (*n* = 31)		
Ideal	3.355	.108	3.142	3.568
Perceived	3.806	.191	3.429	4.184

Table 68 (con't)

Silhouette	*M*	*SE*	*95% CI* *LL*	*UL*
		Third Year (n = 26)		
Ideal	3.615	.118	3.383	3.848
Perceived	4.231	.208	3.819	4.643
		Fourth Year or Higher (n = 18)		
Ideal	3.389	.141	3.109	3.668
Perceived	4.778	.250	4.283	5.273

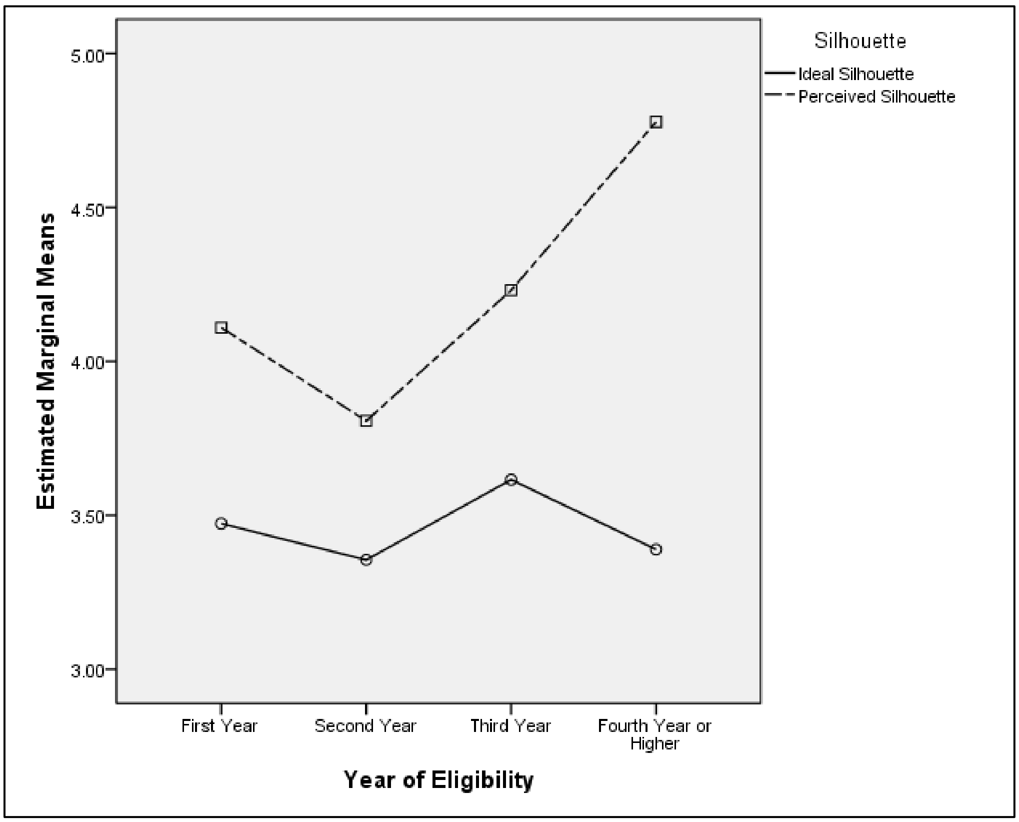

Figure 10. Year of eligibility versus silhouette differences profile plot for African American female participants

Investigation of the marginal means and confidence intervals determined that freshman and senior/graduate African American female subjects reported significant differences between ideal and perceived body silhouettes. Freshman and senior/graduate African American female participants desired to have a significantly smaller body stature. The data display no overlap among the 95% confidence interval of estimated marginal means among second and third year African American females' ideal body silhouette and perceived body silhouette. Table 69 shows the estimated marginal means. Observation of the profile plots (Figure 11) shows a visual of the aforementioned results.

Table 69

African American Female Estimated Marginal Means: Academic Classification Versus Silhouette Differences

			95% CI	
Silhouette	*M*	*SE*	*LL*	*UL*
Freshman (*n* = 47)				
Ideal	3.447	.088	3.273	3.621
Perceived	4.064	.155	3.757	4.370
Sophomore (*n* = 39)				
Ideal	3.410	.097	3.219	3.601
Perceived	3.923	.170	3.587	4.260
Junior (*n* = 24)				
Ideal	3.583	.123	3.340	3.827
Perceived	4.167	.217	3.738	4.596
Senior or Graduate Student (*n* = 20)				
Ideal	3.450	.135	3.183	3.717
Perceived	4.800	.237	4.330	5.270

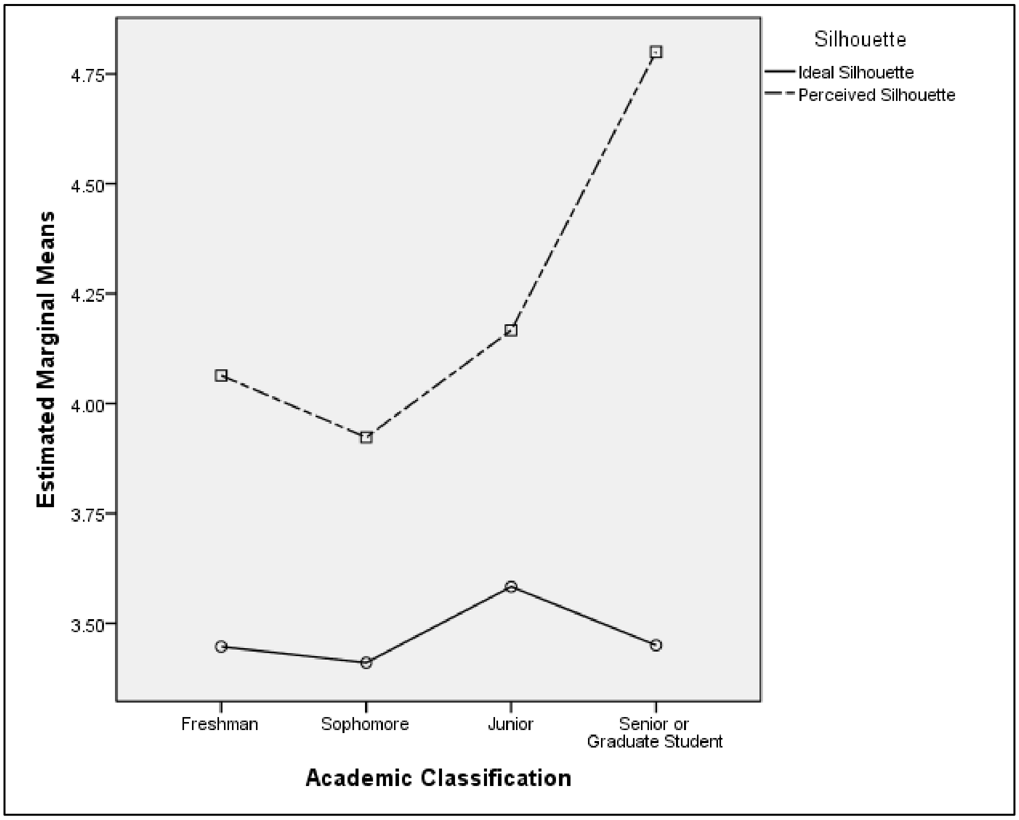

Figure 11. Academic classification versus silhouette differences profile plot for African American female participants

Investigation of the marginal means and confidence intervals determined that normal weight, overweight, and obese African American female subjects reported significant differences between ideal and perceived body silhouettes. All the aforementioned groups desired to have a significantly smaller body stature. Table 70 shows the estimated marginal means. Observation of the profile plots (Figure 12) shows a visual of the aforementioned results.

Table 70

African American Female Estimated Marginal Means: BMI Versus Silhouette Differences

			95% CI	
Silhouette	*M*	*SE*	*LL*	*UL*
		Normal (n = 79)		
Ideal	3.329	.064	3.202	3.456
Perceived	3.620	.076	3.470	3.771
		Overweight (n = 27)		
Ideal	3.519	.110	3.302	3.735
Perceived	4.259	.130	4.002	4.517
		Obese (n = 23)		
Ideal	3.870	.119	3.635	4.104
Perceived	5.913	.141	5.634	6.192

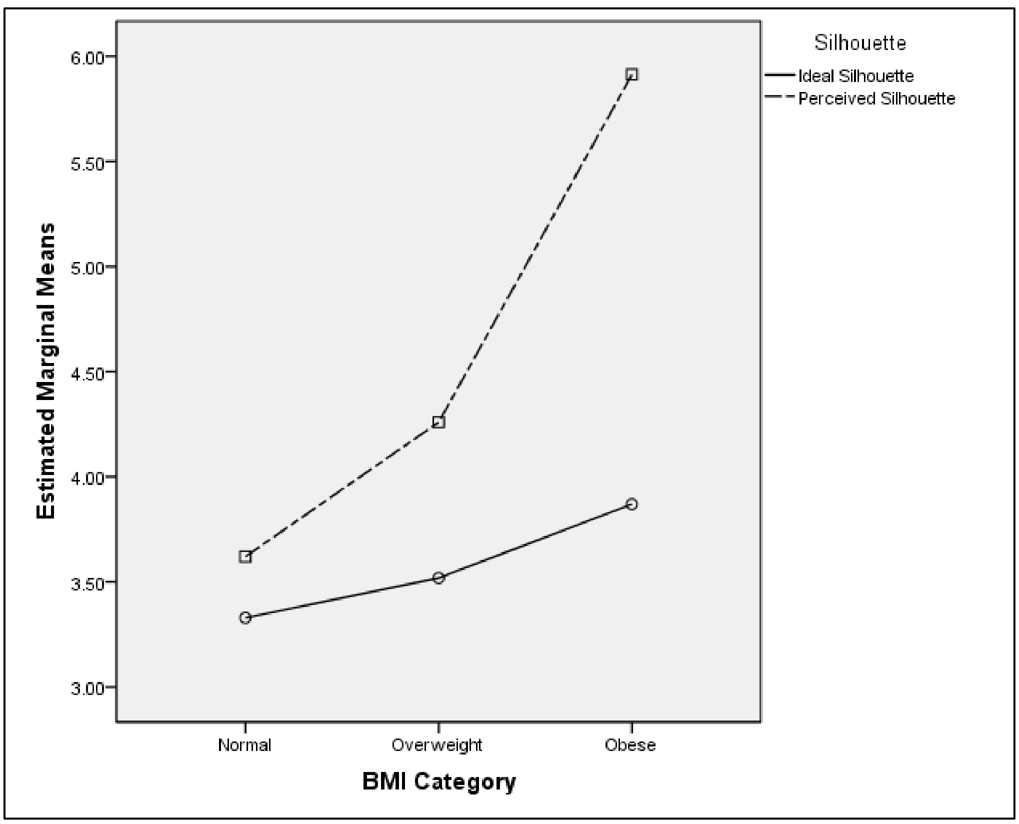

Figure 12. BMI versus silhouette differences profile plot for African American female participants

Among non-African American female participants, institution [F (3, 54) = 1.263, p = .296] lacked statistical significance as a function of the outcome variable. Year of eligibility [F (3, 54) = 2.612, p = .061], academic classification [F (3, 54) = 2.457, p = .072], and BMI [F (2, 54) = 5.453, p = .007] were statistically significant. Table 71 shows the repeated measures analyses calculated.

Table 71

Non-African American Female Body Stature Differences Repeated Measures ANOVA Analyses

Variable	F	(df_{btw}, $df_{w/in}$)	p	η^2	*Power*
Institution	1.263	(3, 54)	.296	.066	.319
Year of eligibility	2.612	(3, 54)	.061	.128	.614
Academic classification	2.457	(3, 54)	.072	.108	.573
*BMI	5.453	(2, 54)	.007	.168	.828

Note: Analysis excluded the only underweight observation in the model to permit further analysis.

Investigation of the marginal means and confidence intervals determined that normal weight, overweight, and obese non-African American female subjects reported significant differences between ideal and perceived body silhouettes. All the aforementioned groups desired to have a significantly smaller body stature. Table 72 shows the estimated marginal means. Observation of the profile plots (Figure 13) shows a visual of the aforementioned results.

Table 72

Non-African American Female Estimated Marginal Means: BMI Versus Silhouette Differences

			95% CI	
Silhouette	*M*	*SE*	*LL*	*UL*
		Normal (*n* = 35)		
Ideal	3.000	.047	2.905	3.095
Perceived	3.686	.082	3.522	3.850
		Overweight (*n* = 17)		
Ideal	3.471	.068	3.334	3.607
Perceived	4.353	.117	4.118	4.588
		Obese (*n* = 5)		
Ideal	3.000	.125	2.749	3.251
Perceived	4.600	.216	4.166	5.034

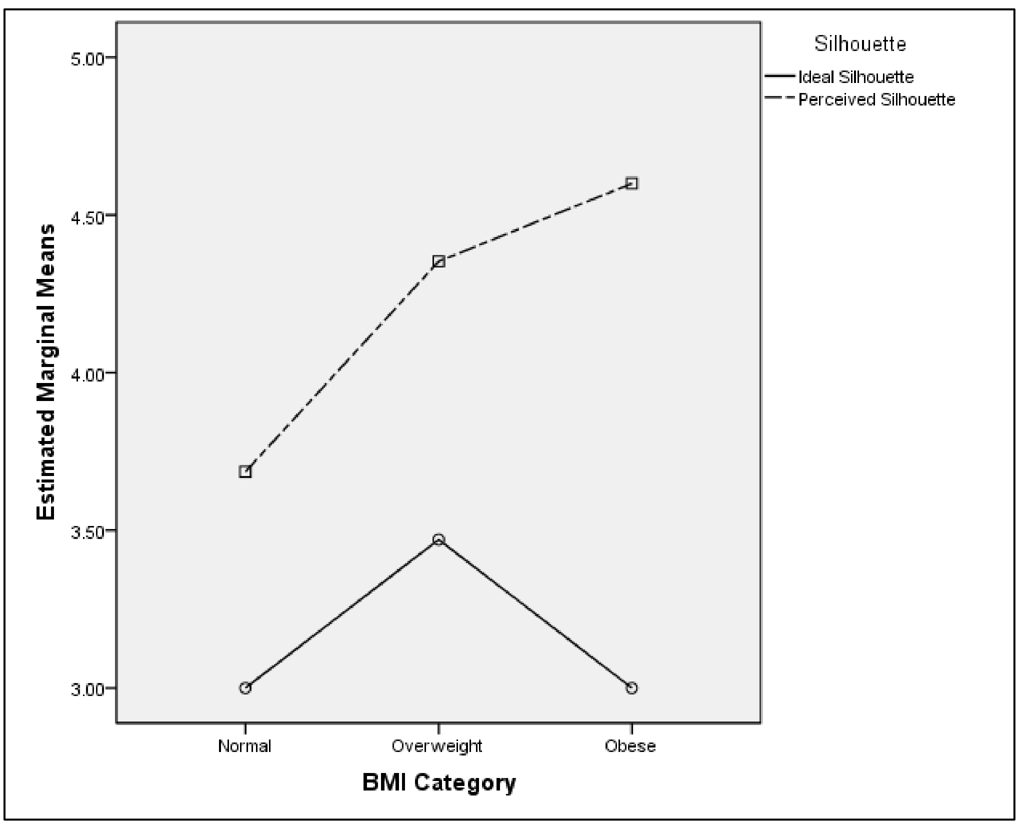

Figure 13. BMI versus silhouette differences profile plot for non-African American female participants

CHAPTER V

DISCUSSION

Chapter V elaborates on the practical interpretation of the study results. This occurs through a summary of the study's purpose, a detailed discussion of each research question's major results and its relationship with the literature as described in Chapters I and II, overall implications of the study findings to the public health field, and directions for future research.

Purpose of the Study

The purpose of this study was to investigate at-risk populations for dietary and exercise conditions among HBCU athletes. ED, ON, and ExD risk levels were assessed along with perceptions of body stature. This study also analyzed the magnitude of norms, attitudes, and control influences on intentions to engage in disordered eating among student-athletes at HBCUs through conceptual application of the TPB. This study was accomplished by disseminating a battery of surveys to 601 varsity level athletes enrolled at HBCUs, of which 71% (N = 427) were used in the analysis.

Though previous studies on EDs report marginal prevalence rates among athletes at the DSM-IV TR clinical level (DePalma et al., 2002; Johnson et al., 1999), prevalence rates for individuals at risk among athlete populations ranged from 8% to 30% (Greenleaf et al., 2009; Johnson et al., 1999; Petrie et al., 2008). Findings in the literature show that college varsity athletes in men's/women's track, wrestling, women's volleyball, and women's gymnastics are at increased risk of EDs compared to the general population (Davis et al., 1994; DePalma et al., 2002; Garner et al., 1998; Johnson et al., 1999; Kleifield et al., 1996; Skolnick, 1993; Smolak et al., 2000; Thiel et al., 1993a, 1993b). Currently warranted are analyses of ED risk levels as they pertain to African American athletes.

Previous studies on ON prevalence rates are limited among not only athletes, but also the American population in general. Most of ON's literature involves participants from European nations. The differing populations in current ON literature influenced the increased variability in the documented prevalence rates of 6.9% - 45.5% (Bağci Bosi et al., 2007; Donini et al., 2004). Bratman (2001) argued that ON leads to physiological results similar to anorexia nervosa. This suspected result illustrates the need for this study to examine this newly identified condition.

According to the literature, athletes are at increased risk for developing symptoms of ExD (Blaydon & Lindner, 2002; Yates et al., 2003). Reported prevalence rates of ExD were 3.1% to 46% among athletes (Blaydon & Linder, 2002; Hausenblas & Downs, 2002b; Ogden et al., 1997; Zmijewski & Howard, 2003). The variation in prevalence is due to the different instruments and *a priori* thresholds used to determine ExD. Like EDs and ON, African American subjects lack presence in ExD literature.

Currently, there is a paucity of in-depth studies examining EDs, ON, and ExD among athletes in the African American population. There is also limited research available on the prevalence and risk level of ON concerning in the American population in general. This study will mitigate these research gaps and contribute to the literature on emerging topics in poorly investigated populations.

Research Question One: What is the Prevalence Rate Among Athletes Enrolled at HBCUs for Eating Disorder Risk, Exercise Dependence Risk, and Orthorexia Nervosa Risk?

Eating disorder. The ED risk prevalence rate (10.8%) is significantly greater than that of the general US population as reported by the National Institutes of Mental Health, but within the range 8% to 38% of athletes at risk (subclinical level) in other studies using athletic populations (Greenleaf et al., 2009; Johnson et al., 1999; Petrie et al., 2008). It is important to note that some studies investigating EDs among the US athlete population were limited in sport, ethnic, and gender diversity. Some prevalence rates of ED risk in the literature included a disproportionate number of subjects documented to be at increased risk, which resulted in reported rates beyond what is expected from general athlete populations. As a result, the variability of prevalence rates in these studies investigating EDs is broad.

Johnson et al.'s (1999) study of 1,445 NCAA student-athletes revealed a bulimia nervosa at-risk prevalence of 38% and an anorexia nervosa at-risk prevalence of 19.32%. This percentage of subjects at risk for anorexia nervosa is almost double the ED at-risk prevalence rate found in the present study (10.8%). The survey used in this study (EAT-26) does not differentiate bulimia nervosa from anorexia nervosa. Johnson et al. study used the EDI 2, which differentiates those at risk for anorexia nervosa from bulimia nervosa. Since the EDI 2 and EAT-26 are instruments with different factors that measure the same outcome, it is conceivable that variation in the prevalence rates of this study and Johnson et al.'s are due to the differing methods of measuring being at risk for an ED.

Milligan and Pritchard's (2006) study of 176 Division I student athletes from the NCAA's Western Athletic Conference produced an ED at-risk prevalence rate of 26% using the EAT-26. The Western Athletic Conference institutional membership list does not encompass any HBCUs. Milligan and Pritchard's sample was 90% Caucasian. Since both studies used the same instrument to measure ED risk, there is evidence that student-athletes enrolled in HBCUs are at decreased risk for an ED compared to student-athletes enrolled at non-HBCUs. This argument is strengthened by the fact that Milligan and Pritchard's findings strongly paralleled the hypotheses of other ED scholars regarding populations at increased risk (DePalma et al., 2002; Johnson et al., 1999; Smolak et al., 2000).

Exercise dependence. The reported prevalence of ExD risk in this study (10.3%) was within the prevalence rates of other studies (Blaydon & Linder, 2002; Hausenblas & Downs, 2002b; Ogden et al., 1997; Zmijewski & Howard, 2003). Hausenblas and Downs reported ExD risk prevalence rates between 3.4% and 13.4% among US college and university students. Hausenblas and Downs (2002b) reported on four experiments involving 553 college and university students in which only one showed a prevalence beyond that in the present study. Therefore, there is evidence that HBCU student-athletes in this study have comparable ExD risk relative to the general college student population.

Blaydon and Linder’s (2002) study reached an overall ExD rate of 30.4% among its 203 Swiss triathlete participants. Similarly, McNamara's (2006) study of Australian athletes revealed an ExD risk prevalence rate of 40%. The higher rates in these two studies may be associated with the nationality of the subjects or the fact that both samples included professional athletes. Since there are very few studies in the literature that examine ExD among US collegiate athletes, it is plausible that there is not enough evidence to compare participants from different countries. The strongest argument based on findings is that professional athletes from other countries are at increased risk for ExD compared to HBCU student-athletes.

Of the 10.3% prevalence, over half (5.4%) are physiologically dependent (withdrawal and tolerance is present) to exercise. Analysis of particular questions (6 point Likert-type scale) in the Reduction in Other Activities construct of the EDS-21 revealed that when given an option to spend time with friends or exercise, most participants would rather spend time with family and friends. This construct had the lowest variability among all seven dimensions of the EDS-21.

Other studies using the EDS-21 (Hausenblas & Downs, 2002b; Zmijewski & Howard, 2003) revealed higher prevalence of reaching dependence and being symptomatic in the Reduction in Other Activities construct of the EDS-21. This helps explain that, although participants exercise for long durations for desired benefits, when given an option to exercise or spend time with a loved one, many will choose to spend time with family and friends. Therefore, it is conceivable that this increased desire to spend time with significant others serves as a protective factor for exercise dependence among HBCU student-athletes.

Orthorexia nervosa. The reported 66.3% prevalence of ON risk in this investigation surpasses those of other studies (Bağci Bosi et al., 2007; Donini, et al., 2004) using the ORTO 15. Donini et al. (2004) reported an ON prevalence of 6.9% in 404 Italian subjects, while Bağci Bosi and colleagues' (2007) study of 318 Turkish medical doctors found a prevalence of 45.5%. Donini et al (2004) originally designed the ORTO 15 in Italian. Both this study and the 2007 investigation by Bağci Bosi and colleagues used translated versions of the ORTO 15. It is tempting to suggest that the criteria to reach ON risk were compromised through translation and that this caused our rates to be higher. However, this is not likely since the ORTO 15 displayed adequate validity and reliability scores in all three studies.

On a 1 to 4-point scale per question, Questions 2, 12, and 14 had the lowest mean scores on the ORTO 15 (lower scores increase risk). Question 2 states, "When you go in a food shop do you feel confused?" The rationale of Donini and colleagues (2004) is that individuals at risk for ON are fully cognizant of the ingredients and options of food offered in restaurants and stores; hence, they are empowered to successfully engage in ON behavior. Question 12 states, "Do you think that consuming healthy food may improve your appearance?" Question 14 states "Do you think that on the market there is also unhealthy food?" The rationale of question 14 is similar to question 2 in that a subject has to be aware and fully informed of food options before choosing the “healthy” food of preference.

These mean score findings were similar to Bağcı Bosi and colleagues’ (2007) result where they concluded that subjects who examine food’s contents and its physiological effects are at increased risk for ON. Collectively, it appeared that most subjects in this study were aware of their healthy and unhealthy food options, while also understanding food’s influence on appearance.

In a study investigating EDs, DePalma and colleagues (1993) concluded that disordered eating is normative in some sport cultures. Since two-thirds of the subjects sampled in this study were at risk for the disordered eating pattern of orthorexia nervosa, it is plausible to believe that orthorexia dietary behavior is normative in the HBCU athlete population.

Research Question Two: Are There Relationships Between HBCU Student Athletes’ Prevalence for Being at Risk for an Eating Disorder, Exercise Dependence, and Orthorexia Nervosa?

When investigating the relationship between ED, ExD, and ON risk; those at risk for an ED are 5.87 times more likely to also be at risk for ExD, when compared to subjects not at risk for an ED. This association parallels that of other studies that have shown that disordered eating and ExD coexist among non-athlete college student subjects (O’Dea & Abraham, 2002; Zmijewski & Howard, 2003).

The association between ExD risk and ED risk was stronger for the HBCU student-athletes in this study than in previously published work (O'Dea & Abraham, 2002; Zmijewski & Howard, 2003). Though both O’Dea and Abraham and Zmijewski and Howard determined that ExD and ED risk are positively related, the relationships between the two conditions were only moderate in strength. Based on empirical findings and literature detailing athlete’s increased risk for ED and ExD individually (Blaydon & Lindner, 2002; DePalma et al., 1993, 2002; Johnson et al., 1999; Yates et al., 2003), it is conceivable that the magnitude of the relationship between ED risk and ExD is stronger in the HBCU student-athlete population when compared to the general college population.

Research Question Three: Are There Between Group Differences Within the HBCU Athletic Population for Prevalence Rates of Eating Disorder Risk, Exercise Dependence Risk, and Orthorexia Nervosa Risk?

At risk for an eating disorder.

Gender. Gender analysis revealed that the prevalence of females at risk (16.5%) was higher than males at risk (6.3%). This finding was consistent with other ED studies that found females to be at increased risk for an ED (Hudson et al., 2007; Johnson et al., 1999; Milligan & Pritchard, 2006). However, the ED risk prevalence rate among females in this study was lower than other studies examining female athletes in non-HBCU populations (Koszewski, & Romani, 2002; Garner et al., 1998; Johnson et al., 1999; Kleifield et al., 1996; Skolnick, 1993; Smolak et al., 2000; Thiel et al., 1993a).

Though several studies used a different survey to determine ED risk, studies that used the EAT-26 reported higher at-risk rates for females than was found in this investigation. Rogers-Wood and Petrie (2010), in a study examining disordered eating in African American females, concluded that their subjects were at decreased risk of ED because of African American social factors making them less likely to adopt general US societal ideals of beauty and attractiveness. Wood and Petrie's study also commented as an African American woman internalizes her culture more, the risk for ED lowers. This suggests that female student-athletes at HBCUs are at decreased risk for an ED when compared to females from non-HBCU populations.

The male prevalence in this study conflicts with the trends reported by Natenshon (1999), Cohn (2000), and Graham's (2004) study of male participants that did not include HBCU student-athletes or many African Americans. Natenshon, Cohn, and Graham suggested that male ED risk prevalence was increasing and was comparable to some female population rates. Not only were male ED risk rates from this study lower than female subjects, but they were also lower than the male prevalence rates of other studies examining ED risk among athletes (Johnson et al., 1999; Milligan & Pritchard, 2006; Sundgot-Borgen & Torstveit, 2004).

Over 70% of this study's male population participated in football. DePalma and colleagues' (1993) football participants doubled the ED at-risk prevalence in this study. Milligan and Pritchard's (2006) study involving collegiate student-athletes concluded that male participants of non-lean sports such as football are at lowest risk for ED when compared to male and female participants of lean sports; as well as female participants of non-lean sports. Therefore, male subjects, especially football athletes, from this study are at lower risk for an ED compared to student-athletes enrolled in non-HBCU institutions.

Institution. The finding of prevalence differences between institutions must be interpreted with care. Investigation of the data revealed that differences occurred because 60.6% of institution 1's subjects were female, and 71.4% of those who participated at institution 3 were male. Hence, gender served as a mediator for the predictor (institution) and outcome (at risk for ED) variables in this analysis.

Race. ED at-risk findings regarding race concluded that African American participants' prevalence (8.4%) was significantly lower than both Caucasian participants (20.8%) and those of other races (16.7%). The African American prevalence rate is barely within the confines of other prevalence rates reported in sport populations (Greenleaf et al., 2009; Johnson et al., 1999; Petrie et al., 2008).

It can be argued that these results provide evidence that Caucasians are at increased risk compared to other races (Hoek, 2006; Striegal-Moore & Smolak, 2000), but this interpretation must be made with greater care. There were only 53 Caucasian subjects in this study, and the behavior of Caucasian student-athletes at HBCUs could be different from those at non-HBCUs. On the surface, when comparing this study's African American prevalence (8.4%) to the increased Caucasian student-athlete ED at risk prevalence from other studies (Greenleaf et al., 2009; Johnson, Powers et al., 1999; Petrie et al., 2008), it is plausible to suggest that Caucasian student-athletes enrolled at non-HBCUs are at increased risk for an ED relative to HBCU participants from this study. Findings from gender analyses warranted deeper understanding of the relationship between ED risk and race. When controlling for gender's relationship on ED risk, race fails to maintain its significant relationship with ED risk. Therefore, gender influences the relationship between race and ED risk with Caucasian HBCU females being at greatest risk. This finding parallels other studies purporting Caucasian females to be at increased risk for ED risk (Hudson et al, 2007; Johnson et al., 1999; Milligan & Pritchard, 2006).

Sport. Subjects from female sports reported higher prevalence rates than participants in male sports. All female sport prevalence rates were above 13.5%, while only male subjects who participated in sports other than track, football, and baseball reported double-digit prevalence rates. Men's track participants reported a lower than expected prevalence rate (5.3%) considering it is identified as a sport at increased risk for an ED (DePalma et al., 2002; Johnson et al., 1999). Since there were 19 male track subjects in this study, care must be taken with inferential conclusions. Observation of confounding issues makes it a possibility that the prevalence rate was low because of male track subjects' BMI. Examination of male track subjects' BMI determined a likelihood of six subjects that participated in track events where lower body weight poses a competitive disadvantage (e.g., discus throw, shot put, etc). Since details of track event participation among track athletes were not collected in this study, confirmation of the previous statement cannot be made. The literature does state that the increased ED risk among track athletes applies to events where lean body figures provide a competitive advantage (DePalma et al., 2002; Johnson et al., 1999; Milligan & Pritchard, 2006).

Though not considered at increased risk in the literature, football players in this study reported a lower than expected prevalence (DePalma et al., 1993). As stated previously, it was suggested that male subjects as a whole were at lower risk for an ED compared to student-athletes enrolled in non-HBCU institutions because of the over-representation of football athletes in this study. It is important to note that DePalma and colleagues' sample of football student-athletes in their study encompassed a high proportion of lightweight athletes where lighter body statures conducive to speed serves as a competitive advantage. Though detail of football position was not collected in this study, examination of BMI makes it highly likely that there were a significant amount of heavier football student-athletes represented in this study. This suggests that lower prevalence of ED risk among football subjects in the study occurred because of a broader sample of football positions.

Though higher in sheer prevalence, women's track (13.5%) and women's volleyball (14.3%) failed to exhibit the statistically increased ED risk identified in other studies involving athletes (DePalma et al., 2002; Johnson et al., 1999). In their study of disordered eating and African American women, Rogers-Wood and Petrie (2010) concluded that African American women who strongly identify with their culture are less likely to internalize general US societal ideals of beauty and attractiveness. As a result, African American women who fully adopt their culture are at lower risk of EDs (Rogers-Wood & Petrie, 2010). Since female subjects of HBCUs are enrolled in institutions that have a disproportionate amount of African Americans compared to non-HBCUs, it is plausible to suggest that enrollment at an HBCU for African American female student-athletes serves as a protective factor against ED risk.

Academic classification. With respect to academic classification and ED risk, there were statistical differences, but this trend did not occur in an ordinal fashion. Therefore, the prevalence of those at risk for an ED did not increase or decrease from one academic classification to the next. When investigating gender as a function of academic classification, all classifications aside from sophomores (64% male, 36% female) had a relatively even mix of females and males. This increased proportion of males among the sophomore participants resulted in a dip in prevalence that eliminated chances of ordinal significance.

Although the literature has mixed reviews with respect to being at risk for an ED as a function of time, most studies examining subjects at risk for ED among college students fail to find perfect ordinal significance (Greenleaf et al., 2009; Milligan & Pritchard, 2006; Petrie et al., 2008). This means that the magnitude of HBCU subjects' risk for an ED in this study may be due to a mediating variable (e.g., race or gender), more so than a function of time. Unfortunately, data limitations did not allow log linear analysis for academic classification.

Engaged in disordered eating. Overall, 31.1% of participants engaged in disordered eating within 6 months of participating in this study, but there were no between group differences. Although disordered eating findings as they pertain to gender do not confirm Baum's (2006) conclusion regarding increased prevalence of ED among males, they do show that the level of engagement for males (33.9%) is comparable to females (27.7%). This suggests that ED behavior among HBCU male student-athletes is still worthy of attention although reported prevalence rates were low for being at risk (Baum, 2006; Cohn, 2000; Graham, 2004).

The prevalence of disordered eating among African American subjects was 32.2%, Caucasians was 30.2%, and those from other races were 23.8%. This lack of statistical variation among races confirms Frank and colleagues' (2007) study where race-based differences in disordered eating among their subjects did not vary.

In addition, it appears that the present study's operationalization of engagement of disordered eating among HBCU student-athletes was less strict than being at risk for an ED. This resulted in increased prevalence for disordered eating for all groups involved. This increased disordered eating prevalence was common in other studies examining disordered eating (Black et al, 2003; Greenleaf et al, 2009; Hoerr et al, 2002; Petrie et al, 2008).

Intend to engage in disordered eating. Over 41% of participants intended to engage in disordered eating within 6 months of participating in this study. Currently, there is minimal literature available that discusses future intentions to engage in disordered eating among athletes.

Sport. Though there was variation between sports, only female track athletes reported a prevalence rate below 25%. Most participants, 70%, completed this survey during their off season, with track and field serving as one of the primary sports that was in season.

This increased prevalence from current disordered eating patterns to future intentions suggests that these intentions involve preparation for the upcoming competitive season of their respective sports. This interpretation is supported by Sundgot-Borgen and Torstveit's (2004) hypothesis that strict dietary practices are normative in some sport cultures.

Academic classification and year of eligibility. When intention to engage in disordered eating as a function of time was examined, there was a slight increasing trend in which intentions to engage in disordered eating increased as remaining athletic eligibility decreased. However, prevalence was not statistically ordinal in this analysis. Upperclassmen subjects were more likely to report future dysfunctional dietary practices than underclassmen. Therefore, it is plausible to suggest that upperclassmen are more likely to use disordered eating as a means for athletic achievement than underclassmen. This result supports conclusions from the literature where athletes increase their level of disordered eating as they become more familiar with their team culture (DePalma et al., 1993; Sundgot-Borgen & Torstveit, 2004).

At risk for orthorexia nervosa. Although institution, race, sport, and year of eligibility were significantly associated with between group differences and ON, the power of practical interpretation of these differences is low. The fact that two-thirds of participants were at risk for ON supersedes the magnitude of group differences. An analysis of all possible groups among all nominal and ordinal predictors revealed that 51.5% was the lowest prevalence reported, which is still high for a prevalence rate.

The findings of this study did not quite match previous ON studies because there is only one similar variable (gender) examined among all studies. Nonetheless, these findings provide evidence that HBCU subjects are at increased risk for ON when compared to Turkish medical doctors and Italian individuals. If Bağcı Bosi and colleagues (2007) were correct in their indication that many symptoms and comorbidities associated with EDs also exist in ON; then the HBCU population needs immediate attention with dietary practices regardless of their relatively low prevalence rates of ED risk.

At risk for exercise dependence. When examining variation of group prevalence rates concerning those that at risk for ExD, none of the groups had significant differences. Zmijewski's and Howard's (2003) study showed that males were slightly more likely to suffer from ExD when compared to females. In this study, although not significant, males had an at risk prevalence of 8.8%, while females had an at risk rate of 12.2%. Though these findings contradict each other, the fact that both differences were marginal limits inferential extrapolation of results regarding gender and ExD.

The preselected predictors, as well as other variables examined in the survey, did not determine between group differences in ExD risk among HBCU student-athletes. The coexistence of ExD risk and ED risk was the primary result from this study that echoed other investigations (O'Dea & Abraham, 2002; Zmijewski & Howard, 2003).

HBCU subject responses from this study appear to have smaller variances and tighter confidence intervals compared to two of Hausenblas and Downs studies' (2002a, 2002b) used to validate the EDS-21. Therefore, it appears that HBCU subjects are homogeneous in behaviors with respect to ExD risk.

Research Questions Four and Five: Are There Between Group Differences Within Each Sport Among the HBCU Athletic Population for Risk of Eating Disorder and Orthorexia Nervosa?

Eating disorder risk level. Close examination of mean ED risk levels shows these results parallel previous research reporting higher risk of ED among females when compared to males (Hudson et al., 2007; Johnson et al., 1999; Petrie et al., 2008). Despite these similarities, it would be premature to confirm this support because the variability of risk levels for females in this study is large, which increases the width of the 95% confidence intervals. The variability was likely large because race appears to statistically influence ED risk levels among female participants in several analyses. Several sports such as soccer, softball, and other women's sports not discretely listed had a larger proportion of Caucasian subjects, which increased both variability and mean ED risk level in their respective sport. This finding strengthens arguments made by ED scholars that Caucasian females are at increased risk for an ED (DePalma et al., 2002; Hoek, 2006; Hudson et al, 2007; Johnson et al., 1999).

Women’s soccer was the only women's sport whose 95% confidence interval is clearly above all other men's sports, 95% CI [10.53, 16.93], meaning that only female soccer participants’ risk was significantly higher than male subjects. This finding conflicts with the results of several studies because soccer is not considered a lean sport (DePalma et al., 2002; Garner et al., 1998), although there have been studies where female soccer participants reached risk levels comparable to lean sports (Kirk, Singh, & Getz, 2001; Milligan & Pritchard, 2006). Further analysis of this sport reveals that many of the soccer athletes were upperclassmen, encompassing 80% of soccer student-athletes at risk for ED. Increased ED risk as a function of time parallels previous research where an athlete’s level of disordered eating increases as they become more acclimated with their team culture (DePalma et al., 1993; Sundgot-Borgen & Torstveit, 2004).

With respect to ED risk level, subjects in all other sports had relatively similar ED risk levels because there was demonstrated overlap in their 95% confidence intervals. These findings of relatively similar risk levels correspond to the results of research question three when examining differences among sports when being at risk for an ED.

In this study, BMI was positively correlated with ED risk level in male subjects who participated in track, basketball, tennis, and golf. In all of these sports, there is a competitive advantage associated with a lean body type. Therefore, as weight increases and performance suffers, these subjects may adopt disordered eating behaviors. Jonnalagadda et al. (2005), DePalma and colleagues (1993), and Sundgot-Borgen and Torstveit (2004) have all speculated that disordered eating practices are perceived as an acceptable method of achieving necessary body types for optimal performance among athletes.

Football participants displayed an increasing ED risk level as years of eligibility decreased, with the greatest change seen from first to second year participants. This suggests that as HBCU football players become acclimated to their culture, ED risk level increases. This finding matches conclusions of previous investigations where disordered eating patterns are engrained in sport cultures and considered normative behavior (DePalma et al., 1993; Sundgot-Borgen & Torstveit, 2004).

Among women's sports, the preselected predictors and covariates failed to exhibit statistical significance with ED risk level among HBCU women's track participants. When examining softball, women's volleyball, and other sports, it appears that race, academic classification, or a combination of the two had a significant influence on ED risk level.

With respect to academic classification, for every sport other than volleyball, class standing and ED risk level increased in parallel fashion. These findings support conclusions from previous research where athletes increase their level of disordered eating as they become more familiar with their team culture (DePalma et al., 1993; Sundgot-Borgen & Torstveit, 2004).

Conversely, women's volleyball participants displayed an opposite trend, where their ED risk level decreased from freshmen subjects to upperclassmen participants. This phenomenon may be explained by the fact that there was an oversampling of freshman subjects (52.3%) and under-sampling of other academic classifications.

When examining race among HBCU women student-athletes, African American participants showed significantly lower levels of ED risk across the board when compared to other races (especially Caucasians). Based on Wood and Petrie's (2010) conclusion that African

American women are at lower risk of ED because of African American social factors, it is conceivable that enrollment in an HBCU with an increased African American student body may potentially lower HBCU women risk for an ED. This study's results support the conclusion that Caucasian females are at greatest risk for an ED. This finding coincides with the results of previous research where Caucasian females were at greater risk of EDs compared to other groups (DePalma et al., 2002; Hoek, 2006; Hudson et al, 2007; Johnson et al., 1999).

Orthorexia nervosa risk level. Observation of mean ON risk levels revealed that every HBCU sport is at risk for ON. The upper limit for the 95% confidence intervals does not include 41 or higher among participants in any of the surveyed sports. Aside from women's volleyball, men's track, and other men's sports, there is a 95% chance that the true population means of ON risk level among HBCU student-athletes are levels considered to be at risk. This conclusion cannot be made for women's volleyball, men's track, and other men's sports because there were not enough subjects in these sports (n<30) for confidence interval inferential interpretation.

Subjects' confidence intervals from Donini et al.'s (2004) study failed to reach levels comparable to this study, but participants' confidence intervals from Bağcı Bosi and colleagues (2007) reached similar levels. Bağcı Bosi and colleagues concluded that educational attainment significantly contributed to Turkish physicians' ON risk, and it is plausible to make a similar argument for the college-educated subjects of this study.

The results suggest that the longer a female HBCU athlete participates in varsity sports, the greater the risk of developing ON. Although there is limited research regarding ON and duration, this finding parallels the results of previous work where the level of disordered eating increased as athletes became more engrained with their team culture (DePalma et al., 1993; Sundgot-Borgen & Torstveit, 2004).

With respect to race and ON risk among female athletes, the finding of elevated risk for Caucasian and other non-African Americans is difficult to interpret. There is no baseline research comparing ON risk level as a function of race, but these findings closely parallel the racial patterns of ED research concerning athletes (DePalma et al., 2002; Hoek, 2006; Hudson et al, 2007; Johnson et al., 1999).

Multiple studies have concluded that Caucasian females are at increased risk over other race groups for an ED (DePalma et al., 2002; Hoek, 2006; Hudson et al, 2007; Johnson et al., 1999). Rogers-Wood and Petrie (2010) concluded that African American women who strongly identify with their culture are at decreased risk for EDs. Although female subjects were not surveyed on perceptual identification of culture, enrollment at an HBCU places subjects in an environment with an increased number of African Americans. Therefore, it is conceivable that the increased exposure to African American culture at an HBCU serves as a protective factor against disordered eating in general. This argument is strengthened by women’s track findings, where all subjects were African American and exhibited lower risk levels relative to other sports.

ON findings for women's volleyball subjects displayed a trend that did not correspond to other disordered eating findings in this study. As BMI increased among these participants, their ON risk decreased. A similar inverted trend in risk level was discovered in ED analysis among female volleyball participants. As discussed previously, an oversampling of freshmen and under-sampling of other academic classifications may explain differing risk level trends in volleyball players relative to other female subjects.

Although there were no significant differences between the mean ON risk levels between men and women, the results slightly parallel the findings of previous research in European studies where males were determined to be at increased risk for ON (Donini et al., 2004). The separation in males and females was marginalized by the fact that those with higher levels of education are also at greater risk (Bağci Bosi et al., 2007; Donini et al., 2004). Since all participants have at least some college education, this may likely increase their risk of ON.

Among male subjects, the preselected predictors and covariates failed to exhibit statistical significance with ON risk level. Based on examination of ORTO 15 item response variances, it is plausible to believe that male subjects are homogeneous in behaviors with respect to ON. As a result, between group differences in ON risk was not present among male subjects.

Research Questions Six Through Eight: Are African American HBCU Athletes' Attitudes, Norms, and Perceived Control Toward Disordered Eating Dietary Behavior Related to Their Intention to Engage in Disordered Eating Behavior?

Research Question Six: Attitude. Among both male and female participants, attitude was significantly associated with intentions to engage in disordered eating. Questions 1 and 24 influenced the beta weight of the attitude construct in the model. Thus, participants that "like for their stomach to be empty" and are "terrified about being overweight" were more likely to intend to engage in disordered eating. Both male (46.1%) and female (67%) subjects were increasingly terrified about being overweight on more than rare occasions. This feeling did not vary over sport among each gender.

Although there is a standardized definition of "overweight" using BMI measures (CDC, n.d.), it is difficult to assume that HBCU participants, especially African Americans, perceive overweight as defined by US governmental standards. Rogers-Wood and Petrie (2010) suggested that overweight statures are socially accepted in African-American culture relative to other races. With that said, overweight as perceived by subjects in this study may include body statures beyond the CDC's criteria for overweight. If that is the case, then the magnitude of participants' fear of being overweight might be inflated. This possibility is further strengthened based on responses from Pulvers et al.'s (2004) figural stimuli, where subjects selected figures that represented BMIs well beyond 25 (Female: M = 30.43 SD = 3.40; Male: M = 31.77 SD = 3.04) as body statures they perceived as overweight.

With the recoded EAT-26 scales of Always (-2) to Never (+2) for the TBP model, a 1-unit increase toward Never lowers the odds of intention to engage in disordered eating by 22.4%. These findings are consistent with past research that has used the TPB, where those who have favorable attitudes toward a behavior (or unfavorable view of an opposite outcome) are more likely to engage in that particular behavior (Montaño & Kaspryzk, 2008; Nejad et al., 2005).

Research Question Seven: Norms. Norms were not statistically significant among either male or female participants. These findings were consistent with previous studies using the TPB to examine dietary behavior, where norms failed to influence intentions toward behavior (Garcia & Mann, 2003; Nejad et al., 2005). Most subjects from this study reported rarely or never with respect to normative influences of behaviors related to EDs. This lack of variation among responses is the reason norms failed to influence intentions to engage in disordered eating.

Wood and Petrie (2010) stated that overweight statures are socially accepted in African American culture. Hence, it is plausible to believe that social acceptedness of being overweight among African Americans reduced normative pressures to engage in disordered eating. This parallels results of other analyses in this study and other works purporting that disordered eating patterns as normative in sport cultures (DePalma et al., 1993; Sundgot-Borgen & Torstveit, 2004) were adopted for other reasons than pressures from teammates.

Research Question Eight: Control. Control measures were only significant among female subjects, with avoidance control and binge control having significant influences on intentions to engage in disordered eating. Ironically, those who do not avoid food when they are hungry, and those who have been on food binges when they cannot stop, are more likely to have intentions to engage in disordered eating. The direction of question 2 from the EAT-26 suggests that few female participants in this study are engaged in anorexic behaviors. Therefore, it can be deduced that many female participants intend to engage in either bulimic or EDNOS behaviors. A 1-unit increase towards “Never” on question 2 on the EAT-26 survey increases the odds of intention to engage in disordered eating by 271%. These findings regarding influence of the control construct on intentions to engage are consistent with Nejad’s (2005) study. In Sacks and colleagues’ (1995) study determining the efficacy of the DASH diet it was stated that African American subjects in the control group not utilizing the DASH diet displayed low amounts of will power with respect to quantity and quality of foods conducive to adverse health (e.g., hypertension, diabetes, etc.). Therefore, it is conceivable that a significant number of African American women in the HBCU student-athlete population had low amounts of will power with respect to binge eating particular foods. This low display of will power may have influenced the binge control measure in the analysis.

Research Question Nine: Are There Significant Differences Between Participants’ Ideal Body Stature and Their Perceived Body Stature? Are There Group Differences Between the HBCU Student-Athlete Population With Respect to Ideal Body Stature and Perceived Body Stature?

Comparison of self-reported BMI to perceived BMI. African American female subjects were the only group in the analysis that selected a perceived silhouette that closely matched their self-reported BMI. African American males, non-African American males, and non-African American females selected silhouettes that represented BMI that significantly differed from their self-reported BMI.

This finding among non-African American males and non-African American females conflicts with the results of Bulik and colleagues' (2001) study. Bulik and colleagues' recommended BMI for each respective silhouette were not aligned with non-African American HBCU subjects, which was not expected from a body image instrument deemed valid for non-African American populations. Though only considered valid for African American populations, further analysis revealed that Kim Pulvers and colleagues' (2004) recommended BMI for each respective silhouette were more aligned with non-African American HBCU subjects than Bulik and colleagues' BMI anchor system. For non-African American females, Pulvers and colleagues' anchor system reported a perceived silhouette (M = 24.84, SD = 1.81, *95% CI* [24.37, 25.31]) that better represents their self-reported BMI (M = 24.65, SD = 3.03). A similar finding occurred for non-African American male participants.

Both Pulvers and colleagues (2004) and Bulik and colleagues (2001) base their figural stimuli from Stunkard et al.'s (1983) nine-figured scale. The difference between the two body image instruments is that Pulvers and colleagues' instrument has more detailed human facial and body features that is absent in Stunkard et al.'s survey. Though Pulvers and colleagues' (2004) intention was to create a body image stimuli that is valid for African Americans, it is conceivable that the facial and body details among each silhouette are better aligned with HBCU student-athletes as a whole.

Female ideal body stature and perceived body stature differences. This research question examined differences between ideal body stature and perceived body stature. Consistent with Kronefeld, Reba-Harrelson, Holle, Reyes, and Bulik's (2010) finding, African American subjects selected slightly larger desired silhouettes than non-African Americans participants. Kronfeld and colleagues' study involving 4,023 female participants concluded that African

American women on average are more satisfied with their body stature than Caucasian women. The overall results among females parallels the findings of Torres-McGehee and colleagues' (2011) examination of 138 equestrian NCAA student-athletes.

The finding that both African American and non-African American female subjects in this sample had a desired silhouette that was smaller than their actual one coincides with Anderson's (1992) results where thinness is a feminine ideal. Collectively, African American female participants selected silhouettes that represented the high end of BMI normal weight range as their ideal body stature. Therefore, African American female subjects may not desire to be thin, although they desire to be thinner. Based on findings from Rogers-Wood and Petrie (2010), African American culture at HBCUs may influence this study female participants' selection of their ideal silhouette.

Male ideal body stature and perceived body stature differences. Conversely, ideal and perceived silhouettes for both African American and non-African American male subjects in this study closely approximated each other. This is not surprising, considering Phillips and de Man's (2010) report that males at times desire larger physiques. Various male participants', especially football athletes, desires to be larger mitigated statistical differences between ideal and perceived body statures among their student-athlete population. Removal of football athletes, which constituted 39% of the sample, from this analysis increased differences to the point of statistical significance. Most positions within the sport of football benefit competitively from body statures that allow the combination of size, strength, and speed (Jonnalagadda et al., 2005), which may not be attainable with a small body stature. The finding that football participants desire to have a larger physique is also consistent in Mills, Jadd, and Key's (in press) results involving 96 undergraduate college males. Though Mills et al. used a different body silhouette instrument, they discovered that their male subjects desired to have a larger body stature.

Female group differences. When observing groups within both African American and non-African American female participants, BMI was statistically significant with regard to ideal and perceived body stature differences. Female subjects classified as obese had significantly larger differences in body stature compared to female participants who were normal, and overweight. The differences were influenced by perceived body silhouette, which means that perceived body stature dictated the magnitude of differences. Hence, most of the female participants desired to have a body silhouette between figures 3 and 4 regardless of current body stature.

Due to the variable body statures needed to remain competitive in various sports, it is likely that most female subjects' desire to have a similar body silhouette has little to do with sport achievement. For example, the body stature needed for athletic achievement is different in the sports of track and softball. This suggests that the driving force behind women participants' desire to have a body stature comparable to silhouette figures 3 and 4 is motivated by factors other than sport. As described by Anderson (1992), there is a desire to be thinner among American women. Therefore, it is conceivable that women HBCU subjects desire to achieve a similar normal BMI body stature for reasons outside of sport.

Male group differences. Consistent with the work of Phillips and de Man (2010), normal weight male subjects in this study selected a perceived silhouette that was smaller than their ideal body stature. Therefore, normal weight male participants desired to increase their body stature. Though obese males selected smaller body statures as their ideal silhouette, the desired body frame was still within a 1-unit figure change. Though it appeared that obese male subjects wanted to lose weight, they still wanted to maintain a body stature close to their current one and maintain a larger physique. This finding among obese male participants parallels the results of Phillips and De man (2010) study.

Implications

The findings of this study filled a void in the literature of disordered eating and ExD by establishing a baseline for African American and HBCU student-athletes. There were few studies with substantial sample sizes that investigated EDs, ExD, and ON among the aforementioned populations.

Eating Disorder. The ED findings among HBCU student-athletes failed to challenge current literature as to populations at increased risk for an ED. As a result, there is insufficient evidence to suggest that HBCU student-athletes were just as susceptible to having an ED as Caucasian females deemed at higher risk. Hence, there is not a pressing need to target HBCU student-athletes for broad ED prevention programming. It is recommended that Caucasian females remain the primary target for broad ED prevention programs among public health officials.

Though the ED risk levels and at-risk prevalence results among African Americans and male participants does not warrant increased ED prevention programming, their prevalence of disordered eating and intentions to engage in disordered eating is worthy of attention. Their risk for an ED increases as they acclimate with their sport. Based on findings, nutritional programming should target HBCU underclassmen student-athletes early in their athletic careers to potentially curb forecasted increases of risk estimated in this study.

Currently, larger Division I NCAA institutions are hiring more registered dietitians as staff in their athletic departments. These dietitians educate and train student athletes on healthy dietary behaviors necessary for optimal health and athletic achievement for their respective sports. None of the institutions represented in this study had a registered dietitian staffed in their athletic department. It is imperative that HBCU student-athletes receive nutritional programming from certified athletic trainers or services from registered dietitians regarding healthy dietary practices for sports performance. Continued practice of disordered eating negatively affects student-athletes' performance in sport and future health in general.

From a theoretical perspective, attitude was the primary construct that exhibited the largest influence on intentions to engage in disordered eating among both male and female participants. Subjects who selected higher frequency in positive attitudes related to disordered eating were more likely to report intentions to engage in disordered eating. Individuals with close relationships with student-athletes, such as coaches, athletic trainers, and team captains can use this information to identify student-athletes (or teams) in need of nutritional counseling. Students and team cultures that portray positive attitudes toward disordered eating or negative attitudes toward healthy eating should serve as a cue for nutritional counseling or nutrition health programming. The cue other athletes, coaches, and professional staff should especially look out for is when HBCU student-athletes convey fear of being overweight.

Exercise Dependence. Though the HBCU student-athlete population as a whole was not at increased risk for an ED, there were individuals at risk. Hence, it is recommended that HBCU student-athletes who receive counseling or treatment for an ED should also receive educational programming for ExD. Similarly, HBCU student-athletes who receive counseling or treatment for ExD should also receive educational programming for ED prevention.

Since, there were no groups within the HBCU student-athlete population deemed at increased risk for ExD; it is difficult to target subgroups within the population for ExD prevention programming. Study finding also suggest that ExD behaviors among HBCU athletes were possibly homogeneous. Therefore, as in the case for EDs, HBCU student-athlete ExD programming and counseling should occur on the individual level, as opposed to programming for a broader population such as a team-based approach.

Orthorexia nervosa. Orthorexia is a novel phenomenon in the US. As a result, future research with respect to American culture is warranted. Based on this study's results, HBCU student-athletes should receive ON prevention programming as part of an overall disordered eating prevention plan. This programming should be integrated with nutritional programming designed to prevent disordered eating.

Limitations

As the case with most research studies, limitations were present in this study. Significant differences between the prevalence rates of engagement of disordered eating and future intentions to engage in disordered eating among student-athletes hinted to seasonal effects in dietary behavior. Since data were collected when most HBCU student-athletes were not actively participating in their respective sport (i.e., off-season), the predictability of future intentions on current behavior might be compromised.

The overrepresentation of football athletes (n =168) and underrepresentation of female student-athletes in volleyball (n = 21) and track (n = 37) may have skewed the prevalence rates reported in research questions one, two, and three. The increased quantity of football subjects might have mitigated the overall prevalence rates of ED in this study because football is a sport deemed at low risk for an ED in various literature sources.

Since the results of this study were based on self-reported responses of participants, dishonesty in responses might be present. Verification of subjects' responses was not possible in this study. It was assumed that participants were fully honest in their responses, and the legitimacy of subjects' responses was based on good faith.

Though BMI is considered a convenient and valid measurement of body stature in many aspects of the literature, there are limitations of its use with athletes. BMI does not differentiate between weight derived from adipose tissue or lean muscle mass. Therefore, there is a possibility of participants with high levels of muscle mass classified as "overweight" though they may have low levels of body fat. This limitation is why BMI is not an outcome variable in this study. This study's use and interpretation of BMI matched other published studies regarding collegiate athletes with similar empirical analyses (Johnson et al., 1999; Milligan & Pritchard, 2006; Torres-McGehee et al, 2011).

Future Research

Eating disorder. Due to the limited number of female participants within key sports historically at risk for an ED (e.g., volleyball and track), detailed analyses examining interactions of variables were not possible. The over-representation of low ED and ExD risk HBCU football athletes may have significantly influenced overall prevalence rates in this study by reducing rates to levels too conservative for the HBCU population. In addition, observation of participant responses revealed the possibility of seasonal effects with student-athletes dietary patterns, which may limit future intentions' predictability on current behavior. Therefore, future research should replicate the ED portion of this study among HBCU student athletes with increased female participation and a longitudinal design. The longitudinal study should investigate the relationship between engagement of disordered eating and future intentions on disordered eating; as well as, possible comorbidities associated with eating disorders (e.g., obsessive compulsive behavior, etc.).

Exercise dependence. Though HBCU student-athletes did not exhibit increased risk for ExD relative to previous studies examining other populations, results did show that spending time with family and friends was preferred over exercise. Future studies should examine the relationship between exercise and significant others in a qualitative study. Themes revealed in a qualitative analysis could lead to programming to treat those at risk for ExD among the HBCU student-athlete population.

Orthorexia nervosa. Due to the lack of prior research studies on this topic, further investigation regarding ON is warranted. Future studies should examine the at-risk threshold for ON among athletes. With two-thirds of participants at-risk, confirmation is needed as to whether a threshold of 40 is too high for athletes on the ORTO 15. If 40 is indeed an adequate threshold for athletes, future studies should investigate the longitudinal physiologic effects of ON among HBCU student-athletes.

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APPENDIX A

Donini et al’s (2004) Orthorexia Nervosa Scale 15 (ORTO 15)

ORTO 15©

Instructions: This is a screening measure to help you determine whether you are at risk for a non-medical dietary mental disturbance called *orthorexia nervosa*. This screening measure is not designed to make a diagnosis or take the place of a professional consultation. Please fill out the below form as accurately, honestly and completely as possible. There are no right or wrong answers. All of your responses are confidential.					
Check a response for each of the following statements:		Always	Often	Sometimes	Never
1	When eating, do you pay attention to the calories of the food?	O	O	O	O
2	When you go in a food shop do you feel confused?	O	O	O	O
3	In the last 3 months, did the thought of food worry you?	O	O	O	O
4	Are your eating choices conditioned by your worry about your health status?	O	O	O	O
5	Is the taste of food more important than the quality when you evaluate food?	O	O	O	O
6	Are you willing to spend more money to have healthier food?	O	O	O	O
7	Does the thought about food worry you for more than three hours a day?	O	O	O	O
8	Do you allow yourself and eating transgressions?	O	O	O	O
9	Do you think your mood affects your eating behavior?	O	O	O	O
10	Do you think that the conviction to eat only healthy food increases self-esteem?	O	O	O	O
11	Do you think that eating healthy food changes your life-style (frequency of eating out, friends,...)?	O	O	O	O
12	Do you think that consuming healthy food may improve your appearance?	O	O	O	O
13	Do you feel guilty when transgressing?	O	O	O	O
14	Do you think that on the market there is also unhealthy food?	O	O	O	O
15	At present, are you alone when having meals?	O	O	O	O

APPENDIX B

Hausenblas and Downs' (2002) Exercise Dependence Scale 21 (EDS-21)

Exercise Dependence Scale-21©

Instructions: Using the scale below, please complete the following questions as honestly as possible. The questions refer to current exercise beliefs and behaviors that have occurred in the past 3 months. Please place your answer in the blank space provided after each statement

Check a response for each of the following statements:		1 Never	2	3	4	5	6 Always
1	I exercise to avoid feeling irritable.	O	O	O	O	O	O
2	I exercise despite recurring physical problems.	O	O	O	O	O	O
3	I continually increase my exercise intensity to achieve the desired effects/benefits	O	O	O	O	O	O
4	I am unable to reduce how long I exercise	O	O	O	O	O	O
5	I would rather exercise than spend time with family/friends.	O	O	O	O	O	O
6	I spend a lot of time exercising	O	O	O	O	O	O
7	I exercise longer than I intend.	O	O	O	O	O	O
8	I exercise to avoid feeling anxious	O	O	O	O	O	O
9	I exercise when injured	O	O	O	O	O	O
10	I continually increase my exercise frequency to achieve the desired effects/benefits.	O	O	O	O	O	O
11	I am unable to reduce how often I exercise.	O	O	O	O	O	O
12	I think about exercise when I should be concentrating on school/work.	O	O	O	O	O	O
13	I spend most of my free time exercising.	O	O	O	O	O	O
14	I exercise longer than I expect.	O	O	O	O	O	O
15	I exercise to avoid feeling tense.	O	O	O	O	O	O
16	I exercise despite persistent physical problems.	O	O	O	O	O	O
17	I continually increase my exercise duration to achieve the desired effects/benefits.	O	O	O	O	O	O
18	I am unable to reduce how intense I exercise.	O	O	O	O	O	O
19	I choose to exercise so that I can get out of spending time with family/friends.	O	O	O	O	O	O
20	A great deal of my time is spent exercising.	O	O	O	O	O	O
21	I exercise longer than I plan.	O	O	O	O	O	O

APPENDIX C

Garner et al.'s (1982) Eating Attitude Test 26 (EAT-26)

Eating Attitudes Test (EAT-26)©

Instructions: This is a screening measure to help you determine whether you might have an eating disorder that needs professional attention. This screening measure is not designed to make a diagnosis of an eating disorder or take the place of a professional consultation. Please fill out the below form as accurately, honestly and completely as possible. There are no right or wrong answers. All of your responses are confidential.

Part A: Complete the following questions:

1) Birth Date	Month:		Day:		Year:	2) Gender	Male	Female
3) Height	Feet:		Inches:				O	O
4) Current Weight (lbs)			5) Highest Weight (exclude pregnancy)				
6) Lowest Adult Weight			7) Ideal Weight				

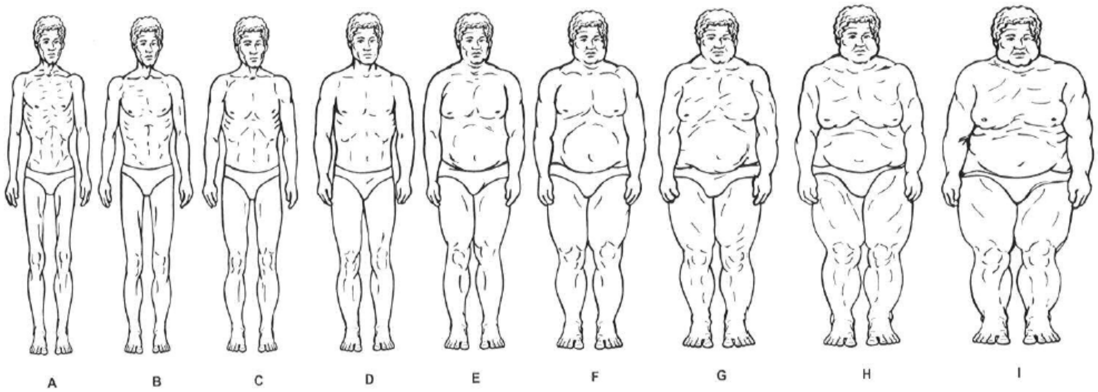
Part B: Check a response for each of the following statements:

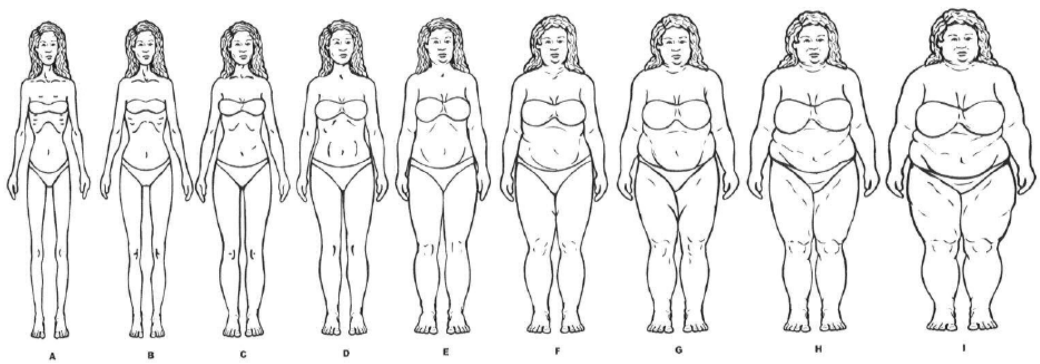
		Always	Usually	Often	Sometimes	Rarely	Never
1	Am terrified about being overweight.	O	O	O	O	O	O
2	Avoid eating when I am hungry.	O	O	O	O	O	O
3	Find myself preoccupied with food.	O	O	O	O	O	O
4	Have gone on eating binges where I feel that I may not be able to stop.	O	O	O	O	O	O
5	Cut my food into small pieces.	O	O	O	O	O	O
6	Aware of the calorie content of foods that I eat.	O	O	O	O	O	O
7	Particularly avoid food with a high carbohydrate content (i.e. bread, rice, potatoes, etc.)	O	O	O	O	O	O
8	Feel that others would prefer if I ate more.	O	O	O	O	O	O
9	Vomit after I have eaten.	O	O	O	O	O	O
10	Feel extremely guilty after eating.	O	O	O	O	O	O
11	Am preoccupied with a desire to be thinner.	O	O	O	O	O	O
12	Think about burning up calories when I exercise.	O	O	O	O	O	O
13	Other people think that I am too thin.	O	O	O	O	O	O
14	Am preoccupied with the thought of having fat on my body.	O	O	O	O	O	O
15	Take longer than others to eat my meals.	O	O	O	O	O	O
16	Avoid foods with sugar in them.	O	O	O	O	O	O
17	Eat diet foods.	O	O	O	O	O	O
18	Feel that food controls my life.	O	O	O	O	O	O
19	Display self-control around food.	O	O	O	O	O	O
20	Feel that others pressure me to eat.	O	O	O	O	O	O
21	Give too much time and thought to food.	O	O	O	O	O	O
22	Feel uncomfortable after eating sweets.	O	O	O	O	O	O
23	Engage in dieting behavior.	O	O	O	O	O	O
24	Like my stomach to be empty.	O	O	O	O	O	O
25	Have the impulse to vomit after meals.	O	O	O	O	O	O
26	Enjoy trying new rich foods.	O	O	O	O	O	O

Part C: Behavioral Questions: **In the past 6 months have you:**		Never	Once a month or less	2-3 times a month	Once a week	2-6 times a week	Once a day or more
A	**Gone on eating binges where you feel that you may not be able to stop?***	O	O	O	O	O	O
B	**Ever made yourself sick (vomited) to control your weight or shape?**	O	O	O	O	O	O
C	**Ever used laxatives, diet pills or diuretics (water pills) to control your weight or shape?**	O	O	O	O	O	O
D	**Exercised more than 60 minutes a day to lose or to control your weight?**	O	O	O	O	O	O
E	**Lost 20 pounds or more in the past 6 months**	Yes O			No O		
**Defined as eating much more than most people would under the same circumstances and feeling that eating is out of control.*							

APPENDIX D

Pulvers et al.’s (2004) Figural Stimuli Instrument





1. Write down your ideal figure. ___
2. Select a figure that best reflects how you think you look. ___
3. Select a figure you feel like most of the time. ___
4. For male figures above, indicate two end points: below which the figure is "too skinny" and above which the figure is "fat". ___ ___
5. For female figures above, indicate two end points: below which the figure is "too skinny" and above which the figure is "fat". ___ ___

APPENDIX E

IRB Approved Consent Form

Participant ID Number: XXXX

Participant Information Sheet
Dietary and Exercise Behavior Survey

Title of Research: **Understanding Prevalence and Attitudes: Dietary and Exercise Behaviors Among African-American Collegiate Athletes**

Principal Investigator: Dwight W. Lewis, M.A.

Explanation of Procedures

You are being asked to complete this questionnaire voluntarily as part of a research study to gain a better understanding of dietary and exercise behaviors among athletes enrolled at HBCUs. This questionnaire will contain questions about your eating, exercise, and other health-related behaviors; as well as your perceptions of the health-related behaviors among your peers. This questionnaire will take approximately 15 minutes to complete. Findings from this questionnaire will be used to assist with the development of health promotion messages and health education theory development, which will attempt to improve the mental health of African-American athletes with regards to eating disorders and exercise dependency.

Risks and Discomforts

There are no physical risks or discomforts in this study. Mild psychological discomfort might be involved in answering questions about certain dietary-related behaviors, but this should be minimal. Should you experience such discomfort, we will inform you about counseling services offered by your college/university. Also, you as a participant have the right to not answer any questions that you do not wish to answer.

Benefits

There are no direct benefits to you for your participation in this study.

Confidentiality

Information gathered during this study will be kept strictly confidential as permitted by law. Your responses will be entered into a database whose files will be indexed with a unique identification number for this study. Data will be stored in secure computers with password protection accessible only to the principal investigator (Dwight Lewis) and his research mentor. The data file linking your questionnaire to your assessment identification number will be kept in a locked filing cabinet on UA campus. At the end of the study, all information identifying a participant will be destroyed. The results of the study may be published for scientific purposes; however, your identity will not be revealed.

Withdrawal Without Prejudice

You are free to withdraw your consent and to discontinue participation in this project at any time without prejudice against future medical care you may receive at this institution.

 UA IRB Approved Document

Request for Results

If requested, students will receive information on their dietary and exercise behaviors at the end of the study. Interested participants must email or call the principal investigator for such a request. In order to disseminate results, participants must provide the subject number transcribed on the survey and listed at the top of this information sheet.

Costs to Subject from Participation in the Research

There will be no cost to you from participation in this research.

Questions

For more information concerning this research you should contact Dwight Lewis at (205) 348-5186 or lewis060@crimson.ua.edu. If you have questions about your rights as a research participant you may contact Ms. Tanta Myles, The University of Alabama Research Compliance Officer, at 205-348-8461 or toll-free at 1-877-820-3066.

Legal Rights

You are not waiving any of your legal rights by reading this information sheet and participating in this research study.

Thank you very much for participating in this questionnaire today. By completing this questionnaire you are agreeing to participate in this research study. Please know that your participation is entirely voluntary and in no way will impact your standing as a varsity athlete at your respected institution.