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DISORDERED EATING HABITS AND BEHAVIORS AMONG
ELITE COLLEGIATE ATHLETES

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the
College of Agriculture and the University of Kentucky

By

Ann Michelle Armes

Lexington, Kentucky

Director: Dr. Kelly Webber, PhD, MPH, RD, LD

Lexington, Kentucky

2013

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ABSTRACT OF THESIS

DISORDERED EATING HABITS AND BEHAVIORS AMONG ELITE COLLEGIATE ATHLETES

Eating disorders and disordered eating habits and behaviors were measured using the Eating Disorders Inventory-3 Referral Form (EDI-3 RF). The sample consisted of 159 elite, collegiate student athletes, males and females, aged 18 to 22. Five sports were represented, including basketball, gymnastics, soccer, swimming & diving, and volleyball. Overall, findings support the position that athletes, as a distinct population, and specifically female athletes and those that participate in lean sports, are at an increased risk for disordered eating behaviors and diagnosable eating disorders. Of the 159 total athletes that completed the questionnaire, 33% (n=53) of the athletes sampled met one or more referral criteria based on reported behavior in the 3 months prior. A total of 37 athletes were referred to professional healthcare providers for meeting criteria of disordered eating behavior according to the Eating Disorder Inventory-3 Referral Form.

KEYWORDS: Disordered Eating, Athletes, Eating Disorder Inventory- 3 (EDI-3 RF), Drive for Thinness, Body Dissatisfaction

Ann Michelle Armes

July 15, 2013

DISORDERED EATING HABITS AND BEHAVIORS AMONG
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Chapter 1. Introduction

The importance of nutrition as a contributing factor to athletic performance and success has been recognized for decades and is widely accepted. The human body must be supplied continuously with energy to perform its many complex functions. As a person's energy demand increases with physical activity, the body must have appropriate energy stores or the performance of the individual will suffer.

In the elite athlete, meeting the caloric needs at regular, appropriate times without compromising performance can be challenging; particularly so for the collegiate athlete, for whom school schedules, budgets, cafeteria schedules, travel requirements, and a varying appetite can further complicate the situation. There have been numerous studies as of late addressing the, presumably unintentional, internal and external pressures to perform placed on a collegiate athlete even beyond the previously noted logistical setbacks that a student-athlete at the collegiate level must overcome in order to ensure an adequate diet and overall physical wellbeing. In certain cases, these competitive athletes are believed to be at an increased risk for the development of unhealthy weight control behaviors and possibly eating disorders. Both male and female student-athletes who participate in activities that emphasize a lean body type or require athletes to meet and maintain a certain weight (e.g. wrestling, cheerleading) are especially vulnerable (Byrne & McLean, 2001; Byrne & McLean, 2002; Sundgot & Torstveit, 2004).

Researchers have found varied results as they relate to the prevalence of eating disorders in athletes as a whole over the years, but it is relatively well-established that the incidence of eating disorders in female athletes is significantly greater than that of female

non-athletes and also that of male athletes of similar ages and backgrounds (Burckes-Miller and Black, 1988, Stice, 2002; Sundgot-Borgen, 1994). The prevalence of disordered eating among female collegiate athletes has been reported to be between 1% and 39% for meeting medical criteria for anorexia nervosa and bulimia nervosa, and has been documented to be as high as 62% for pathogenic weight control behaviors (Sanborn et al, 2000).

Detection of an inadequate diet and/or disordered eating habits among the athlete population is crucial to prevent the onset of malnutrition and adverse health problems. However, this can be a challenging task. The rationale for this study is that athletes, in particular female athletes, with disordered eating habits and/or inadequate diets are at increased risk for poor nutritional status, the female athlete triad and adverse health effects in the long-term. Early recognition of inappropriate eating behaviors and unhealthy beliefs regarding body image and weight control, as well as any insufficient dietary intake, is an imperative step towards implementing any type of nutrition intervention or programming for elite collegiate student-athletes competing at a high level. The purpose of this study is to add to the growing body of knowledge of the prevalence of disordered eating habits in elite athletes.

With limited performance nutrition education, eating disorder awareness or prevention programs in place at the time of data collection, it is expected that results from this study population will reflect the current reported prevalence of pathogenic disordered eating symptoms and behaviors in collegiate, elite-level athletes.

Chapter 2. Literature Review

Nutrition and Athletic Performance

It has been well established that there are many variables that must be taken into account when discussing the high-level performance ability and success of elite athletes; a few key factors include genetic makeup, quality skills training and conditioning programs, and a diet supplying adequate nutrition. Optimal nutrition is essential for peak performance. There are multiple governing bodies that address this subject. As of 2009, the latest and most comprehensive stance on the topic of nutrition and athletic performance is as follows:

“It is the position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine that physical activity, athletic performance, and recovery from exercise are enhanced by optimal nutrition. These organizations recommend appropriate selection of foods and fluids, timing of intake, and supplement choices for optimal health and exercise performance...”

“... Inadequate energy intake relative to energy expenditure compromises performance and negates the benefits of training. With limited energy intake, fat and lean muscle tissue will be used for fuel by the body. This loss of lean tissue mass results in the loss of strength and endurance, as well as potentially compromised immune, endocrine, and musculoskeletal function”

(Academy of Nutrition and Dietetics, 2009)

As it relates to energy requirements, the position statement also expresses the specific need for energy in order to maintain appropriate weight and body composition while training for a sport. Low energy intake (e.g. <1,800 to 2,000 kcal/day) for athletes is a major nutritional concern because a persistent state of negative energy balance can lead to weight loss, increases susceptibility to dehydration, anemia, osteoporosis, muscle atrophy, cardiac arrhythmia, disruption of endocrine function, and other negative health consequences (Williams, Goodie, and Motesinger, 2008; Academy of Nutrition and Dietetics, 2009).

Energy pathways

There are three primary energy systems that play various roles in converting energy yielding nutrients consumed as food into usable fuel that the body can use to contract muscles; in this context, and for the remainder of this report, the term “energy” refers to the capacity of the body to do work (perform). All three systems provide energy; however the use of one system over the other depends on the duration, intensity, and type of physical activity. The first of these energy systems is the Adenosine Triphosphate Phosphocreatine (ATP-PCr) system. This system is responsible for the rapid release of energy when needed only in short supply, i.e. sudden bursts, or about 1-6 seconds of maximum effort.

The second energy system that plays a role in athletic performance is often referred to as the Lactic Acid Energy System (anaerobic glycolysis, “glycolytic system”). Hence the name, this system is able to function without the presence of oxygen. Athletes that utilize this system are primarily short-duration, high-intensity-type athletes or those

whose sport consists of many explosive stop-and-go, repeated 30-120 second movements occurring over an extended period of time. This system is responsible for the production of lactic acid and results in muscle fatigue and soreness that athletes experience post workout.

In simplest terms, glycolysis is the breakdown of glucose; which supplies the necessary energy from ATP. Glucose from the bloodstream is first transported and stored, primarily in the liver and muscle cells, in the form of glycogen. Glycogen is a high-molecular weight, branched polymer of glucose that is used as an energy reserve for the body during fasting states or anytime the body is in need of additional fuel. Any remaining available glucose that does not get stored as glycogen is converted and stored as fat in adipose tissue. During vigorous activity, stored muscle glycogen is broken down into glucose, which is converted to pyruvic acid. If oxygen supply is insufficient, as is the case in many high-intensity, short-duration training or competition sessions, the result is the production of both ATP for energy and lactic acid as a by-product. This method of acquiring ATP for the body is relatively inefficient.

The third energy system is the most efficient at replenishing ATP, and thus providing energy to the body. This system applies most specifically to athletes that participate in so-called endurance or “aerobic” sports; distance running, swimming, triathlons, that take place over an extended period of time and at lower, more controlled heart rates. The oxidative phosphorylation system does not generate ATP per se; instead, any increase in the ratio of ADP/ATP will signal the body to generate ATP to meet energy needs. If and when oxygen is readily available, the glucose derived from

glycogen stores is converted to pyruvate through the glycolytic pathway to generate ATP and a molecule of NADPH+H.

The glucose from muscle glycogen is used to serve the energy needs of the muscle tissue and glucose derived from liver glycogen is exported from the liver and delivered to peripheral tissues, particularly the brain, to generate energy. The acetyl CoA generated from this pathway will continue to the Krebs Cycle to generate energy. Additionally, fatty acids are broken down, via beta oxidation. This breakdown of fatty acids generates several molecules of acetyl CoA. The acetyl CoA generated from these pathways can enter the Krebs Cycle to generate NADH +H, FADH₂ and GTP. These reducing equivalents are then used in the electron transport chain to generate the proton gradient, which is necessary for the generation of ATP. Low levels of blood glucose signals the body to make or consume glucose. Without glucose consumption, the liver will activate gluconeogenesis to generate glucose using substrates such as pyruvate, lactate, glycerol, and certain amino acids. The glucose is exported to peripheral tissues and converted to acetyl CoA.

In many cases an athlete will use more than one pathway for the supply of energy. Often at the beginning of any physical activity, ATP is produced anaerobically via the lactic acid system. If the athlete continues to exercise and does so at a moderate intensity for a prolonged period, the aerobic pathway will become the dominant pathway for fuel, of which the primary source of energy is glucose. This is especially the case with the high-level training that occurs in elite college and professional level athletics. In general, as the duration of exercise lengthens, the contribution of fats as an energy source

becomes greater. The opposite is true for high-intensity exercise; as the intensity of the activity increases, the body relies on carbohydrates as its main source of fuel.

Carbohydrates, fat, and protein are all possible sources of fuel for muscle contraction. The glycolytic pathway (anaerobic) is restricted to using only glucose as fuel, which will typically originate in dietary carbohydrates or stored glycogen.

Inadequate energy intake can occur in the form of insufficient protein, carbohydrates, and also fats. In athletes, low carbohydrate intake combined with intense training may lead to low glycogen stores and contribute to increased fatigue, risk of injury, and slower recovery time (Beals and Manore, 1998). Low protein intake among athletes may hinder improvements in muscle strength and overall function (Wolfe, 2000). Fat intake below 15% of total daily kilocalories has been shown to hinder muscle endurance (Short & Short, 1983).

Implications of an inadequate diet: non-energy components

While vitamins and minerals are not direct sources of energy, they are still crucial to metabolic function, energy production and overall health. Suboptimal vitamin & mineral intake can lead to various deficiencies which have the potential to affect a wide array of physical health; to name a few, low calcium intake, especially when combined with menstrual dysfunction (e.g. amenorrhea), may contribute to decreased bone density, thus increasing susceptibility to stress fractures and premature osteoporosis.

Iron depletion is one of the most prevalent deficiencies in female athletes, one study of international professional female soccer players found that 57% of the 28 team

members sampled were iron deficient, and 29% were found to have iron deficiency anemia 6 months before the FIFA Women's World Cup (Landahl et al, 2005).

Iron deficiency and/or iron deficiency anemia may result in fatigue, decreased physical performance, and decreased immune function. Athletes are more sensitive to the effects of iron deficiency and anemia because they depend on the body's ability to transport oxygen to the muscles. In addition, having limited stores of iron available can decrease energy efficiency and increase muscle fatigue and cramping. It has been reported in several studies that athletes who are involved in heavy training may be prone to iron deficiency, which can lead to iron deficiency anemia (Sinclair & Hinton, 2005). Those most at risk include female athletes, male endurance athletes, and runners.

A few common ways that iron is lost, as it relates to athletes, include destruction of red blood cells which can occur as a result of strenuous training, through sweat, and from taking aspirin and other anti-inflammatory drugs, which reduce the body's ability to absorb iron. Iron deficiency in athletes may develop either because athletes are using more iron than they take in, because there is an increased loss of iron, or by a combination of these two factors. Young female athletes are at particular risk of iron deficiency because their average caloric intake does not match their additional iron losses due to menstruation. Often an athlete is unaware of their dietary problem and it can continue for some time without being recognized and treated.

Incidence of Eating Disorders in Athletes

Eating disorders, in general, are characterized by gross disturbances in eating behavior according to the diagnostic and *Statistical Manual of Mental Disorders, 4th Edition* (DMS-IV). A detailed list of these signs and symptoms is included, following, in Table 2.1 Determination of the exact prevalence depends on the definition applied, the procedures and instruments used for assessment, and the sampling method and the population from which the subpopulation was drawn. It be difficult to accurately compare and contrast results among and between different studies.

Anorexia Nervosa (AN) is characterized by a refusal to maintain a minimal body weight considered normal for age and height, a distorted body image, and an intense fear of fatness or weight gain while being underweight or having amenorrhea, defined by the absence of three or more consecutive menstrual cycles due to inadequate energy intake. Bulimia Nervosa (BN) is characterized by binge eating (rapid consumption of large amounts of food in a discrete period of time) along with purging or other compensatory behaviors to avoid weight gain. During binge eating episodes individuals report a feeling of lack of control over the eating behavior.

In the case that an individual displays the pathology of having an eating disorder, but his/her symptoms do not meet DSM-IV criteria for anorexia nervosa or bulimia nervosa, the individual is diagnosed as having an eating disorder not otherwise specified (ED-NOS) (Sundgot-Borgen, 1994). Due to the elevated prevalence of disordered eating among athletes, an attempt has been made to identify athletes who show significant symptoms of eating disorders, but who do not meet the DSM criteria for having a clinical eating disorder. For example, unlike persons with Anorexia Nervosa, athletes may not be

identified as being drastically below a healthy weight for their height based on physical appearance due to their relatively adequate muscle mass, yet may be just as likely to experience health and performance setbacks due to inadequate diets as those non-athlete individuals diagnosed with an eating disorder. Furthermore, athletes may demonstrate relative sound mental health (compared to the psychiatric patients diagnosed with clinical eating disorders), yet still be at risk (Llyod, 2005). These particular individuals have been classified as having subclinical disordered eating habits, specifically, a classification of an ED-NOS known as Anorexia Athletica (Sundgot-Borgen, 1994b). Because clinicians, at this time, only have criteria to diagnose full blown eating disorders, coaches, athletic trainers, and athletes may not initially identify their practices as problematic.

Sundgot-Borgen and Tostveit (2004) found that more athletes than controls had subclinical or clinical eating disorders. Greenleaf, Petrie, Carter, and Reel (2009) reported that 25% of their sample of female, collegiate athletes expressed disordered eating symptoms. Also in the study, 54% of the sample reported being dissatisfied with their current weight, and of these women, 88% believed that they were overweight (Greenleaf C. , Petrie, Carter, & Reel, 2009). Beals and Hill (2006) reported that among US female collegiate athletes, 25% met criteria for disordered eating. Johnson, Powers, and Dick (1999) found that 9% of female collegiate Division I athletes needed treatment for clinical eating disorders and another 58% exhibited disordered eating behaviors.

Picard et al (1999) surveyed a sample of collegiate athletes at a NCAA division I institute, a division III institute and group of non-athletes; the study concluded that athletes at higher levels of competition may be at an increased risk for disordered eating. Because there is pressure to have the perfect body for a sport, which for many sports

(e.g., gymnastics, track, swimming, diving, rowing, beach volleyball, dancing), means leanness for both performance and appearance, studies have shown that unrealistic dieting and eating disorders are more common in female athletes than in the non-athlete population (Sundgot-Borgen, 1994; Johnson et al, 1999).

TABLE 2.1 Signs and Symptoms of Individuals suffering from an Eating Disorder

<p style="text-align: center;">General</p>	<ul style="list-style-type: none"> • Preoccupation with food, weight, and body • Unrelenting fear of gaining weight • Refusal to eat except for tiny portions • Dehydration • Compulsive exercise • Excessive fine hair on face or body • Distorted body image • Abnormal weight loss • Sensitivity to cold • Absent menstruation • Rapid consumption of a large amount of food • Eating alone or in secret • Abuse of laxatives, diuretics, diet pills, or emetics • Depression, feelings of shame, guilt and withdrawal
<p style="text-align: center;">Mental Functioning</p>	<ul style="list-style-type: none"> • Feeling dull • Feeling listless • Difficulty concentrating or focusing • Difficulty regulating mood • Associated with mental disorders: depression, anxiety disorders, obsessive-compulsive disorder, substance abuse
<p style="text-align: center;">Cardiovascular (Heart)</p>	<ul style="list-style-type: none"> • Slow, irregular pulse • Low blood pressure • Dizziness and faintness • Shortness of breath • Chest pain • Decreased potassium levels may result in life-threatening cardiac arrhythmias or arrest • Electrolyte imbalances may lead to life-threatening cardiac arrhythmias or arrest
<p style="text-align: center;">Muscular Skeletal (Bones)</p>	<ul style="list-style-type: none"> • Stunted growth in children • Stress fractures and broken bones more likely • Osteoporosis
<p style="text-align: center;">Mouth</p>	<ul style="list-style-type: none"> • Enamel erosion • Loss of teeth • Gum disease • “Chipmunk Cheeks” swollen salivary glands from vomiting • Sore throat because of induced vomiting
<p style="text-align: center;">Esophagus</p>	<ul style="list-style-type: none"> • Painful burning in throat or chest • May vomit blood from tear(s) in esophagus

Adapted from National Eating Disorder Association, 2013

TABLE 2.1 Signs and Symptoms of Individuals suffering from an ED (cont)

<p style="text-align: center;">Endocrine System</p>	<ul style="list-style-type: none"> • Thyroid abnormalities • Low energy or fatigue • Cold intolerance • Low body temperature • Hair becomes thin and may fall out • Development of fine body (NAME) hair as the body’s attempt to keep warm
<p style="text-align: center;">Stomach</p>	<ul style="list-style-type: none"> • Stomach may swell following eating or bingeing (causing discomfort & bloating) • Gastric rupture due to severe binge eating • Vomiting causes severe electrolyte imbalance which can lead to cardiac arrest
<p style="text-align: center;">Intestines</p>	<ul style="list-style-type: none"> • Normal movement in intestinal tract often slows down with very restricted eating and severe weight loss • Frequent constipation • Chronic irregular bowel movements
<p style="text-align: center;">Complications associated with Laxative abuse</p>	<ul style="list-style-type: none"> • Kidney complications • “Carthartic colon” (inability of colon to function normally without large doses of laxatives due to destruction of nerves) • Electrolyte imbalance • Dehydration • Potassium depletion • Dependence on laxatives

Adapted from National Eating Disorder Association, 2013

Predisposing Factors of Eating Disorders in Athletes

Cumulative evidence has begun to specify in greater detail the respective roles of cultural, individual (i.e. developmental, psychological, biological, genetic), and familial risk factors that contribute to the expression of eating disorders (Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004; Stice, 2002). Important predisposing factors of eating disorders in general include: (a) being female; (b) living in Western society; (c) adolescence or early adulthood; (d) low self-esteem; (e) perfectionism; (f) depression; (g) a family history of any type of eating disorder, obesity, depression, or substance abuse. Additional associated factors include: (a) dieting to lose weight; (b) occupational or recreational pressures to be slim; (c) critical comments about weight and shape; and (d) sexual abuse.

Thompson and Sherman (1993) stated, “Athletes appear to be at an increased risk due to factors within the sport environment”, and suggested that athletes frequently possess traits that are common among individuals with eating disorders (e.g. perfectionism, need for achievement, ability to withstand pain and discomfort). It is believed that there are unique characteristics of the sport environment that increase the risk of developing eating problems in athletes. Competitive sport inherently place athletes, their bodies, and their physical capability to perform on public display; revealing attire and uniforms in sports such as gymnastics, swimming, and beach volleyball have been found to increase body dissatisfaction and disordered eating (Greenleaf, 2002; Krane, Waldron, Michalenok, & Stiles-ShIPLEY, 2001).

Athletes, as members of the broader society are affected by sociocultural influences; what occurs in general society usually occurs in sport as well, if not to a

greater degree (Thompson & Sherman, 2009). In western cultures, the role of media has been cited extensively in influencing body dissatisfaction, specifically with the general female population, but is prevalent in male and female athletes alike (Greenleaf et al, 2009; Heywood, 2006)

Eating Disorder Risk Assessment Tool: Eating Disorder Inventory-3 RF

The EDI-3, written by David M. Garner, is a standardized assessment tool used to assess “eating disorder risk” based on dieting concerns, body weight, weight history, height and behavioral symptoms indicative of eating disorders. It measures the psychological traits present in individuals with eating disorders and assesses associated risk factors. It is primarily used to assess the diagnosis criteria of Anorexia Nervosa, Bulimia Nervosa, as well as EDNOS according to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (DSM-IV-TR, American Psychiatric Association, 2000). The EDI-3 RF is not intended to yield a diagnosis of an eating disorder and it is important to note that the results of the assessment alone are not sufficient for diagnosis (Atlas, 2007).

The EDI-3 RF is a brief self-report form designed to systematically assess information in three areas: (a) body weight, (b) dieting concerns, and (c) behavioral symptoms indicative of an eating disorder. The main scales of the assessment are the Drive for Thinness (DT), Body Dissatisfaction (BD) and the Bulimia (B) scales.

According to the manual, the DT and BD scales should always be interpreted in the context of the respondent's actual body weight. An intense drive to be thinner has different implications for someone who is already thin compared to the person who might be considered objectively heavier than the norm and is therefore subjected to both internal and external pressures to lose weight for health and social reasons. A relatively low DT scale raw score may indicate that the patient is satisfied with the weight loss achieved and, at least for the moment, does not wish to lose more weight and feels confident about avoiding weight gain. It is more common among patients with AN; however, this may be a temporary phenomenon, because patients with eating disorders may feel satisfied with a low weight for a while, but then feel that they must press for a new lower weight.

Davis, Kennedy, Ravelski, and Donne (2004) found that in a study of hospitalized patients with AN and age-matched controls, patients were more physically active than controls from adolescence onward. Excessive exercise prior to the onset of the disorder was reported by 78% of patients and 60% indicated that they were competitive athletes or dancers. Furthermore, 75% of the patient sample claimed that physical activity steadily increased during the period when food intake and weight decreased the most (Davis et al, 2004). Thus, excessive exercise may be more than a deliberate method of calorie expenditure for patients with AN; it may actually predispose the person to the progression of self-starvation. Excessive physical activity may also interfere with recovery. The notion that calorie restriction and excessive activity may potentiate one another must be taken seriously in sports where athletes are encouraged to be thin and meet performance or appearance standards.

Sundgot-Borgen (1994) examined risk factors for eating disorders among 522 elite athletes representing six different groups of sports and found that 117 (22.4%) were classified as at risk for an eating disorder, based on Drive for thinness and Body Dissatisfaction subscales scores on the EDI. Of the at-risk athletes who participated in a clinical interview (n=103), 48% met criteria for AN or BN and an additional 41% displayed significant fears of fatness and eating disorder symptoms. The prevalence of eating disorders was greatest in sports requiring a thinner shape to meet performance or appearance standards.

When analyzing the male athlete, it was noted that this particular tool does not accurately represent male body image and disordered eating patterns as it does females; this statement was based on findings that the three primary scales of the EDI-3 RF were shown to be significantly lower in body dissatisfaction, drive for thinness, and bulimia when used to assess the males (Stanford & Lemberg, 2012). Currently, there is no tool available that provides an accurate, valid, and reliable assessment of disordered eating in male athletes.

Chapter 3. Methodology

Research Purpose

The primary purpose of this study was to examine the risk of eating disorders in both male and female elite, collegiate athletes as indicated by self-reported pathogenic eating behaviors and beliefs. Data were used to compare and contrast the difference in eating disorder behaviors, as measured by the Eating Disorder Inventory-3, amongst members of various types of sports in both male and female athletes. This investigation will add to the growing body of knowledge of the prevalence of disordered eating beliefs, habits, and behaviors in elite athletes.

Research Objectives

Objective 1 Assess the prevalence of disordered eating behaviors in a sample of elite, collegiate student-athletes using scores from the Eating Disorder Inventory-3, Referral Form (EDI-3 RF).

Objective 2 Compare and contrast the difference between male and female athletes in scores on EDI-3 RF.

Objective 3 Compare and contrast the difference in scores among teams of female athletes on EDI-3 RF.

Research Hypothesis

Hypothesis 1 The majority of elite, collegiate athletes will not meet referral criteria according to the EDI-3 RF. Disordered eating habits and eating disorders as defined using EDI-3 RF standards will reflect that of recent previous studies.

Hypothesis 2 Female athletes will report more disordered eating behaviors and beliefs than male athletes.

Hypothesis 3.1 Female athletes that participate in “lean sports” will report more eating disordered behaviors than female athletes that participate in “non-lean” or ball sports.

Hypothesis 3.2 Female athletes that participate in “lean sports” will be more likely to meet criteria for referral than those athletes that participate in sports considered “non-lean” or “ball sports” according to the Drive for Thinness (DT) and Body Dissatisfaction (BD) scales in the EDI-3 RF.

Study Design

The measurements analyzed for this study were a portion of a larger data set from a research project conducted by the Department of Dietetics and Human Nutrition at the University of Kentucky. The study was approved by the University of Kentucky Institutional Review Board (IRB) in August 2010 as a nonmedical research protocol and received continuation status in current years. The full research project consisted of data collected via the Bod Pod® instrument, anthropometric measurements of height and waist circumference, the Block Dietary Data Systems 2005 Food Questionnaire, and the

EDI-3 Eating Disorder Inventory Referral Form. The portion of data used in this study included only the EDI-3 Questionnaire, Bod Pod® measurements and height.

Recruitment

The research project was a collaboration of a college athletic department and the university's department of Dietetics and Human Nutrition. The athletic department approached the researchers for assistance in determining body composition of various athletes. An agreement was made that the researchers would assess athletes and would have access to them for securing consent for the research project. Athletic department strength and conditioning coaches were provided the body composition results for all the athletes, but were not present for the testing and thus, were unaware of which athletes agreed to participate in the separate research study.

All athletes took part in the body composition testing; though the subjects' consent to participate in the study was obtained voluntarily. No incentive was provided to the participants other than the opportunity to help with a research project about collegiate athletes and the possible opportunity to learn about their own body composition on an individual basis, if their coaches chose to reveal it. Some of the athletes chose not to participate in the study and only took part in the BodPod® assessment portion as indicated by the athletic department.

Data Collection:

Data used for this study were collected from 159 collegiate athletes. Both males and females participated in the data collection, all were 18 years of age or older, currently enrolled in school with remaining eligibility for competition. Subjects completed a questionnaire regarding age, current weight, desired weight, height, menstrual history, and exercise habits. Actual anthropometric measurements of height, weight, and waist circumference were recorded at the time of data collection as well. Behaviors, desires, and perceptions of body image associated with disordered eating habits were assessed using the Eating Disorders Inventory-3 RF (Psychological Assessment Resources Inc. Odessa, FL)

Results were gathered over time period of three years with each individual team repeating the nutritional testing battery multiple times throughout a given academic school year. In order to maintain consistency, only the data collected during the subjects' first session was used in this analysis.

EDI-3 RF Scale Descriptions

The Drive for Thinness (DT) subscale has been described as one of the cardinal features of eating disorders and has been considered an essential criterion for a diagnosis according to many classification schemes. The seven items on the DT scale assess an extreme desire to be thinner, concern with dieting, preoccupation with weight, and an intense fear of weight gain (Garner, 2004). Prospective studies have indicated that this scale is a good predictor of binge eating and the development of formal eating disorders.

The Bulimia (B) subscale assesses the tendency to think about, and to engage in, bouts of uncontrollable overeating (i.e. binge eating). The eight items on this scale assess concerns about binge eating and eating in response to being upset (Garner, 2004). The presence of binge eating is one of the defining features of Bulimia Nervosa and differentiates the restricting and binge-eating/purging types of anorexia nervosa. Research has shown that binge eating is common in individuals who do not meet all of the criteria to qualify for a formal diagnosis of an eating disorder; nevertheless, in most cases, severe binge eating is associated with marked psychological distress.

The Body Dissatisfaction (BD) subscale consists of 10 items that assess discontentment with the overall shape and size of those regions of the body of extraordinary concern to those with eating disorders (i.e. stomach, hips, thighs, buttocks). One item on this scale measures the feeling of bloating after eating a normal meal, a common feature of those who are dissatisfied with their body weight. Given the fact that body dissatisfaction is so common to young women in Western culture, it cannot be concluded that this construct alone causes eating disorders. However, it may be considered a major risk factor that is responsible for initiating and then sustaining the extreme weight-controlling behaviors seen in eating disorders.

Chapter 4. Results

Description of Participants

Of the 159 total participants, 67.3% (n= 107) were female, and 32.7% (n= 52) were male. The sample was made up of participants from five different sports: Swimming & Diving (33.3% total; 58.4% male, 41.5% female), soccer (37.1% total; 37.5%male, 62.5%female), women's basketball (8.8% total, n=14), women's volleyball (10.0%, n=16), and women's' gymnastics (12.6%, n=20). The average age of all respondents was 19.29 ± 1.2 years. Based on actual height & weight, the average BMI for the overall sample was 23.18 ± 2.0 (23.7 ± 1.8 males, and 22.18 ± 2.0 females). Table 4.1 and Table 4.2, on the following page, shows this information in a table form.

TABLE 4.1 Descriptive characteristics of all female athletes by sport

Sport	N	Age (yr)	BMI	DT score	BD score	Actual vs. Desired Weight
Gymnastics	20	18.95	23.36 (± 2.24)	9.20 (± 6.34) ^a	15.30 (± 8.07) ^a	6.89 (± 7.98)
Swim/Dive	22	19.21	23.05 (± 2.14)	10.73 (± 7.90) ^a	14.68 (± 8.63) ^a	9.81 (± 10.65) ^a
Soccer	35	19.42	22.21 (± 1.90)	4.06 (± 4.30)	8.20 (± 6.80)	3.56 (± 6.65)
Basketball	14	19.50	21.97 (± 1.93)	3.36 (± 3.775)	5.64 (± 6.30)	2.92 (± 5.84)
Volleyball	16	19.31	23.25 (± 1.93)	4.00 (± 4.10)	8.13 (± 4.21)	1.00 (± 7.82)
Total	107	19.29	22.18 (± 2.00)	6.29 (± 6.34)	10.51 (± 7.88)	5.01 (± 8.40)

Note: Values for BMI, DT, BD, and difference between desired & actual weight are given as mean \pm standard deviation

^aSignificantly different from all Soccer, WBB, & Volleyball (i.e. *ball sports*)

TABLE 4.2 Descriptive characteristics of all male athletes

Sport	N	Age (yr)	BMI	DT score	BD score	Actual vs. Desired Weight
Total	52	19.47	23.77 (± 1.84)	3.54 (± 4.64)	5.31 (± 5.60)	-1.92 (± 9.45)

Note: Values for BMI, DT, BD, and difference between desired & actual weight are given as mean \pm standard deviation

Descriptive Statistics

The referral criteria can be met in a number of ways according to the EDI-3 RF, one being if the individual's calculated DT or B total raw scores are **equal or greater** than the respective DT and B critical values indicated in Table 4.3. Of the 68 female athletes that had a BMI of greater than 22, a total of 3 met the criteria for referral based on BMI and DT scores. Of the 35 female athletes that reported a BMI of less than 22, none met referral criteria based on BMI and DT raw scores. Of the 41 male athletes that reported a BMI of greater than 22, only one met referral criteria based on BMI and DT scores. There were 7 males that reported a BMI of less than 22; none met referral criteria based on BMI and DT raw scores.

TABLE 4.3 Determination of referral based on BMI, DT, and B scores

\geq Age 18 Years			
Calculated BMI	Critical value		
	<i>DT</i> total raw score		<i>B</i> total raw score
≤ 18.0	15	or	5
$> 18.0 \ \& \ \leq 22.0$	22	or	8
$> 22.0 \ \& \ \leq 25.0$	24	or	10
> 25.0	25	or	12

The determination of referral based on behavioral symptoms only was more common in athletes than the previous comparison of BMI and DT/BD raw scores. There were 34 total student-athletes from the sample that met one or more criteria for referral based on four categories: binge eating behavior, self-induced vomiting, laxative use, and excessive weight loss over the last 3 months. For this study, the dependent variable, excessive physical activity was excluded from referral criteria results due to a perceived misunderstanding of the language used as it relates to the elite college athletics.

The total sample of athletes reported the following results for the three major scales of the EDI-3 RF: DT score 5.39 ± 5.97 (6.29 ± 6.34 females and 3.54 ± 4.6 males), B score 2.74 ± 3.73 (2.60 ± 3.48 females and 3.04 ± 4.2 males), and BD score 8.81 ± 7.6 (10.51 ± 7.9 females and 5.31 ± 5.6 males). For the overall sample, the difference between self-reported weight and desired weight as stated on the questionnaire was 2.7 ± 9.30 lbs. Based on the self-reported results of all athletes in the sample, female athletes ($n=100$) desired to be 5.01 ± 8.38 lbs lighter than their actual weight. Male athletes ($n=50$) desired to be 1.92 ± 9.44 lbs greater than their actual weight ($p < 0.01$).

There were 23 total athletes that met the referral criteria for binge eating behavior, which was defined as having eaten a large amount of food while feeling out of control 2-3 times per month or more. Of the 23 athletes that met these criteria, 16 were females and 7 were males. Swimmers and divers made up the majority of the group ($n=14$). Results for binge eating behavior are shown in Table 4. 4 on the following page.

Table 4.4 Binge Eating Behavior and Referral Criteria of all athletes

Gender		Frequency	Percent	Cumulative Percent	Percent meeting referral criteria
Female	Never	77	72.0	72.0	14.0%
	Once a month or less	15	14.0	86.0	
	2-3 times/month	11	10.3	96.3	
	Once a week	2	1.9	98.1	
	2-6 times/week	1	0.9	99.1	
	Once a day or more	1	0.9	100.0	
	Total	107	100.0		
Male	Never	39	75.0	75.0	15.4%
	Once a month or less	5	9.6	84.6	
	2-3 times/month	4	7.7	92.3	
	Once a week	3	5.8	98.1	
	2-6 times/week	1	1.9	100.00	
	Once a day or more	1	0.0		
	Total	52	100.0		

As a whole, 96.9% (n=154) of athletes did *not* meet referral criteria for self-induced vomiting behavior within the last three months. Of the few athletes that reported making themselves sick (vomiting) to control their weight, shown in table 4.5 on the following page, 3.2% (n=5), four were females, and one was a male athlete. Self-induced vomiting referral criteria were met if the athlete reported having made him or herself sick (vomiting) to control weight at any point in the previous 3 months.

Table 4.5 Self-Induced Vomiting Behavior & Referral Criteria of all athletes

Gender		Frequency	Percent	Cumulative Percent	Percent meeting referral criteria
Female	Never	103	96.3	96.3	3.8%
	Once a month or less	2	1.9	98.1	
	2-3 times/month	2	1.9	100.0	
	Once a week	0	0.0		
	2-6 times/week	0	0.0		
	Once a day or more	0	0.0		
	Total	107	100.0		
Male	Never	51	98.1	98.1	1.9%
	Once a month or less	1	7.7	100.0	
	2-3 times/month	0	5.8		
	Once a week	0	1.9		
	2-6 times/week	0	0.0		
	Once a day or more	0			
	Total	52	100.0		

There was a 1.2% (n=2) reported abuse of laxatives amongst the sample as a whole. These athletes reported using laxatives to control their weight or shape at least once within the last three months. There were no females reporting use of laxatives; both instances occurred in male athletes. There were two male swimmers who met referral criteria based on their reported use of laxatives to control weight a minimum of one time in the study. These results are shown in Table 4.6 on the following page.

Table 4.6 Laxative Use Behavior and Referral Criteria of all athletes

Gender		Frequency	Percent	Cumulative Percent	Percent meeting referral criteria
Female	Never	107	100.0	100.0	0%
Male	Never	50	96.2	96.2	3.8%
	Once a month or less	1	1.9	98.1	
	2-3 times/month	0	0.0	98.1	
	Once a week	1	1.9	100.0	
	2-6 times/week	0	0.0		
	Once a day or more	0	0.0		
	Total	52	100.0		

Among the entire sample, 86.85% (n=138) of student athletes did *not* meet the referral criteria as it related to excessive exercise to control weight; 13.2% (n=21) of the total athletes sampled reported exercising 60 minutes or more once-a-day or more in order to lose or control their weight. Of the 21 total athletes that met referral criteria for excessive exercise, 42.9% (n=9) were female, and 57.1% (n=12) were male. Within the gender-specific groups, 8.4% of the sample of female athletes met referral criteria, and 23.1% of the male athletes met referral criteria by stating that they exercised 60 minutes once or more each day in order to control their weight (Table 4.7). Finally, 1.9% of the total athlete sample reported that they had lost 20lbs or more in the last 6 months; 0.9% (n=1) were females, 3.8% (n=) were males. Results are shown on Table 4.7 on the following page.

Table 4.7 Excessive Physical Activity to control weight of all athletes

Gender		Frequency	Percent	Cumulative Percent	Percent meeting referral criteria
Female	Never	67	62.6	62.6	
	Once a month or less	7	6.5	69.2	
	2-3 times/month	2	1.9	71.0	
	Once a week	4	3.7	74.8	
	2-6 times/week	18	16.8	91.6	
	Once a day or more	9	8.4	100.0	
	Total	107	100.0		8.4%
Male	Never	30	57.7	57.7	
	Once a month or less	5	9.6	67.3	
	2-3 times/month	2	3.8	71.2	
	Once a week	2	3.8	75.0	
	2-6 times/week	1	1.9	76.9	
	Once a day or more	12	23.1	100.00	
	Total	52	100.0		23.1%

T-Test Independent Samples: Comparing male and female athletes

On the DT subscale there were significant differences ($p=0.008$) reported between the groups of male and female athletes. Results showed that as a group, female athletes ($n=107$) scored a mean value of 5.39 ± 5.958 . Male athletes ($n=52$) reported a mean value of 3.54 ± 5.638 . As a whole, the mean DT score was equal to 5.39 ± 5.968 .

On the Bulimia (B) subscale, male and female athletes did not differ significantly ($p=0.057$); females ($n=107$) scored 2.60 ± 3.475 and males ($n=52$) scored 3.04 ± 4.215 . On the Body Dissatisfaction (BD) scale, even though, according to the scoring manual qualitative range description, female athletes ($n=107$) were '*moderately*' dissatisfied with their bodies (score: 10.51 ± 7.789), as opposed to male athletes ($n=52$) who reported '*low*' dissatisfaction (score 5.31 ± 5.603) with the physical appearance of their bodies, there was no significant statistical difference ($p=6.148$) between the two groups.

The results did not show a significant difference between male and female athletes in the average number of times they reported experiencing a binge-eating episode in the previous 3 months. Female athletes reported a mean value of 0.49 ± 0.935 and male athletes reported a mean of 0.50 ± 1.00 . There was no significant difference in vomiting behavior found between male and female athletes (females 0.06 ± 0.302 , males 0.02 ± 0.139) Finally, there was no significant difference in reported laxative use between male ($n=52$) and female athletes ($n=107$). The mean score of laxative use in male athletes was 0.07 ± 0.43 . It should be noted that there were only two male athletes that reported any laxative use in the 3 months prior to the administration of the questionnaire.

ANOVA multiple comparisons among female sports teams

Only two male teams participated in this study, thus they have been excluded from this portion of the results. This section addresses only the results found between and among female athletic teams. Amongst the given population of athletes, there were significant differences between the female groups.

The Drive for Thinness (DT) subscale scores were significantly different between several groups of female athletes. The women's gymnastics sample (9.20 ± 6.933) subscale scores were significantly different ($p < 0.05$) than those of both women's basketball (3.36 ± 3.775) and women's soccer (4.06 ± 4.284). There was also a significant difference in the average DT scores between the sample of female swimmers & divers (10.73 ± 7.889) and each of the "non-lean", or "ball sport" teams, including women's basketball (3.36 ± 3.775) women's soccer (4.06 ± 4.284), and women's volleyball (4.00 ± 4.099).

There was a significant difference ($p < 0.05$) in the average Bulimia (B) subscale scores of female swimmers & divers in comparison with each of the other teams, in this study, including gymnastics. The mean B score for female swimmers and divers ($n=22$) was 4.96 ± 5.103 . The sample of female swimmers and divers reported an average score of 2.783 ± 0.895 ($p= 0.020$) higher than the sample of soccer players. The sample of female swimmers and divers reported an average score of 4.026 ± 1.125 ($p= 0.005$) higher than the sample of female basketball players. The sample of female swimmers and divers reported an average score of 3.080 ± 1.080 ($p= 0.041$) higher than the sample of female volleyball players. The sample of swimmers and divers reported an average score of 2.455 ± 1.016 ($p= 0.018$) higher than the sample of female volleyball players.

There was a significant difference ($p < 0.05$) in the average Body Dissatisfaction (BD) subscale scores between both women's gymnastics and women's swimming and diving and each of the "non-lean", "ball sports" in this study. The women's gymnastic team reported a mean BD score of 15.30 ± 8.073 . The sample of gymnasts reported an average score of 7.100 ± 1.988 ($p = 0.001$) higher than the sample of women's soccer players. The sample of gymnasts reported an average score of 9.657 ± 2.471 ($p = 0.000$) higher than the sample of women's basketball players. The sample of gymnasts reported an average score of 7.175 ± 2.379 ($p = 0.003$) higher than the sample of female volleyball players. The sample of women's swimmers and divers reported a mean BD score of 14.68 ± 8.632 . The sample of swimmers and divers reported an average score of 6.482 ± 1.929 ($p = 0.001$) higher than the sample of women's soccer players. The sample of swimmers and divers reported an average score of 9.039 ± 2.424 ($p = 0.000$) higher than the sample of women's basketball players. The sample of swimmers and divers reported an average score of 6.557 ± 2.330 ($p = 0.006$) higher than the sample of women's volleyball players.

Among the female athletes, there were significant differences ($p < 0.05$) between the groups in the disordered eating behavior symptoms reported. There was a significant difference in the occurrence of binge eating behavior reported between female swimmers & divers and each of the other teams included in this study; the mean binge eating score of the given sample of swimmers and divers was 1.23 ± 1.445 . The sample of swimmers and divers reported an average of 0.856 ± 0.236 ($p = 0.000$) higher than the sample of women's soccer players. The sample of swimmers & divers reported an average 1.084 ± 0.297 ($p = 0.000$) higher than the sample of women's basketball players. The sample of

swimmers and divers reported an average of 1.040 ± 0.285 ($p= 0.000$) higher than the sample of women's volleyball players. The swimmers & divers reported an average score of 0.877 ± 0.268 ($p= 0.001$) higher than the sample of women's gymnasts.

In addition to binge eating behavior, there were also significant differences reported in the occurrence of self-induced vomiting behavior in the three months prior to data collection reported between female swimmers & divers and each of the other teams included in this study; the mean self-induced vomiting score of the given sample of swimmers and divers was 0.23 ± 0.612 . The sample of swimmers and divers reported an average of 0.199 ± 0.080 ($p= 0.015$) higher than the sample of women's soccer players. The sample of swimmers & divers reported an average 0.227 ± 0.101 ($p= 0.026$) higher than the sample of women's basketball players. The sample of swimmers and divers reported an average of 0.227 ± 0.097 ($p= 0.021$) higher than the sample of women's volleyball players. The swimmers & divers reported an average score of 0.227 ± 0.091 ($p= 0.014$) higher than the sample of women's gymnasts.

Chapter 5. Discussion

Findings

The study was conducted with the intent of investigating the prevalence of disordered eating habits in elite athletes. The results indicated that this sample of collegiate athletes was generally reflective of other similar studies on athletic population in regards to disordered eating behaviors and reported risk of eating disorders.

The first objective of this study was to assess the prevalence of disordered eating behaviors in a sample of elite, collegiate student-athletes using scores from the Eating Disorder Inventory-3, Referral Form (EDI-3 RF). It was hypothesized that the majority of collegiate elite athletes will not meet referral criteria according to the EDI-3 RF and that disordered eating habits and eating disorders as defined using EDI-3 RF standards will reflect that of recent previous studies. Of the 159 total athletes that completed the questionnaire, 33% (n=53) of the athletes sampled met one or more referral criteria based on reported behavior in the 3 months prior. Due to the decision that the dependent variable, excessive physical activity, was to be excluded from referral criteria, the actual number of athletes referred to the appropriate healthcare professional within the athletic department based on solely on behavioral symptoms was 37 athletes (23% of the athletes were determined to be at risk based on behavioral symptoms only). A total of 8 athletes met referral criteria based on their BMI and Drive for Thinness (DT) raw scores; each of these 8 athletes also met referral criteria for one or more behavioral symptoms.

The second objective of the current study was to compare and contrast the difference in scores between male and female athletes in scores on the EDI-3 RF. The hypothesis that female athletes would report more disordered eating behavior and beliefs than male athletes could not be fully supported by the given data. Based on reported disordered eating behavior only, and excluding excessive physical activity as an indicator, of the 37 total athletes that were referred to a healthcare profession for follow-up, the majority, 67.5% (n=25) were females, 23.4% (n=12) were male athletes. While these values are reflective previous findings, due to the limited number and lack of variety of male participants, the results do not accurately represent the elite male athlete population at a whole and therefore may not prove to be an accurate analysis.

The third and final objective of the current study was to compare and contrast the differences in scores between female athletes using the EDI-3 RF. It was hypothesized that female athletes that participate in “lean sports” would report more eating disordered behaviors than female athletes that participated in “non-lean”, or ball sports. It was also hypothesized that athletes that participate in “lean sports” will be more likely to meet criteria for referral than those athletes that participate in sports considered “non-lean” or “ball sports” as determined by the Drive for Thinness (DT) and Body Dissatisfaction (BD) scales, as well as the symptomatic eating behaviors reported on the EDI-3 RF. This hypothesis was supported by the results of the current study of female athletes. Women’s gymnastics and women’s swimming and diving athletes (lean-sports) scored significantly higher on the Drive for Thinness (DT) scale and the Body Dissatisfaction (BD) scale. Athletes on those two teams were also more likely to meet referral criteria based on binge eating behaviors, and self-induced vomiting behavior.

Implications

This collection of data related to disordered eating behaviors and beliefs of elite, collegiate, student-athletes have the potential to be used as a reference for future research. The current study largely supports previous research findings and will add to the growing body literature on this topic.

There is enough data available to support the position that athletes, as a distinct population, and specifically female athletes, are at an increased risk for disordered eating behaviors and diagnosable eating disorders, whether they be clinical, subclinical, or not otherwise specified (EDNOS). Interpretation of previous findings suggest that athletes from both lean and non-lean sports are especially vulnerable due to their own innate, self-defined personalities; characteristics include perfectionism, need for control, achievement orientation, self-absorption, and competitiveness, as well as influences and perceived expectations of their sport environment, media, and coaches (Sterling & Kerr, 2012).

Eating disorders have long been assumed to occur primarily in women. Until recently, one of the most frequently cited statistics was that men comprised a mere 5 to 10% of the eating disorder population (Boerner, Spillane, Andersen, & Smith, 2004). Due to this fact, understandably so, the large majority of research addressing the topic of disordered eating habits and eating disorders to date has been focused on females, and similarly, female athletes. This same priority of researching eating disorders in women also applies to the development and validation of eating disorder assessment tools. Recently though, more attention by researchers has been given to males and their eating behaviors, beliefs, and their own relative body image struggles. A 2007 Harvard study showed that 25% of all eating disorder cases are now men (Hudson, Hiripi, Pope, &

Kessler, 2007) and further reports have indicated that this and similar numbers may be an underestimation, due primarily to non-inclusive and inappropriate diagnostic criteria in the DSM-IV-TR. With the prevalence rate of men being diagnosed with eating disorders on the rise, it will be very important that more empirical research efforts be put into place ensure proper assessment and diagnosis of this unique population, and as with the female population, expanded further to address risks that occur in the elite male athlete population (Stanford and Lemberg, 2012).

Based on the results of the current study and also previous findings, it is recommended that NCAA-sanctioned institutions, at all levels, have a nutrition and ED screening protocol in place. It is advantageous for an athletic department to have a team of specialists assembled whose purpose is to accommodate the specific needs of a student athlete struggling with disordered eating. This team may consist of the team physician, head athletic trainer, respective staff athletic trainer, a Registered Dietitian, and a psychologist. It is advantageous for any university athletic department to offer its' athletes access to a Registered Dietitian, particularly a dietitian that specializes in sports nutrition, to aid in the education, counseling, and promotion of proper nutrition practices and impact on athletic performance as they relate to the unique needs of elite-level athletes.

Strengths, Limitations, and Future Research

One strength of the study, as it relates to the design, was that it not only benefitted the research team, but the individual athletes, as well as the athletic department as a whole. In an athletic department that had previously had no dedicated sports nutrition emphasis or involvement with its' athletes, the results of this nutrition screening helped to raise awareness of pathogenic eating behaviors that occur amongst collegiate athletes. Over the period of four years since the current study has been continuously conducted, it has perceivably played a role in encouraging the department to initiate a response that involved addressing the nutritional wellbeing of its' athletes as an integral part of overall health and physical performance. An additional strength as it relates to the design of the study was obtaining informed consent and actual data collection. By collecting data at a neutral site, out of contact with athletic coaches, athletic trainers, and similarly related personnel and assuring athletes that their information would be kept private, only to be accessed by a select group of authorities, the potential response bias associate with a desire to meet a standard and please coaches and authorities was arguably lower than it would have been otherwise.

There were several limitations that should be noted in this study. First, there was limited participation by teams in the study; only teams whose coaches requested the Bod Pod/nutrition screening participated. Participation was completely voluntary by both teams and individual athletes. Of the twenty-two intercollegiate teams that made up the athletic department, only seven teams, five women's teams and two men's teams, were included in the study. Teams of particular interest and concern, based on previous research, that did not participate in the study include track & field, cross country, and

potentially cheerleaders and members of the university's dance team (not formal NCAA-sanctioned athletic programs).

Second, in order to maintain consistency, only the data collected during the subjects' first session were used in this analysis. Because the data collection took place over a time period of three years, after the initial collection year, only new first-year and transfer student-athletes were considered in the data set resulting in potentially biased results. This potential bias is reflected in the average age reported by the given athlete sample being just slightly over 19 years old (19.29 years, females; 19.49 years, males). It should also be considered that the first data collection, and was thus, used as data in this report; occurred early in the fall athletic season, during a time many of the first-year athletes had not taken part in any sort of strength and conditioning program; which would presumably result in changes in perceived body composition. It is unknown at this time how, and/or whether, individual responses would have been altered in either direction based on the given athletic program expectations, body composition changes and/or other environmental influences over time.

A third limitation in the current study relates to the EDI-3 RF and its use in the given population. The EDI-3 RF has consistently proven to be a reliable risk assessment tool in females, and even to a varying extent in female athletes. It was determined by the research team, as indicated in previous studies, to produce skewed results as they relate to the male population as a whole, and in particular the male athlete population. As referenced previously and throughout the report, differences between men and women exist specifically as they relate to the constructs of body dissatisfaction. Anderson, Cohn, and Holbrook (2000) criticize the use of the EDI, suggesting that men may not relate

when they are asked for their input associated with the EDI-3 such as, “I think my thighs are too large”, or “I like the shape of my buttocks.” Additional items that may not apply to men are “I am preoccupied with a desire to be thinner” and “Other people think I am too thin,” since many men with eating disorders often do not strive to be “thin” as much as they do, “muscular.” Evidence shows that males generally wish to change their bodies from the waist up, while females usually dislike their bodies from the waist down. Weltzin et al (2005) found that men were less likely to restrict food intake and more likely to binge eat and to engage in activities such as excessive exercise to control their body weight than women; the mentioned behaviors, observations and opinions of male athletes in comparison with female athletes in general were reflected to a certain degree in the current study.

In the future, there is a need to develop a more applicable, valid, and reliable tool for assessing eating disorders in elite athletes; this is true as it relates to the need in female athletes and especially true as there is a need for such a tool that addresses the unique circumstances of an elite male athlete. In addition, most of the available research on the topic exists on the risk factors for the development of disordered eating in female athletes, research has only begun to understand an athletes’ perspective on why they develop disordered eating practices. The literature-to-date has relied predominately on quantitative, psychometric assessments to assess risk factors; very few studies have approached this question using qualitative methods. Further studies of this nature may help to further understand the athletes’ perspectives on the development of disordered eating behavior in sport. A final area of potential future research that would be beneficial to the field would address the effectiveness of specific university athletic department

nutrition interventions, programs and protocols being put into practice.

Conclusion

A total 37 of athletes (23.2%), both male and female athletes in this study were referred to appropriate healthcare personnel as having met criteria to be at risk for an eating disorder. While the instrument used, EDI-3 RF, is not to be used as a tool for diagnosis, current results are similar to and reflect similar studies of both the general female and the athlete population. Much like previous research, Disordered eating behaviors were more often reported by athletes engaging in aesthetic or “lean” sports than in those participating in “non-lean” or ball sports.

The results suggest, as in previous research, that sport’s emphasis on the body and appearance is a factor of vulnerability of athletes; in particular female athletes as it relates to the development of disordered eating behaviors. It is suggested that the qualities valued by athletes involved in competitive sport may also be potential of vulnerability to disordered eating. Due to the general secretive nature of eating disorders, in addition to the fear that athletes may have of jeopardizing their opportunity to compete, their desire to please coaches, teammates, media and the like, and the acceptance of many disordered eating behaviors as “normal” (i.e. 60+ min of physical activity each day, eating seemingly excessive amounts of food, preoccupation with weight, planning day around meals, etc), it is likely that the current study, as well as previous research findings, underreport the true incidence of disordered eating behavior and eating disorders among all populations, including athletes.

Because of the potentially severe physiologic and psychological consequences associated with an eating disorder, collegiate athletic programs should have screening and prevention protocols in place as well as ensuring that effort are made to raise awareness and educate coaches, athletic trainers, and staff in recognizing the signs and symptoms of an eating disorder the their athletes. It is extremely important that the athletic departments are prepared to offer both the athlete and staff the appropriate, and necessary, resources for the treatment of an eating disorder.

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