DISORDERED EATING AND COMPULSIVE EXERCISE IN COLLEGIATE ATHLETES

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ABSTRACT

Over the past two decades, a large body of research has examined the issues of eating disorders as well as compensatory behaviors in collegiate competitive athletes. Up to 49.1% of student-athletes engage in disordered eating and compensatory behaviors, while up to 7.1% of athletes have symptoms that reach the threshold of formal psychiatric diagnoses. Greater symptoms are linked to reduced athletic and academic performance, both of which may impact physical and psychosocial functioning later in adulthood. However, most athletes suffer from these symptoms in isolation, as these behaviors are often undetected by athletic trainers and coaches. The purpose of the current study was: (a) to examine the prevalence of both formal eating disorders and disordered eating symptomatology in a sample of collegiate student-athletes; (b) to explore the frequency of compulsive exercise occurrence; (c) to investigate the differences in athletes' disordered eating, compulsive exercise, and body image concerns by gender, sport type, and level of athletic participation; and (d) to assess the relationships among athletes' disordered eating, compulsive exercise, and body image concerns, as well as associations between athletes' age and each of these three variables.

In total, 128 NCAA Division I varsity and club athletes completed the Eating Disorder Examination Questionnaire (EDE-Q), Compulsive Exercise Test (CET), and Multidimensional Body Self-Relations Questionnaire – Appearance Scales (MBSRQ-AS). Correlational analysis, Independent two-sample, and Welch's t-tests were conducted to establish statistical significance for the relationships of interest. Out of 128 athletes, 11 athletes (8.6%) scored in the clinically significant range on at least one EDE-Q subscale. Four athletes (3.2%) met criteria for Bulimia Nervosa, 3 athletes (2.4%) met

criteria for Binge Eating Disorder, and 2 athletes (1.6%) met criteria for Unspecified Feeding or Eating Disorder. In addition, 40 athletes (31.3%) reported subclinical symptoms of an eating disorder. Nineteen athletes (14.85%) scored above the clinical cut-off score for compulsive exercise behavior. Female athletes reported greater disordered eating symptomatology and body image dissatisfaction than males. In addition, lean-sport athletes had a higher prevalence of maladaptive eating behaviors than non-lean sport athletes. Age was not associated with athletes' disordered eating, compulsive exercise, and body image scores. Also, no differences were found between club and varsity athletes for the same variables. Positive correlations were found between athletes' eating pathology and their compulsive exercise behaviors, suggesting that greater eating disorder symptoms were associated with greater excessive exercise engagement. In contrast to athletes with no symptoms of an eating disorder, athletes with symptoms of an eating disorder reported using exercise as a weight control measure. Higher levels of body image dissatisfaction were also associated with greater eating pathology.

This study addressed a number of methodological shortcomings across the body of eating disorder research (e.g., studies with insufficient sample sizes, lack of group comparisons by age and level of athletic participation, and suboptimal psychometric measures) and underscored the need for a new generation of studies. The study also explored the frequency of compulsive exercise, a compensatory behavior which is highly prevalent, but often overlooked among athletes. The study findings may aid coaches, athletic administration, and mental health professionals in identifying at-risk athletes. The study findings also inform the development of prevention and treatment efforts.

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CHAPTER 1

INTRODUCTION

Statement of Problem

Disordered eating is prevalent among National Collegiate Athletic Association (NCAA) athletes (Clifford & Blyth, 2019; Joy, Kussman, & Nattiv, 2016; Sundgot-Borgen & Torstveit, 2004). Disordered eating refers to a wide range of pathogenic behaviors (Sundgot-Borgen & Torstveit, 2010). These include, but are not limited to, restricted caloric intake, fasting, binge eating, self-induced vomiting, excessive exercise, as well as the misuse of laxatives, diuretics, or diet pills (Joy et al., 2016).

Approximately 45% of female and 20% of male collegiate athletes have clinical or subclinical symptoms of an eating disorder, such as Anorexia Nervosa, Bulimia Nervosa, and Binge Eating Disorder (Kato, Jevas, & Culpepper, 2011; Petrie, Greenleaf, Reel, & Carter, 2008). In addition, up to 84% of female and 72% of male collegiate athletes reported eating disorder symptoms, such as binge eating, fasting, restricted dieting, excessive exercise, or using weight loss supplements (Chatterton & Petrie, 2013; Greenleaf, Petrie, Carter, & Reel, 2009). These behaviors can contribute to poor health as well as suboptimal athletic and academic performance (Joy et al., 2016). Most individuals suffer with these symptoms in isolation, as these behaviors are often undetected by athletic trainers and coaches (Watson, 2005, 2006).

The Prevalence of Disordered Eating in Collegiate Athletes

The prevalence rates of collegiate student-athletes suffering from subclinical or clinical eating disorders vary greatly, from 1.1% to 49.2% (Carter & Rudd, 2005; Chatterton & Petrie, 2013; Greenleaf et al., 2009; Kato et al., 2011; Petrie et al., 2008).

The rates of disordered eating vary by gender, from 0 to 19% in male athletes and 6 to 45% in female athletes (Bratland-Sanda & Sundgot-Borgen, 2013). Lean-sport athletes (such as gymnasts, runners, swimmers, cyclists, and wrestlers) are believed to be at greater risk for developing an eating disorder than non-lean sport athletes, who do not focus on body weight and physical appearance as part of their sport (Anderson & Petrie, 2012; Rosendahl, Bormann, Aschenbrenner, Aschenbrenner, Strauss, 2009). Other studies, however, have found no relationship between athletes' sport types and engagement in unhealthy eating behaviors (Greenleaf et al., 2009; Petrie et al., 2008). The lack of consensus across studies emphasizes the need for additional research on disordered eating among collegiate athletes (Joy et al., 2016).

In summary, eating disorders and subclinical features of these conditions affect a large number of collegiate athletes (Clifford & Blyth, 2019; Chatterton & Petrie, 2013; Kato et al., 2011). Those affected by these conditions can experience health complications as well as decreased academic and athletic performances (Joy et al., 2016; Tenforde, Nattiv, Ackerman, Barrack, & Fredericson, 2016). Athletes with symptoms of disordered eating may also engage in excessive, compulsive exercise above and beyond their NCAA-required training time (Meeusen et al., 2013). Compulsive exercise used as a weight control measure further exacerbates the health consequences of disordered eating (McNamara & McCabe, 2012). However, the extent of this excessive exercise, and its relationship to eating disorder symptomatology, is largely unknown.

To address these issues, the proposed study: (1) examined the presence of both clinical and subclinical eating disorders among a sample of collegiate student-athletes; (2) explored the frequency of self-reported compulsive exercise in these athletes; (3)

investigated the relationships among disordered eating, compulsive exercise, and body image attitudes, based on athletes' gender and sport type; and (4) assessed the associations between disordered eating, compulsive exercise, and body image, as well as relationships between athletes' age and each of these three variables. Results of the study may help coaches, athletic trainers, and mental health professionals in identifying athletes engaging in these behaviors as well as inform the development of prevention and treatment efforts.

Risk Factors for Disordered Eating in Collegiate Athletes

The demands of being a student-athlete are believed to contribute to the development of disordered eating behaviors (Bratland-Sanda & Sundgot-Borgen, 2013; Krentz & Warschburger, 2013). In season, student-athletes are restricted to 20 hours of weekly on-and-off the court/field physical workload, including the time spent in competition ("2018-19 NCAA Division I manual", 2018). However, the 20-hour rule is frequently violated (National Collegiate Athletic Association, 2008). For instance, Division I football, baseball, and basketball players reported the highest weekly in-season athletic commitments, averaging nearly 40 hours per week (NCAA, 2008). In all other sports, the weekly times spent in training and competition averaged 32 hours (NCAA, 2008). The combination of disordered eating and physical overload among collegiate athletes can further result in low energy availability, muscle weakness, acquisition of overuse injuries, mineral bone deficiency, impaired immune function, malnutrition, dehydration, and fatigue (Beals & Hill, 2006; Dalle Grave, Calugi, & Marchesini, 2008). Physical overtraining and inadequate nutrition also can have a deleterious effect on

mood, which can further contribute to poor academic and athletic performances (Etzel, 2006; Joy et al., 2016; Putukian, 2016).

The challenge of finding a favorable balance between academic and athletic workloads also could potentially lead to the development of poor nutrition habits (Greenleaf et al., 2009; Kato et al., 2011; Petrie et al., 2008). By prioritizing studying, training, and frequent traveling for competitions, student-athletes often compromise their self-care and, as a result, engage in unhealthy behaviors (Etzel, 2006; McNamara & McCabe, 2012). Athletes at-risk for an eating disorder are known to engage in restricted caloric intake, binge eating, as well as compensatory behaviors, including compulsive exercise, self-induced vomiting, and the misuse of laxatives/diuretics or diet pills (Anderson & Petrie, 2012; Chatterton & Petrie, 2013). These maladaptive behaviors, in conjunction with intense physical training, can lead to physical and psychological symptoms that affect multiple areas of athletes' lives (Carter & Rudd, 2005; Tenforde et al., 2016).

Many athletes at-risk for an eating disorder also engage in compulsive exercise, which is characterized by an excessive involvement in prolonged and intense physical activity as a way to compensate for immoderate caloric intake (Plateau et al., 2014). Athletes who exercise compulsively often continue to exercise despite recurring or persistent physical problems, such as fatigue, illness, or injury (Yates, 2013). Personality characteristics also may contribute to disordered eating. Many student-athletes are highly self-reliant and resilient, but also have low levels of social support (Watson 2005, 2006). Consequently, student-athletes at-risk for an eating disorder and compulsive exercise may potentially acquire maladaptive approaches of dealing with sociocultural

pressure and resist professional assistance for these behaviors (Gulliver, Griffiths, & Christensen, 2012).

Significance of Study

Collegiate student-athletes represent a unique population of young adults who, because of the demands on their time associated with their sport, may be at particular risk for disordered eating and compulsive exercise (Meeusen et al., 2013). Specifically, up to 68% of collegiate athletes appear to use excessive exercise as a compensatory behavior to control their body weight (Anderson & Petrie, 2012; Chatterton & Petrie, 2013; Greenleaf et al., 2009; Petrie et al., 2008). Compulsive exercise, in combination with the sport-required training, place student-athletes at a high-risk for overuse injuries, and physical exhaustion, which can further impede athletic performance (Chatterton & Petrie, 2013; Sundgot-Borgen & Torstveit, 2010). Therefore, there is a need to examine compulsive exercise patterns among NCAA Division I student-athletes in order to draw athletic staff's and athletes' attention to the deleterious health effects of this disordered behavior.

Structured educational and assistance programs have shown to reduce the impact of risk factors of disordered eating (Elliot et al., 2004; Martinsen, Sherman, Thompson, & Sundgot-Borgen, 2015). Prompt detection of unhealthy eating behaviors through screening protocols is associated with better treatment outcomes (Bonci et al., 2008; Thiemann et al., 2015). The roles of athletic trainers and coaches are paramount in recognizing detrimental eating and exercise patterns in athletes and providing them with the necessary professional assistance (Currie, 2010).

Despite the availability of various eating disorder prevention strategies, Vaughan, King, and Cottrell (2004) found that only 1 in 4 (27%) of athletic trainers feel confident in identifying an athlete with an eating disorder. In addition, only 38% of athletic trainers feel confident in asking an athlete about disordered eating behavior (Vaughan et al., 2004). Although educational programs and counseling services have been created for college student-athletes, proactive steps on behalf of the university athletic staff are necessary for early detection and prevention of eating disorders (Bonci et al., 2008; McLester, Hardin, & Hoppe, 2014).

Thus, a goal of the current study was to examine the frequency of disordered eating and compulsive exercise behaviors in a large sample of collegiate athletes. The relationship of these behaviors to body image dissatisfaction was explored, as was the relationship of these behaviors to age, gender, and sport type. The findings may aid athletic programs in the identification of these maladaptive behaviors as well as inform the development of interventions and prevention programs.

Problem Statement

The study investigated disordered eating and compulsive exercise in a sample of collegiate athletes. The study had four specific aims. The first aim was to investigate the frequency of disordered eating symptoms in a large, mixed gender sample of collegiate athletes. The second aim was to examine the frequency of compulsive exercise in these individuals. A third aim was to assess athletes' maladaptive eating, compulsive exercise patterns, and body image attitudes, based on their gender and sport type. The fourth aim was to examine the relationships among athletes' disordered eating, compulsive exercise,

and body image attitudes, as well as associations between athletes' age and each of these three variables.

Aims and Hypotheses

The following specific aims and hypotheses are proposed for the study:

Specific Aim 1. To investigate the number of collegiate athletes suffering from clinical and subclinical symptoms of disordered eating.

Specific Aim 2. To examine the frequency of compulsive exercise in this sample of athletes.

Specific Aim 3. To explore the differences in athletes' disordered eating, compulsive exercise, and body image attitudes, based on their gender and sport type.

Hypothesis 3a. There are significant differences in disordered eating, compulsive exercise, and body image scores by gender (female vs. male).

Hypothesis 3b. There are significant differences in disordered eating, compulsive exercise, and body image scores by sport type (lean vs. non-lean).

Specific Aim 4. To examine the relationships between athletes' disordered eating, compulsive exercise, and body image attitudes, as well as between athletes' age and these three variables.

Hypothesis 4a: Athletes' disordered eating is associated with their compulsive exercise and body image scores.

Hypothesis 4b: Athletes' age is associated with their disordered eating, compulsive exercise, and body image scores.

Delimitations

The study included the following limitations:

1) The study specifically focused on collegiate student-athletes (i.e., Division I varsity and club athletes).
2) Only student-athletes who have reached 18 years of age participated in the study.
3) The number of the NCAA Division I student-athletes participating in the study was unlikely to include the entire population.
4) In order to assure response clarity and manageability of the collected data, survey instruments contained only multiple-choice items. Thus, survey questions did not include open-ended response items, where the participants could provide additional information about their eating and exercise habits.

Limitations

The study included the following limitations:

1) The study results may not be generalized to the entire NCAA Division I or club athlete populations due to small sample size.
2) Due to the possibility of sample participants failing to answer with candor about their maladaptive eating and exercise behaviors, results may not reflect accurate rates of disordered eating among collegiate athletes.
3) Participants could engage in other maladaptive eating and exercise behaviors, not mentioned on the survey instruments. In addition, due to the NCAA required 20-hour weekly training, varsity athletes could underreport the amount of compulsive exercise.

4) Due to possible feelings of embarrassment or a fear of being identified, some participants may not provide candid responses about the frequency and severity of their maladaptive eating and exercise behaviors.

Definition of Terms

The following definitions are outlined by the Diagnostic and Statistical Manual (DSM-V) of the American Psychiatric Association (2013):

Eating disorder – is characterized by severe alterations in an individual's eating habits that are linked to physiological changes. Individuals with eating disorders become pre-occupied with food, body weight, and physical appearance.

Binge eating episode – is defined as consuming a large amount of food within a short time period (e.g., 2-hour period). During a binge eating episode, a person lacks control over eating and experiences a feeling of not being able to stop food consumption.

Compensatory behaviors – refer to an individual's engagement in recurrent maladaptive behaviors to prevent weight gain. Such behaviors include: self-induced vomiting; misuse of laxatives, diuretics, or other medications that facilitate significant weight loss; severe restrictions in caloric intake or fasting; and excessive exercise involvement to the point of physical and mental exhaustion.

Compulsive exercise – is an eating disorder symptom, characterized by excessive involvement in strenuous physical activity for the purpose of controlling or reducing one's body weight. Compulsive exercise is often used as a way to compensate for immoderate caloric intakes, as a means to engage in binge eating episodes, or as an alternative method for self-induced vomiting. Individuals who exercise compulsively

continue to exercise despite injuries or other health complications (Meyer, Taranis, Goodwin, & Haycraft, 2011).

Anorexia Nervosa (AN) – an eating disorder characterized by persistent restriction of caloric intake, resulting in significantly low body weight (below the minimal norm considering an individual's age, height, weight, and developmental trajectory). It also manifests through an intense fear of gaining weight and severe disturbances in one's perceptions of his or her own body weight and shape (i.e., refusal to recognize the seriousness of one's low body weight; APA, 2013).

Bulimia Nervosa (BN) – an eating disorder characterized by the following symptoms: (a) recurrent episodes of binge eating; (b) recurrent engagement in detrimental compensatory behaviors in order to prevent weight gain; (c) the binge eating and compensatory behaviors must occur at least once a week for three consecutive months; and (d) an individual's body and shape become vital parts in his or her self-evaluation (APA, 2013).

Binge Eating Disorder (BED) – an eating disorder characterized by the following symptoms: (a) recurrent engagement in episodes of binge eating; (b) occurrence of binge eating episodes, on average, at least once a week for three consecutive months; (c) manifestation of distress related to binge eating; and (d) disassociation with the recurrent use of compensatory behaviors as in Bulimia Nervosa or Anorexia Nervosa (APA, 2013).

Other Specified Feeding or Eating Disorder (OSFED) – can be applied to cases, when a person engages in eating behaviors that cause clinically significant distress or impaired functioning, but does not meet full criteria for an eating disorder (APA, 2013). The following are the examples of OSFED:

Atypical Anorexia Nervosa – applies to cases when all criteria for Anorexia Nervosa are met except for significant weight loss (APA, 2013).

Purging Disorder – is characterized by binge eating, but the absence of recurrent purging behavior to manipulate body weight or shape (APA, 2013).

Night Eating Syndrome – is characterized by recurring episodes of eating after awakening from sleep or by immoderate food consumption following the evening meal (APA, 2013).

Unspecified Feeding or Eating Disorder (UFED) – can be applied to cases in which an individual's eating behaviors cause clinically significant distress or impaired functioning, but do not meet full criteria of any of the DSM-V feeding or eating disorders. This category is used by clinicians who choose not to indicate why criteria for an eating disorder are not met, or when there is a lack of information to make an accurate diagnosis about the severity of eating disorder symptoms (APA, 2013).

Female Athlete Triad – refers to the relationship between energy deficiency, menstrual irregularities, and low bone mass that occur as a result of malnutrition and disordered eating (Nattiv et al., 2007). Female Athlete Triad can be detected when one or more of the following three conditions in female athletes are met: disordered eating, amenorrhea, and osteoporosis.

CHAPTER 2

REVIEW OF LITERATURE

The proposed study investigated the following: (a) the rates of clinical and subclinical eating disorders among NCAA Division I student-athletes; (b) the frequency of compulsive exercise occurrences as a compensatory behavior; (c) the differences in athletes' disordered eating, compulsive exercise, and body image attitudes, based on their gender and sport type; and (d) the relationships between athletes' disordered eating, compulsive exercise, and body image attitudes, as well as associations between athletes' age and each of these three variables. The sections below review the literature in support of the study aims and hypotheses.

DSM Diagnostic Criteria for Eating Disorders

Eating disorders are characterized by severe disturbances in an individual's eating behaviors that significantly impact physical health and psychosocial functioning (APA, 2013). The most common types of eating disorders identified in college athletes are Anorexia Nervosa, Bulimia Nervosa, and Binge Eating Disorder (Currie, 2010; DiPasquale & Petrie, 2013; Sundgot-Borgen & Torstveit, 2004).

Anorexia Nervosa. Anorexia nervosa is characterized by low body weight, body image distortion, and an obsessive fear of weight gain (APA, 2013). To be diagnosed with Anorexia Nervosa, a person must display the following criteria: (1) restricted caloric intake leading to low body weight (i.e., energy intake below the minimum recommended norm considering a person's age, sex, and physical health); (2) an intense fear of gaining weight, or persistent behavior that interferes with weight gain despite a significantly low body weight; and (3) distorted perception of one's body weight and shape, or persistent

refusal to recognize the seriousness of the current low body weight. Other symptoms of Anorexia Nervosa include frequent avoidance of eating meals, obsessive rituals around food, mood disturbances, low self-esteem, and heightened sensitivity to criticism about one's body shape, weight, and physical appearance (APA, 2013).

Strict dieting and compulsive exercise often occur as symptoms of Anorexia Nervosa. According to Currie (2010), athletes at-risk for anorexia nervosa refuse to eat the recommended number of calories and are unable to maintain the expected body weight (considering an athlete's gender, age, height). In addition to exercising compulsively, athletes at-risk for Anorexia Nervosa may also pretend to eat or exaggerate the amount of food they consume, as well as check their weight multiple times a day (Currie, 2010).

Bulimia Nervosa. Bulimia Nervosa is characterized by recurrent binge-eating episodes, operationalized as consumption of abnormally large food intake in a short period of time, followed by a compensatory behavior such as vomiting, laxative misuse, or excessive exercise (APA, 2013). According to the DSM-V (APA, 2013), to be diagnosed as having Bulimia Nervosa, a person must display the following criteria: (1) recurrent binge eating episodes that are characterized by eating in a discrete period of time (e.g., within a 2-hour period) and by lack of control over the amount of consumed foods; (2) recurrent compensatory behaviors to prevent weight gain (e.g., self-induced vomiting, dieting, fasting, use of diet pills, compulsive exercise); (3) binge eating and compensatory behaviors must both occur at least once a week for at least 3 months; (3) body shape and weight are integral parts of self-evaluation; and (4) the disturbance does

not occur exclusively during episodes of Anorexia Nervosa methods to compensate for overeating.

Athletes at-risk for Bulimia Nervosa binge eat frequently and lack control over the amount of food they consume (DiPasquale & Petrie, 2013). After binge eating, bulimic athletes experience the fear of gaining weight and engage in one or more compensatory behaviors, such as self-induced vomiting, fasting, excessive exercise, and the use of laxatives, diuretics, enemas, or diet pills (Currie, 2010). Athletes at-risk for Bulimia Nervosa usually maintain an average weight, which creates difficulties in recognizing this eating disorder (Currie, 2010). Thus, the presence of a binge-purge-exercise cycle is often the key in identifying athletes at-risk for Bulimia Nervosa (APA, 2013).

Binge Eating Disorder. Binge Eating Disorder is characterized by frequent consumption of large food intake (i.e., bingeing), even when a person is not hungry (APA, 2013). According to the DSM-V (APA, 2013), to be diagnosed as having Binge Eating Disorder, a person must display the following criteria: (1) recurrent episodes of binge eating, which is characterized by consumption of abnormally large food intakes in a short period of time (e.g., two hours); (2) the binge eating episodes manifest through three or more of the following: eating at a faster rate than normal, eating until feeling uncomfortably full, consuming large amounts of food in the absence of hunger, isolating oneself during food consumption due to the feeling of embarrassment by the amount of food one is eating, and feeling disgusted and guilty following a binge eating episode; (3) the presence of distress in regards to binge eating; (4) occurrence of binge eating at least once a week for three months; and (5) binge eating does not occur during the course of

Bulimia Nervosa or Anorexia Nervosa methods to compensate for large food intakes, such as self-induced vomiting. Unlike Bulimia Nervosa, the individual with BED does not engage in compensatory behaviors after binge eating.

Other Specified Feeding or Eating Disorder (OSFED). Atypical Anorexia Nervosa is another psychological disorder seen in athletes (Watson & Andersen, 2003). It is classified as Other Specified Feeding or Eating Disorder (OSFED) and is characterized by the same criteria as Anorexia Nervosa, except for significant weight loss (APA, 2013). Athletes with symptoms of Atypical Anorexia Nervosa usually have weight within or above the normal range, which creates barriers in the identification process of at-risk athletes (Watson & Andersen, 2003). While many signs of Anorexia Nervosa are present in athletes with Atypical Anorexia Nervosa, certain symptoms may be absent, such as weight loss below 85% or amenorrhea (Watson & Andersen, 2003).

Anorexia Athletica. Anorexia Athletica is another form of disordered eating that can be found in athletes (Sudi et al., 2004). The disorder, however, does not appear in the DSM-V (APA, 2013). Anorexia Athletica is characterized by an obsession with being slim and an excessive fear of weight gain. The key feature of Anorexia Athletica is the tendency to exercise compulsively (Sudi et al., 2004). Athletes at-risk for Anorexia Athletica engage in excessive amounts of physical training to the point when exercise interferes with their work, school, and social life activities. Exercise becomes an integral part of an athlete's self-worth in regards to athletic performance. Athletes experiencing Anorexia Athletica overly emphasize leanness, which often results in restricted caloric intake or the use of exercise as a means of reducing their body fat percentage. Long-term

Anorexia Athletica manifests through hormonal dysfunctions and decrease in resting metabolic rate (Sudi et al., 2004).

Health Consequences of Eating Disorders

While each eating disorder has its distinct signs, symptoms, and health effects, the general signs and symptoms of disordered eating and compensatory behaviors include: sudden weight loss, gain, or fluctuation; hypothermia (i.e., a dangerously low body temperature); and fatigue (Joy et al., 2016). Oral and dental problems caused by pathogenic weight control behaviors are dental erosion or caries, perimolysis (i.e., a dental condition linked to frequent regurgitation), and recurrent sore throats (Winstead & Willard, 2006). Disordered eating behaviors also severely affect an individual's endocrine system by resulting in irregular menstrual cycles or a complete absence of menstruation (i.e., amenorrhea), which could potentially lead to infertility (Tenforde et al., 2016). Furthermore, prolonged misuse of laxatives, diuretics, enemas, and diet pills, as well as self-induced vomiting lead to various gastrointestinal problems, such as abdominal pain, early satiety and delayed gastric emptying, constipation, hematemesis (i.e., the vomiting of blood), and hemorrhoids (Nattiv et al., 2007). The resulting damages of disordered eating on the cardiorespiratory system include, but are not limited to, chest pains, hypotension (i.e., low blood pressure), arrhythmia (i.e., irregular heartbeat), bradycardia (i.e., an extremely low heart rate), and shortness of breath (Casiero & Frishman, 2006).

Another consequence of maladaptive eating and compensatory behaviors is low bone mineral density, which could result in injuries, stress fractures, and potential osteoporosis (Tenforde et al., 2016). This may be especially hazardous for competitive

athletes who are generally at higher risks for overuse injuries due to their continuous engagement in high amounts of intense physical training (Vetter & Symonds, 2010). Dermatological issues, such as hair loss, brittle nails, skin discoloration, and poor skin healing, also arise in individuals suffering from an eating disorder (Swenne & Engström, 2007). Finally, neuropsychiatric symptoms, including memory loss or lack of concentration, insomnia, increased anxiety, depression, seizures, obsessive compulsive behavior, and suicidal ideation can be seen in persons with eating disorders (Stiles-Shields, Labuschagne, Goldschmidt, Doyle, & Grange, 2012). Up to a third of athletes at-risk for an eating disorder tend to engage in multiple pathogenic behaviors, as opposed to a single behavior such as restrictive eating (Pernick et al., 2006). Practicing two or more maladaptive weight control methods further exacerbates the deleterious effects of these behaviors on an athletes' body (Stiles-Shields et al., 2012).

Compulsive Exercise as an Eating Disorder Symptom

Compulsive exercise is believed to be common, but often undiagnosed, in competitive athletes (Homan, 2010). Compulsive exercise is characterized by excessive involvement in strenuous physical activity for the purpose of maintaining or reducing one's body weight (Meyer et al., 2011). Compulsive exercise is often used as a way to compensate for excessive caloric intake, binge eating, or as an alternative method for self-induced vomiting (Freimuth, Moniz, & Kim, 2011). Individuals who exercise compulsively often continue to exercise despite pain, injuries, fatigue, and physical exhaustion (Meyer et al., 2011). Other complications of compulsive exercise include energy deficiency, muscle weakness, acquisition of overuse injuries, mineral bone deficiency, chronic bone and joint pain, impaired immune function, arrhythmia, and

amenorrhea (Berczik et al., 2012; Dalle Grave et al., 2008). In addition, compulsive exercise has been associated with increased anxiety, negative mood, life dissatisfaction, and depression (Lichtenstein, Hinze, Emborg, Thomsen, & Hemmingsen, 2017; Weinstein, Maayan, & Weinstein, 2015).

Lichtenstein et al. (2017) suggest that compulsive exercisers can be described as individuals with a competitive mindset who tend to exercise excessively in spite of pain and injury, even when it jeopardizes their physical and mental health. Consequently, competitive athletes represent a vulnerable group of individuals prone to engage in compulsive exercise due to their high physical training tolerance (Anderson & Petrie, 2012; Rosendahl et al., 2009). Compulsive exercise can develop quickly as a weight control measure, leading to the physical symptoms noted above, as well as poor academic and athletic performance (Joy et al., 2016; Putukian, 2016; Plateau et al., 2014).

In examining the association between compulsive exercise and eating pathology, a persistent drive for intense physical activity was frequently reported by eating disordered individuals (Meyer et al., 2011; Shroff et al., 2006). Among samples of individuals with eating disorders, compulsive exercise has been significantly associated with higher levels of eating disorder symptomatology, dietary restrain, as well as weight and shape concerns, drive for thinness, and body image dissatisfaction (Adkins & Keel, 2005; Dalle et al., 2008; Holtkamp, Hebebrand, & Herpertz-Dahlmann, 2004; Shroff et al., 2006). In addition, Mond and colleagues (2004, 2006, 2008, 2009) have found that the degree to which exercise is used to manipulate one's weight or shape is a dimension of compulsive exercise, which is strongly associated with disordered eating and diminished quality of life. Such compulsive exercise has shown clear distinctions

between eating disordered and non-eating disordered patients (Mond & Calogero, 2009). For instance, the feelings of intense guilt when exercise is missed or exercising primarily for weight control and shape manipulation were the abnormal exercise behaviors that most clearly differentiated between patients suffering from an eating disorder and healthy patients (Mond & Calogero, 2009). Specifically, patients at-risk for Bulimia Nervosa exhibited significantly higher scores on the measures of these behaviors than healthy patients (Mond & Calogero, 2009).

In group comparison of disordered eating and compulsive exercise among athlete and non-athlete populations, Goodwin and colleagues (2011) found greater levels of compulsive exercise on the Compulsive Exercise Test (CET; Taranis, Touyz, & Meyer, 2011) in adolescent competitive athletes than their non-athlete peers. One explanation for this finding could be attributed to how athletes perceive their eating disorder symptoms (Fewell, Nickols, Shiltzer Tierney, & Levinson, 2018). Specifically, the way in which athletes evaluate their maladaptive eating and exercise habits can foster maintenance of an eating disorder (Fewell et al., 2018). For instance, Thompson and Sherman (2010) found that athletes tend to underreport their eating disorder symptoms due the misconception that dietary restriction and excessive exercise will result in enhanced sport performance. Athletes and coaches often reinforce maladaptive behaviors (i.e., dietary restriction, excessive exercise) because they believe that certain aspects of sport participation, such as mental toughness and continuous engagement in intense training, are pivotal in reaching optimal performance (Plateau et al., 2014). As a result, athletes may perceive compulsive exercise as a demonstration of high commitment to

their sport, rather than a symptom of an eating disorder (Bruin, Oudejans, & Bakker, 2007).

Furthermore, several studies have shown that behaviors such as dieting and exercise tend to co-occur because of the personal and social benefits individuals derive from these activities (Mond et al., 2006; Mond & Calogero, 2009; Thome & Espelage, 2004, 2007). Weight loss has been reported as a primary reason by men and women for beginning an exercise program (Thome & Espelage, 2007). However, exercise can facilitate weight and diet concerns in certain susceptible individuals, such as athletes, some of whom have a heightened interest in physical appearance for performance purposes (Meyer et al., 2011).

This finding is at odds with the widely used cognitive-behavioral theory of eating disorders, which views compulsive exercise as a symptom of an eating disorder, rather than a causal agent (Fairburn, Cooper, & Shafran, 2003). According to cognitive-behavioral theory, body image dissatisfaction, namely weight and shape concerns, are core features of the initiation of compulsive exercise (Meyer et al., 2011; Mond et al., 2006; Mond & Calogero, 2009). In the absence of an eating disorder, however, compulsive exercise is not viewed as constituting a clinically significant syndrome (Mond et al., 2006). Specifically, Mond et al. (2006) found no relationship between exercise and reduced quality of life, when statistically controlling for the eating pathology. On the contrary, in the presence of eating pathology, compulsive exercise is used as a maladaptive strategy for burning calories in weight and shape pre-occupied individuals. Thus, disordered eating behaviors and attitudes are viewed as central

components of compulsive exercise that foster its development and maintenance (Dalle et al., 2008; Meyer et al., 2011; Mond & Calogero, 2009).

Female Athlete Triad

A health consequence of disordered eating behaviors that commonly affects female athletes is the Female Athlete Triad (De Souza et al., 2014). According to Tenforde et al. (2016), the Triad involves one or more of the three interrelated components: (1) low energy availability caused by nutrient deficiency; (2) menstrual irregularities; and (3) low bone mineral density. Competitive female athletes exhibiting one or more of the three Female Athletes Triad components may further develop more severe hormonal and musculoskeletal conditions, such as amenorrhea and osteoporosis (Tenforde et al., 2016). Amenorrhea is the absence of menstrual cycles caused by restricted caloric intake and resulting energy deficiency (Nattiv et al., 2007). Low energy availability in association with amenorrhea can further lead to osteoporosis, which is characterized by extremely low bone density (Duckham et al., 2012). Amenorrhea in combination with osteoporosis are significant risk factors for stress fractures and bone stress injuries in female athletes suffering from an eating disorder (Nazem & Ackerman, 2012). Other medical complications of the Female Athlete Triad involve the gastrointestinal, endocrine, renal, and neuropsychiatric systems (Nattiv et al., 2007). Estrogen deficiency, infertility, and impaired bone health may develop in female athletes with an eating disorder (De Souza et al., 2014).

Up to 79% of competitive female athletes suffer from one or more components of the Female Athlete Triad (Beals & Hill, 2006; Hoch et al., 2009; Nattiv et al., 2007; Nichols, Rauh, Lawson, Ji, & Barkai, 2006; Torstveit & Sundgot-Borgen, 2005). While

the prevalence of menstrual abnormalities ranges from 6 – 79% in female athletes, the rates of low bone mineral density vary from 11 – 22% (Beals & Hill, 2006; Hoch et al., 2009; Nattiv et al., 2007; Nichols et al., 2006; Torstveit & Sundgot-Borgen, 2005). Although the triad may be found across various sports, athletes competing in endurance, aesthetic, or weight-class sports that emphasize leanness are at an increased risk (De Souza et al., 2014; Nattiv et al., 2007).

Consequences of Eating Disorders on Athletic Performance

Disordered eating can have an effect on athletic performance (El Ghoch, Soave, Calugi, & Dalle Grave, 2013). In aesthetic, endurance, and weight-class sports, it is believed that leanness leads to enhanced performance (Bratland-Sanda & Sundgot-Borgen, 2013). However, many athletes achieve low weight through disordered eating and compensatory behaviors, which can significantly decrease athletic performance (El Ghoch et al., 2013; Joy et al., 2016). Specifically, long-term disordered eating impairs the main components of muscular fitness (i.e., aerobic fitness, musculoskeletal fitness, motor fitness, and flexibility), thus resulting in poor athletic performance (Alberti et al., 2009). In addition, the health consequences of restricted caloric intake, such as loss of fat, lean body mass, electrolyte imbalances, and dehydration, can contribute to diminished performance (El Ghoch et al., 2013). In a study among junior elite female swimmers, VanHeest, Rodgers, Mahoney, and De Souza (2014) found that female athletes who restricted caloric intake and increased energy expenditure in training frequently suffered from ovarian suppression (i.e., lack of estrogen production). Female athletes who trained in the presence of low energy availability and ovarian suppression exhibited significant declines in their swim velocity (Vanheest et al., 2014).

A similar study of high school athletes found a negative relationship between disordered eating and athletic performance (Thein-Nissenbaum, Rauh, Carr, Loud, & Mcguine, 2011). Among a large sample of high school athletes, 35.4% were found to suffer from disordered eating, 18.8% reported menstrual irregularities, while 65.6% reported suffering a sports-related musculoskeletal injury during the ongoing season. Athletes exhibiting disordered eating behaviors were twice as likely to sustain a sports-related injury during a competitive season, as compared to the athletes reporting healthy eating behaviors. Moreover, the inability to train and compete due to an injury further resulted in decreased athlete performance upon the athlete's return to play (Thein-Nissenbaum et al., 2011).

In addition to physical consequences on sport performance, disordered eating may contribute to other psychosocial issues (El Ghoch et al., 2013). In particular, obsessive concern about weight and body image, as well as continuous eating restriction have been associated with mood disorders, which may impact both athletic and academic performance (Hjern, Lindberg, & Lindblad, 2006). Furthermore, overemphasis of body shape, weight, and eating control, as well as anxiety and depression that often coexist in athletes at-risk for an eating disorder, can further decrease athletes' motivation to train and compete. The resulting poor performance may subsequently increase the pressure experienced by athletes to train more intensely and adhere to even more rigid dieting for weight loss (El Ghoch et al., 2013). Disordered eating behaviors in competitive athletes may not only severely undermine athletes' health, but may also produce deterioration in sport performance (El Ghoch et al., 2013).

The Prevalence of Disordered Eating in Athletes and Non-Athletes

A high incidence of disordered eating and other pathogenic weight control behaviors have been found among student-athletes (Chatterton & Petrie, 2013; Hinton, Sanford, Davidson, Yakushko, & Beck, 2004; Petrie et al., 2008). For example, Sundgot-Borgen and Torstveit (2010) found that up to 70% of elite athletes participating in weight-class sports, such as wrestling, rowing, and martial arts, engage in abnormal eating and weight control methods to facilitate a rapid weight reduction prior to competition. Such pathogenic behaviors include strict dieting or fasting, excessive exercise, binge eating, and self-induced vomiting (Sundgot-Borgen & Torstveit, 2010).

Rosendahl et al. (2009) found that nearly 50% of adolescent male elite athletes participating in different categories of sports (i.e., aesthetic, weight-class, and endurance sports) reported body dissatisfaction, 19% were dieting, and 11% were using maladaptive weight control behaviors. In Anderson and Petrie's (2012) study on eating disorder symptoms and weight control behaviors among female varsity athletes, 26.8% of women reported disordered eating. Over 6% of the athletes met diagnostic criteria for clinical Bulimia Nervosa. These athletes reported binge eating at least twice per week followed by compensatory behaviors. Approximately 40% of the athletes engaged in at least two hours of daily physical activity, suggesting that many may be using this high level of activity as a compensatory strategy in response to the binge eating. Up to 28% of athletes reported dieting or fasting at least two times over the past year (Anderson & Petrie, 2012).

A large number of studies have explored the prevalence rates of eating disorders among college varsity and elite athletes, as compared to non-athletes (Holm-

Denoma, Scaringi, Gordon, Van Orden, & Joiner, 2009; Petrie et al., 2008; Sundgot-Borgen & Torstveit, 2004; Thiemann et al., 2015). Both female and male athletes are believed to be at greater risk of developing an eating disorder as compared to non-athletes (Glazer, 2008; Holm-Denoma et al., 2009; Sundgot-Borgen & Torstveit, 2004; Thiemann et al., 2015). Socio-cultural risk factors, such as emphasis on high achievements, resulting overtraining, as well as pressure to maintain a low body weight for competitive advantage, have been associated with the onset of eating pathology (Bratland-Sanda & Sundgot-Borgen, 2013; Rosendahl et al., 2009).

For instance, in a sample of over 1000 individuals, athletes exhibited higher scores on standardized questionnaires which assessed disordered eating, as compared to non-athletes (Glazer, 2008). Among 1620 Norwegian elite athletes and 1696 non-athletes, 8% of male and 20% of female athletes were classified in the subclinical or clinical range for an eating disorder, as compared to 0.5% of male and 9% female non-athletes (Sundgot-Borgen &Torstveit, 2004). Moreover, 8.4% of athletes, as compared to 2.9% of non-athletes, met the criteria for Anorexia Athletica and Eating Disorder – Not Otherwise Specified. Meanwhile, 5.1% of athletes and 1.7% of non-athletes were classified as at-risk for either Anorexia Nervosa or Bulimia Nervosa (Sundgot-Borgen & Torstevit, 2004).

Comparable results have been found in the United States. In a sample of 274 undergraduate female participants, Holm-Denoma et al. (2009) found that women who participated in the Division I varsity or club athletics demonstrated higher levels of eating disorder symptomatology than women who did not exercise. Division I varsity and club athletes scored higher on the drive for thinness, bulimic symptoms, and body

dissatisfaction subscales of the Eating Disorders Inventory (EDI; Garner, Olmstead, & Polivy, 1983), as compared to independent exercisers and non-exercisers (Holm-Denoma et al., 2009). Moreover, the level of athletic participation, in conjunction with high anxiety, were significant predictors of an athlete's body dissatisfaction and bulimic symptoms. From these results, Holm-Denoma and colleagues (2009) concluded that college varsity and elite athletic participation places athletes in a higher risk category for an eating disorder as compared to non-athlete peers. Specifically, socio-cultural pressures placed on competitive athletes may generate competition-related anxiety in those athletes vulnerable to the development of anxiety symptoms, which can further increase their propensity for maladaptive eating (Holm-Denoma et al., 2009).

More recent studies have also confirmed that pathogenic eating behaviors are more common among athletes than non-athletes (Martinsen & Sundgot-Borgen, 2013; Thiemann et al., 2015). Thiemann and colleagues (2015) compared disordered eating patterns of professional German female athletes with non-athlete peers. Structured Clinical Interviews for DSM-IV (SCID) were conducted to identify individuals with eating disorders. The study found that 17% of athletes in aesthetic sports (such as, gymnastics, figure skating, and synchronized swimming) and 3% in ball sports suffered from an eating disorder, as compared to 2% of non-athletes. Thiemann et al. (2015) suggested that socio-cultural pressure created by the media to adhere to certain body image "standards" could affect both, athletic and non-athletic groups. However, pressure generated by coaches and teammates to attain a certain body composition for performance enhancement is a risk factor affecting only athletes.

Martinsen and Sundgot-Borgen (2013) compared the propensity for the development of eating disorders among a total sample of 966 Norwegian elite high school athletes and non-athletes. Twenty-five percent of athletes and 50.7% non-athletes were classified as at-risk for an eating disorder based on the Eating Disorders Inventory-2 (EDI-2). These at-risk individuals subsequently completed the Eating Disorder Examination (EDE) interview. Based on the interview, 7.0% of the athletes and 2.3% of the non-athletes met the DSM-IV criteria for an eating disorder. The estimated prevalence of subclinical eating disorders was higher in female athletes (14%) than female non-athletes (5.1%).

Although more non-athletes reported a higher frequency of disordered eating behaviors on the self-report measure, a significantly higher prevalence of clinical eating disorders was found among adolescent elite athletes than non-athletes following clinical interviews conducted by eating disorder specialists (Martinsen & Sundgot-Borgen, 2013). Specifically, many athletes underreported the use of pathogenic weight control behaviors on the initial EDI-2 self-report, as compared to the EDE follow-up clinical interview. Martinsen and Sundgot-Borgen's (2013) findings indicate that athletes may view their disordered eating behaviors as a natural element of their sport participation, rather than a clinical issue in need of treatment. Thus, athletes may be likely to continue their maladaptive eating and exercise habits because they believe that such behaviors may lead to enhanced athletic performance.

In contrast, several studies found no difference in the rates of disordered eating among athletes and non-athletes (DiBartolo & Shaffer 2002; Martinsen, Bratland-Sanda, Eriksson, & Sundgot-Borgen, 2010). DiBartolo and Shaffer (2002), for example, found

that female athletes exhibited less eating disorder symptoms on the self-reported measures of eating attitudes, body satisfaction, and perceived self-competence, as compared to non-athletes. In addition, female athletes had higher scores on the measures related to healthy psychological functioning than non-athletes. These findings were consistent with Martinsen et al.'s (2010) study, which also found that a higher percentage of non-athletes reported engaging in pathogenic eating behaviors and weight control measures than athletes. The findings from both studies indicate that athletic involvement could be correlated with an increased knowledge of healthy eating and psychological functioning in athletes (DiBartolo & Shaffer, 2002; Martinsen et al., 2010).

Other studies have also examined dieting, weight concerns, body dissatisfaction, and disordered eating symptoms among elite adolescent and varsity athletes and their non-athlete peers (Dempsey, Wiemann, Moreland, & Anding, 2004; Rosendahl et al., 2009). For example, Dempsey et al. (2004) explored the differences in the manifestation of the female athlete triad components (i.e., disordered eating, amenorrhea, and osteoporosis) in 97 Division I college female athletes and 153 non-athletes. The study found no significant differences in the mean disordered eating scores and the prevalence of amenorrhea between athletes and non-athletes (Dempsey et al., 2004). Dempsey et al. (2004) concluded that Division I athletes are as likely to have the components of the female athlete triad as their non-athlete peers.

In a sample of 576 elite adolescent German athletes and 291 non-athletes, Rosendahl et al. (2009) also did not find a higher frequency of pathogenic eating behaviors in athletes as compared to non-athletes, leading them to conclude that sport participation may serve as a protective mechanism against the development of unhealthy

eating behaviors. More specifically, during the course of sport participation, athletes may acquire knowledge on proper nutrition for reaching optimal performance, as compared to non-athletes, who are not pressured to adhere to a specific nutrition plan for performance enhancement (Rosendahl et al., 2009).

Reinking and Alexander (2005) found a total of 7.1% of varsity athletes and 12.9% of non-athletes classified as at-risk for an eating disorder. Moreover, non-athletes scored significantly higher on the body dissatisfaction and ineffectiveness subscales of the Eating Disorder Inventory (EDI), which indicated that non-athletes experienced feelings of general inadequacy, worthlessness, and insecurity more frequently than athletes. Similarly, DiPasquale and Petrie (2013) explored disordered eating, body image, and compensatory behaviors among 302 NCAA Division I student-athletes and a matched sample of 523 non-athletes. Utilizing the Questionnaire for Eating Disorder Diagnosis (Q-EDD; Mintz, Halloran, Mulholland, & Schneider, 1997), 29.2% of female non-athletes scored in the symptomatic range for an eating disorder, significantly greater than the 6.5% of female athletes. In addition, 5.9% of female non-athletes were classified with Bulimia Nervosa, Anorexia Nervosa, or Binge Eating Disorder. No female athletes were diagnosed with an eating disorder. Among males, 18.8% of non-athletes and 12.2% of athletes demonstrated severe symptoms of disordered eating. Regarding the use of weight-control behaviors, athletes, reported significantly less frequent use of dieting, compulsive exercise, weight-loss drugs, and self-induced vomiting than non-athletes, which suggests that athletes may possess more knowledge about proper nutrition than non-athletes (DiPasquale & Petrie, 2013).

In summary, disordered eating appears to affect 30-70% of varsity athletes. (Anderson & Petrie, 2012; Rosendahl et al., 2009; Sundgot-Borgen & Torstveit, 2010). In most, but not all studies, the rates of disordered eating are higher among athletes than non-athletes (Holm-Denoma et al., 2009; Martinsen & Sundgot-Borgen, 2013; Sundgot-Borgen & Torstveit, 2004). Considering the severity of the disordered eating problem, there is a need to further explore the prevalence of pathogenic eating behaviors in the athletic community (Blair et al., 2017). The current study will examine the occurrence of maladaptive eating behaviors, in conjunction with compulsive exercise, among NCAA Division I college athletes. The study will add to the existing evidence on the complex interaction between dysfunctional eating and compensatory behaviors.

Eating Disorders in Female and Male Athletes

A great number of studies have revealed a higher prevalence of eating disorders and maladaptive eating habits in female athletes compared to male athletes (Greenleaf et al., 2009; Martinsen et al., 2010; Sundgot-Borgen & Torstveit, 2004). In a sample of 800 NCAA Division I student-athletes, 19% of female and 12% of male athletes reported unhealthy eating habits (Carter & Rudd, 2005). Krebs, Dennison, Kellar, and Lucas (2019) also found a higher rate of eating disorders in college varsity female athletes than males. Specifically, three times as many female distance runners screened positive for an eating disorder compared to male (46% and 14%, respectively).

While eating disorders are more common among varsity female than male athletes, male athletes are also affected by this issue (Glazer, 2008; Chatterton & Petrie, 2013; Petrie et al., 2008). For instance, certain male athletes, specifically wrestlers, rowers, and long-distance runners, are more likely to engage in pathogenic weight control

behaviors than female athletes in general due to an increased focus on physical appearance and weight (Glazer, 2008; Hinton et al., 2004). Hinton and colleagues (2004) examined dietary intake and eating behaviors in 345 NCAA Division I student-athletes. They found that more male athletes than female athletes exhibited having inadequate nutrient intake. Specifically, only 10% of male athletes, as compared to 19% of female athletes, consumed the recommended minimum of carbohydrates per each kilogram of their body weight, while 19% of males and 32% of females consumed the minimum recommended amount of protein. Moreover, male athletes were more likely to exceed the Dietary Guidelines for fat, saturated fat, sodium, and cholesterol intakes, as compared to female athletes (Hinton et al., 2004).

In contrast to female athletes, who indicated restricting their nutrient intakes for weight gain prevention, male athletes reported using dietary supplements (other than vitamins) for weight reduction (Hinton et al., 2004). Also, approximately 6% of male athletes indicated restricting their fluid intake. These findings can potentially be understood in the context of men's preoccupation with muscularity, resulting in a focus on diet, nutritional supplements, and excessive exercise (Carter & Rudd, 2005). Hinton et al.'s (2004) study findings suggest that male athletes, just as female, undergo psychological problems of body dissatisfaction and low self-esteem, which leads to the onset of eating pathologies. In regards to sport-specific factors, male athletes are equally pressured to diet and exercise compulsively in order to maintain low body weight and produce successful athletic results (Currie, 2010).

High school athletes also show comparable gender rates of eating disorders. In a sample of 263 adolescent and adult athletes participating in high intensity sports, 22% of

female and 4% of male athletes were classified as at-risk for an eating disorder (Byrne & McLean, 2002). Martinsen et al. (2010) identified 44.7% of female and 13.1% of male high school athletes having severe symptoms of eating disorders. In addition, female athletes exhibited higher scores than males on the drive for thinness and body dissatisfaction subscales. Lastly, more females (11.1%) than males (2.1%) used pathogenic weight control methods, such as the use of laxatives, diuretics, diet pills, self-induced vomiting, and strict dieting. The main explanation for this tendency is that women are more subjected to socio-cultural pressure to diet and be thin, while men tend to be more concerned with physical fitness and masculinity (Martinsen et al., 2010). Thus, fewer male athletes contemplate dieting as compared to female athletes, which represents a risk factor for the development of eating disorders in women (Støving, Andries, Brixen, Bilenberg, & Horder, 2011).

Rosendahl et al. (2009) reported similar percentages of disordered eating symptoms in a sample of 576 competitive high school athletes, ranging from 10.4% for males to 26.7% for females. Fortes, Kakeshita, Almeida, Gomes, and Ferreira (2013), however, found a smaller difference between the genders. In a sample of 500 athletes, 18.1% of females and 14.4% of males reported eating disorder symptoms based on the Eating Attitudes Test (EAT-26; Garner, Olmstead, Bohr, & Garfinkel, 1982). Female athletes also exhibited significantly higher scores than male athletes on the food preoccupation, bulimia, and diet subscales. It may be that young female athletes are more likely to experience body dissatisfaction because pubescent female athletes may gain a significant amount of fat (Fortes et al., 2013). This physiological change may

contribute to the higher incidence of dieting among female athletes than male athletes (Bartland-Sanda & Sundgot-Borgen, 2013).

In summary, a substantial body of literature shows that rates of eating disorders and disordered eating symptoms range widely, 0-19% in male athletes and 6-45% in female athletes (Bratland-Sanda & Sundgot-Borgen, 2013; Krebs et al., 2019; Martinsen et al., 2010). While the occurrence of clinical eating disorders is more prevalent in female athletes than male athletes, male athletes, in some sports, are at greater risk for pathogenic weight control behaviors (Hinton et al., 2004; Sundgot-Borgen & Torstveit, 2004). Such findings highlight inconsistencies in the eating disorder area and emphasize the need for additional research on the prevalence of eating disorders among both male and female athletes. One of the aims of the current study was to explore the differences in student-athletes' maladaptive eating and exercise patterns based on their gender. The study findings may establish a more lucid pattern of disordered eating in varsity male and female student-athletes.

Eating Disorders by Sport

A number of studies have determined that the sport type in which an athlete participates can serve as a risk-factor for the development of disordered eating (Anderson & Petrie, 2012; Glazer, 2008; Rosendahl et al., 2009; Sungdot-Borgen & Torstveit, 2004). In eating disorder research, sports have been categorized according to the level of pressure an athlete faces to maintain a low body weight for aesthetic reasons and/or performance enhancement (Currie, 2010). From various studies (Anderson & Petrie, 2012; Glazer, 2008; Joy et al., 2016; Petrie et al., 2008), the following categories have emerged: aesthetic or lean sports (e.g., gymnastics, figure skating, swimming, diving,

track and field), endurance sports (e.g., cross country, cycling), technical sports (e.g., tennis, golf, baseball, softball), ball game sports (e.g., soccer, volleyball, basketball, football), weight-class sports (e.g., wrestling, rowing), and anti-gravitational sports (e.g., skiing, pole vault jumping).

Higher prevalence rates of eating disorders in aesthetic, endurance, and weight-class sports have been consistently reported (Bratland-Sanda & Sundgot-Borgen, 2013; Joy et al., 2016; Thiemann et al., 2015). For example, in a group of 108 professional female athletes, Thiemann et al. (2015) found a higher frequency of maladaptive eating in aesthetic sports (17%) than in ball-game sports (3%). In Sundgot-Borgen and Torstveit's (2004) study on elite Norwegian athletes, 42% of women in aesthetic sports (e.g., gymnastics, figure skating, diving), 24% in endurance sports (e.g., long-distance running, cycling, swimming), 17% in technical sports (e.g., golf, tennis), and 16% in ball game sports (e.g., soccer, volleyball, basketball) had subclinical and clinical eating disorders. Among male athletes, 9% of eating disorders were reported in men participating in endurance sports and 5% in ball-game sports (Sundgot-Borgen & Torstveit, 2004). Rosendahl and colleagues (2009) reported similar rates of disordered eating for high school female athletes in aesthetic (40%), endurance (10%), and ball-game sports (15.6%).

There are three major reasons that could explain higher prevalence rates of eating disorders in aesthetic, endurance, and weight-class sports. First, in endurance sports, such as cross country, weight higher than an athlete's optimum performance weight is linked to decreased performance (Currie, 2010). Second, in weight category sports, such as wrestling, athletes are pressured to meet a specific weight requirement just to qualify

for a competition (Bratland-Sanda & Sundgot-Borgen, 2013). Third, in aesthetic sports, such as gymnastics, athletes' physical appearance is a part of an aesthetic evaluation, which pressures athletes to attain a certain body composition (Currie, 2010).

Due to the increased focus on body weight and physical appearance that prevails in lean, aesthetic, and weight-class sports, up to 70% of athletes competing in these sports develop maladaptive eating behaviors (Rosendahl et al., 2009; Sundgot-Borgen & Torstveit, 2010; Thiemann et al., 2015). Nevertheless, while the prevalence of disordered eating in sports that emphasize leanness is high, the reported rates of eating disorders vary by sport (Holm-Denoma et al., 2009; Rosendahl et al., 2009). For instance, in a sample of 414 NCAA Division I female athletes competing in gymnastics and swimming/diving, 108 females (28.9% of which were gymnasts and 20.9% were swimmers/divers) scored in the subclinical range for an eating disorder (Anderson & Petrie, 2012). In addition, 26 athletes (6.1% of gymnasts and 6.7% of swimmers/divers) were classified as having an eating disorder. Out of 26 athletes in the eating disorder group, 20 athletes were identified as having subthreshold Bulimia Nervosa, 4 with Non-Bingeing Bulimia, and 2 with Binge Eating Disorder (Anderson & Petrie, 2012).

In contrast to Anderson and Petrie's (2012) findings, Carter and Rudd (2005) detected lower prevalence rates of disordered eating considering the sport type. In a mixed-gender sample of 800 NCAA Division I athletes, Carter and Rudd (2005) found 9.2% of non-lean sport athletes and 17.5% of lean-sport athletes exhibiting subclinical features for an eating disorder. Carter and Rudd (2005) included certain aesthetic and weight-class sports, such as gymnastics, swimming, rowing, volleyball, and wrestling in the lean-sport classification, while golf, tennis, football, basketball, and soccer were

categorized as non-lean sports. Additionally, 6.1% of athletes in lean sports suffered from "chronic dieting," as compared to 2.5% of athletes in non-lean sports. Such high rates of disordered eating in gymnasts and swimmers/divers support the notion that athletes competing in lean and aesthetic sports are encouraged to possess ideal body weight for reaching optimal performance. Thus, lean- and aesthetic-sport athletes are exposed to higher risks for developing an eating disorder than athletes competing in sports that do not overly emphasize body weight and physical appearance (Anderson & Petrie, 2012; Carter & Rudd, 2005).

Furthermore, Glazer (2008) found that athletes participating in physique-salient sports averaged significantly higher on the Eating Attitudes Test (EAT) and the Social Physique Anxiety Scale (SPAS), suggesting greater disordered eating and physique anxiety, as compared to athletes participating in non-physique salient sports. Glazer's (2008) findings support the notion of increased prevalence of eating disorders in sports that emphasize leanness (e.g., gymnastics, long distance running). Participation in non-physique salient sports (e.g., basketball, softball, soccer) may be a protective factor for the development of disordered eating (Glazer, 2008).

Although some studies have linked the sport team classification to disordered eating levels (Anderson & Petrie, 2012; Carter & Rudd, 2005; Rosendahl et al., 2009), other studies found no support for this relationship (Greenleaf et al., 2009; Petrie et al., 2008; Sanford-Martens, Davidson, Yakushko, Martens, & Hinton, 2005). For example, in Petrie et al.'s (2008) study, none of the 203 varsity athletes were diagnosed with an eating disorder, while 19.2% of athletes had subclinical symptoms. Despite the high frequency of disordered eating behaviors in athletes, no association was found between

sport team classification and eating disorder status. Similarly, Greenleaf et al. (2009) found no differences in the frequency of maladaptive eating behaviors across sport type, although 2% of athletes were identified as having an eating disorder and 25.5% as symptomatic. These results corroborated previous findings from Sanford-Martens and colleagues' (2005) study. While 18% of varsity athletes scored in the subclinical range for an eating disorder, there were no differences in symptoms across sport type. These findings suggest that sport type may not be an influential factor in the development of maladaptive eating habits in competitive athletes (Sanford-Martens et al., 2005).

In summary, while some studies suggest that lean-sport athletes are at a higher risk for disordered eating than non-lean sport athletes (Anderson & Petrie, 2012; Carter & Rudd, 2005), other studies suggest that maladaptive eating occurs equally across sports (Greenleaf et al., 2009; Petrie et al., 2008). This observation calls for the need to broaden researchers' perspectives on identification of at-risk athletes (Bratland-Sanda & Sundgot-Borgen, 2013). The current study explored the relationship between sport type and an athletes' pathogenic eating and compensatory behaviors. The study findings may provide a more clear pattern between the sport type and disordered eating in collegiate athletes.

Eating Disorders and Age

While a great number of studies on the prevalence of eating disorders among athletes have reported their ages as a demographic variable (Glazer, 2008; Martinsen et al., 2010; McNamara & McCabe, 2012; Reinking & Alexander, 2005; Sundgot-Borgen & Torstveit, 2004), only a few studies assessed the direct link between disordered eating and college athletes' age (Gomes, Martins, & Silva, 2011; Greenleaf et al., 2009; Petrie et al., 2008). For instance, while none of the 203 college-aged male athletes were classified

as eating disordered, 19.2% of athletes reported subclinical-level symptoms of an eating disorder in Petrie et al.'s (2008) study. Nevertheless, disordered eating group status (symptomatic vs. asymptomatic) was not related to age, indicating that symptomatic athletes may be found among all different ages (Petrie et al., 2008).

Greenleaf et al. (2009) replicated Petrie et al.'s (2008) findings. In a sample of 204 college athletes with an average age of 20.16 years, 2% of clinical and 25.5% of subclinical eating disorders were identified. However, no differences were exhibited in athletes' eating disorder status (i.e., symptomatic vs. eating disordered) based on their age. These findings suggest that the age variable may not be an influential factor on college athletes' disordered eating symptomology (Greenleaf et al., 2009). Similarly, in a sample of 290 elite athletes between 14 and 30 years of age, Gomes et al. (2011) assessed the relationship between unhealthy eating behaviors and age. No association was found between athletes' age and each subscale of the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 2008). Thus, the findings indicate that athletes across different ages may be equally at-risk for developing maladaptive eating habits (Gomes et al., 2011; Petrie et al., 2008).

Pettersen, Hernæs, and Skårderud (2016) further examined the prevalence of disordered eating in 225 Norwegian athletes in the age groups of 17, 18, and 19+ years old. In total, 18.7% of the athletes exhibited symptoms of disordered eating. Age was not a significant predictor of athletes' maladaptive eating patterns. However, in Kantanista et al.'s (2018) and Karr et al.'s (2013) studies, age was a greater contributing factor to the development of eating disorders in adolescent athletes (13-17 years old) than adults (18-30 years old). As Pettersen et al. (2016) explain, the peak risk for the

development of an eating disorder occurs between childhood and early adolescence. Specifically, adult athletes have acquired higher levels of confidence and self-esteem than athletes in their early adolescence, which could serve as a protective mechanism against the development of eating pathologies (Kantanista et al., 2018; Pettersen et al., 2016).

In summary, some studies suggest that the prevalence of maladaptive eating behaviors (e.g., fasting, self-induced vomiting, using laxatives and diuretics, bingeing followed by exercise, etc.) is higher in the college-aged athletes, as compared to competitive adolescent athletes (Joy et al., 2016; Kato et al., 2011; Pettersen et al., 2016). Nevertheless, a substantial body of literature indicates that competitive adolescent athletes experience severe eating disorder symptoms as do collegiate athletes (Bratland-Sanda & Sundgot-Borgen, 2013; Joy et al., 2016; Pettersen et al., 2016). The studies that focused on the impact of age, however, did not establish a relationship between age and eating disorder status in adult athletes (Greenleaf et al., 2009; Petrie et al., 2008; Pettersen et al., 2016). The current study explored whether age is a contributing factor to the development of unhealthy eating patterns in collegiate athletes.

Other Psychosocial Risk Factors for Eating Disorders in Athletes

In examining the psychosocial and athletic factors associated with the varsity athletes' disordered eating, physical overtraining, excessive weight control, body image dissatisfaction, societal pressure to be thin, and high demands to produce successful results are the common pressures that could lead to the development of eating disorders (Bruin, Oudejans, Bakker, & Woertman, 2011; Meeusen et al., 2013; Thiemann et al., 2015). For instance, Thiemann et al. (2015) found that societal pressure to be thin, its internalization, and body dissatisfaction, are the putative risk factors for eating disorders

in professional female athletes. Another sport-specific factor is sports pressure that promotes attainment of a lean body for optimal performance (Thiemann et al., 2015).

While societal pressure to be thin may be exerted through various media sources, sports pressure to be lean may be generated by teammates and coaches (Hinton & Kubas, 2005; Thompson & Sherman, 2010). For instance, in a sample of 106 Division I varsity athletes, 76.5% reported engaging in up to 6 hours of weekly physical activity in addition to the NCAA required training time (Berestetska & Sachs, 2018). On the NCAA required day off, 59% of student-athletes indicated participating in up to 2 hours of voluntary physical activity. Pressure to improve one's athletic performance was the main reason behind varsity athletes' additional physical training. Thus, compulsive exercise may affect a significant number of college varsity athletes, as they view additional physical training as an integral part of their athletic career (Berestetska & Sachs, 2018). Being exposed to both sources of pressure (i.e., societal and sport-specific pressure) results in an increased likelihood of internalization of societal body ideals and body dissatisfaction, depending on the discrepancy between the real and the perceived ideal body (Thompson & Sherman, 2010). These psychological issues can contribute to the development of restrained eating and subsequent clinical eating disorders (Thiemann et al., 2015).

Summary of Literature

Collegiate athletes are a particular group of individuals that have been found to exhibit elevated levels of eating and exercise pathology (Bratland-Sanda & Sundgot-Borgen, 2013; Chatterton & Petrie, 2013; Clifford & Blyth, 2019; Greenleaf et al., 2009; Kato et al., 2011). Up to 74% of collegiate athletes reported engaging in maladaptive

eating and weight control behaviors, such as binge eating, excessive exercise, strict dieting, fasting, self-induced vomiting, and the use of weight loss supplements (Chatterton & Petrie, 2013; Clifford & Blyth, 2019; Greenleaf et al., 2009). Such dangerous behaviors may result in poor health, as well as reduced athletic and academic performance (Joy et al., 2016). Unfortunately, most of these athletes experience eating disorder symptoms in isolation, as these behaviors are often overlooked by the coaching and athletic training staff (Watson, 2005, 2006).

The substantial physical demands of being a student-athlete have been identified as the contributing factors to the development of eating pathology and compensatory behaviors (Krentz & Warschburger, 2013). The 20-hour limit on weekly training imposed by the NCAA is often violated, which results in excessive hours of physical activity and subsequent overtraining (NCAA, 2008). The combination of disordered eating and physical overtraining may further produce significant health impairments, such as low energy availability, muscle weakness, acquisition of overuse injuries, mineral bone deficiency, cardiac complications, impaired immune function, malnutrition, dehydration, fatigue, amenorrhea, and osteoporosis (Beals & Hill, 2006; Dalle et al., 2008). Physical overtraining and inadequate nutrition can also negatively impact an athlete's mood, contributing to poor academic and athletic performance (Joy et al., 2016; Putukian, 2016).

Collegiate athletes suffering from disordered eating are known to engage in compulsive exercise as a strategy to compensate for immoderate caloric intake (Lichtenstein et al., 2017). However, compulsive exercise in combination with the sport-required training place student-athletes at a high-risk for physical overtraining, overuse

injuries, and subsequent diminished performance (Chatterton & Petrie, 2013; Sundgot-Borgen & Torstveit, 2010). In addition, this compensatory behavior often occurs as a symptom of eating psychopathology (Freimuth et al., 2011; Lichtenstein et al., 2017). Particularly worrisome is the finding that maladaptive eating with simultaneous engagement in compulsive exercise can often remain undetected in athletes and contribute to the progression of an eating disorder (McNamara & McCabe, 2012; Putukian, 2016). Thus, further studies are necessary for identifying maladaptive eating and compensatory behaviors in athletes (Gulliver et al., 2012; Joy et al., 2016).

Although disordered eating and exercise behaviors have been highlighted as significant issues among collegiate athletes, the percentage of athletes who meet full diagnostic criteria for clinical or subclinical eating disorders vary greatly, from 1.1% to 49.2% across studies (Carter & Rudd, 2005; Chatterton & Petrie, 2013; Greenleaf et al., 2009; Kato et al., 2011; Petrie et al., 2008). There also are large differences in rates of disordered eating among males (0 - 19%) and females (6 - 45%) (Bratland-Sanda & Sundgot-Borgen, 2013). The prevalence of disordered eating also varies by sport. Some studies suggested that lean-sport athletes (such as gymnasts, runners, swimmers, cyclists, and wrestlers) are more prone to developing an eating disorder than non-lean sport athletes, who do not overly emphasize body weight and physical appearance as part of their sport (Anderson & Petrie, 2012; Rosendahl et al., 2009). However, other studies failed to establish the relationship between athletes' sport classification and their propensity for unhealthy eating behaviors (Greenleaf et al., 2009; Petrie et al., 2008). Finally, while certain studies reported athletes' age as a demographic variable, there is a paucity of literature showing whether age serves as a risk factor for disordered eating in

collegiate athletes (Gomes et al., 2011; Greenleaf et al., 2009; Martinsen et al., 2010; Petrie et al., 2008). Such contradictory findings in the eating disorder field call for additional research on eating disorders and associated symptoms, including compulsive exercise, among collegiate athletes (Bratland-Sanda & Sundgot-Borgen, 2013; Joy et al., 2016).

Considering the previously discussed gaps in eating disorder research, the proposed study: (1) examined the prevalence of both formal eating disorders and disordered eating symptomatology in a large sample of collegiate athletes; (2) explored the frequency of self-reported compulsive exercise in these athletes; (3) assessed the differences in athletes' disordered eating, compulsive exercise, and body image attitudes, based on their gender and sport type; and (4) examined the associations between athletes' disordered eating, compulsive exercise, and body image attitudes, as well as associations between age and each of these three variables. The study findings may provide additional information on the relationship of disordered eating and compulsive exercise among collegiate student-athletes. The study results may further aid coaching and athletic training staff in promptly identifying at-risk athletes to inform prevention and treatment efforts.

CHAPTER 3

METHODOLOGY

The purpose of this study was to examine the prevalence both formal eating disorders and disordered eating symptomatology in a sample of collegiate student-athletes. A second aim was to explore the frequency of compulsive exercise occurrence as a compensatory behavior. Additional aims were: (1) to explore the differences in athletes' disordered eating, compulsive exercise, and body image by gender and sport type; and (2) to assess the relationships between athletes' disordered eating, compulsive exercise, and body image attitudes, as well as associations between athletes' age and each of these three variables.

Participants

The initial target population of the study were NCAA Division I student-athletes at Temple University. However, the current study was a part of a parent study investigating the relationship between traumatic brain injury and substance misuse in varsity, club, and recreational athletes. The parent study recruited college varsity and club athletes at different times of the 2019 academic year. During the data collection time for the current study, from September 25th until December 18th of 2019, responses were collected from a mixed sample of collegiate and club athletes at Temple University. All participants met the following eligibility criteria: being a minimum of 18 years of age; being included on an official team roster during the 2019 – 2020 academic year; and being proficient in English. Language proficiency was defined as the ability to understand the questionnaires, which were in English. All participants were enrolled in an undergraduate Bachelor's program. None of the participants had major limitations in

sight or hearing that could preclude standard administration of the psychometric measures and exclude them from the study participation.

Participants were recruited at Temple University by institutional Review Board (IRB) approved flyers or advertisements over the period of 12 weeks in Fall, 2019. The recruitment of athletes was accomplished by the research team through prior communication with coaches and athletic trainers, and subsequent presentation of information to teams that may be considered for participation. The format of this presentation provided information about the study, objectives of the research, tasks involved in participating and contact information if group members were interested in participating. The study team also contacted coaches and athletic trainers of Temple University to provide information about the study. Coaches, athletic trainers, and student-athlete organizations (e.g., Student-Athlete Advisory Committee) were provided with the flyer and asked to provide it to their student-athletes via email.

In addition to these methods, participants were provided information about the study via social media posts (Facebook, Twitter, etc.). The content of these posts included the approved flyer and language introducing the study. The research team also utilized SONA, Temple Psychology Research Participation system, through the Psychology Department at Temple University. This allowed current Temple University students to receive course credit for participation in research studies. Email and phone were utilized to communicate about scheduled appointments. Subject participation began at the time of enrollment and ended upon completion of testing. The assessments required one visit that took approximately 2-3 hours; questionnaires specific for this study took approximately 30 minutes to complete.

Collected data were de-identified by assigning a code to each subject. Only study personnel had access to code and name data. Data collected using paper-pencil methods were stored under double lock and key in investigator offices could only be accessed by study personnel. Data collected via computer were stored on a password-protected computer and with access only by study personnel. Any data containing identifiable information (e.g., name) were stored until the conclusion of the project and then destroyed.

Procedures

The current study was a part of a larger project exploring: (1) whether lifetime history of traumatic brain injury (TBI) is predictive of severity of substance use disorder in current and former collegiate athletes; and (2) if history of TBI is predictive of increased risk for substance use disorder/ alcohol abuse disorder (SUD/AUD) in individuals with no prior history of substance or alcohol abuse. The assessment for this larger study consisted of questionnaires, measures of cognitive abilities, and clinical interviews in a single session lasting 2-3 hours. Following the IRB approval, the Eating Disorder Examination-Questionnaire (EDE-Q; 6.0), the Compulsive Exercise Test (CET), and the Multidimensional Body Self-Relations Questionnaire – Appearance Subscales (MBSRQ-AS) were added to the study assessments. These instruments evaluated student-athletes' symptoms of disordered eating, the use of exercise as a weight control measure, and their body image attitudes, respectively. All three measures took approximately 30 minutes to complete. Participation was voluntary and could be discontinued at any time. The participants were given ample time to complete the surveys.

Instrumentation

Eating Disorders. To assess the participants' eating disorder symptomatology, the Eating Disorder Questionnaire (EDE-Q, version 6.0) was utilized in the study (Fairburn & Beglin, 2008). This measure was developed to provide a self-report method for evaluation of the eating disorder psychopathology (Fairburn & Beglin, 2008). The 28-item EDE-Q (6.0) includes the following four subscales: Restraint (items 1-5), Eating Concern (items 7, 9, 19-21), Weight Concern (items 8, 12, 22, 24, 25), and Shape Concern (items 6, 8, 10, 11, 23, 26-28). The Restraint subscale includes questions assessing athletes' caloric restrictions, food avoidance, and dietary rules (Fairburn & Beglin, 2008). The Eating Concern subscale evaluates athletes' preoccupation with food, fear of losing control over eating, and feelings of guilt about eating. The Weight Concern subscale assesses athletes' perceptions of their weight, including importance of weight, desire to lose weight, and body dissatisfaction. Lastly, the Shape Concern subscale evaluates athletes' perceptions of their shape, including preoccupation with shape, importance of shape, fear of weight gain, discomfort seeing body, fear of exposure, and dissatisfaction with shape (Fairburn & Beglin, 2008).

The EDE-Q (6.0) instrument generates two types of data (Fairburn & Beglin, 2008). First, the instrument provides frequencies of disordered eating behaviors in terms of the number of episodes of each behavior occurring during the past 28 days. Second, the instrument provides subscale scores indicating the severity of the disordered eating attitudes (Fairburn & Beglin, 2008). The EDE-Q items evaluating athletes' eating disorder attitudes and behaviors are scored on a 7-point Likert scale, where a rating of 0 corresponded to "none of the times", followed by "a few of the times", "less than half",

"half of the times", "more than half", "most of the time", and "every time" for a rating of 6. For items 1-12, a rating of 0 corresponded to "no days," followed by "1-5 days", "6-12 days", "13-15 days", "16-22 days", "23-27 days", and "every day" for a rating of 6. The scores of four or higher on at least one subscale or Global scale are indicative of a clinical eating disorder (Aardoom, Dingemans, Slof Op't Landt, & Van Furth, 2012). Based on the ratings of the relevant items for each subscale, the sum subscale scores are calculated and then divided by the total number of items comprising the subscale. To reflect an overall or "global" score for the EDE-Q measure, the four subscale scores are added together, and the resulting total is then divided by the total number of subscales (i.e., four). The score of 4 or higher on at least one EDE-Q subscale or Global scale is indicative of an eating disorder (Aardoom et al., 2012). Subscale results are reported as means and standard deviations (Faiburn & Beglin, 2008).

Since individuals' maladaptive behaviors were assessed in terms of the number of episodes of each behavior occurring during the past 28 days (Aardoom et al., 2012; Darcy, Hardy, Lock, Hill, & Peebles, 2013). "Regular" occurrence of binge eating episodes followed by misuse of laxatives, diuretics, and self-induced vomiting is defined as at least 4 occurrences in the past 28 days, while excessive exercise and extreme dietary restraint (i.e., fasting) are recognized as subclinical when these behaviors occur at least 4 times within the past 20 and 13 days, respectively (Aardoom et al., 2012). Reporting regular occurrence of at least one disordered eating behavior placed the participant in the subclinical category (Aardoom et al., 2012).

The EDE-Q has been a widely used measure in eating disorder research because it provides a comprehensive assessment of the psychopathology of disordered eating

behaviors in a brief self-report format (Darcy et al., 2013; Martinsen & Sundgot-Borgen, 2013; Torstveit, Fahrenholtz, Lichtenstein, Stenqvist, & Melin, 2019). Studies testing the validity of this instrument have determined a high level of agreement between the EDE-Q and the Eating Disorder Examination interview (Aardoom et al., 2012; Mond et al., 2006). Aardoom et al. (2012) demonstrated the discriminant validity of the EDE-Q global score, showing that it was highly accurate in discriminating between individuals with a clinical eating disorder and individuals reporting healthy eating behaviors. The results revealed a 96%-likelihood that the EDE-Q global score of a randomly selected individual in the clinical eating disorder sample will be significantly higher than a randomly selected individual in the asymptomatic sample (Aardoom et al., 2012).

Furthermore, studies examining other psychometric properties of the EDE-Q measure confirmed its high internal consistency and test re-test reliability (Berg, Peterson, Frazier, & Crow, 2011; Mond et al., 2006; Rose, Vaewsorn, Rosselli-Navarra, Wilson, & Striegel Weissman, 2013). Berg et al. (2011) concluded that the EDE-Q instrument is a viable alternative to the EDE interview. In addition, studies regarding the validity of the EDE-Q have demonstrated a high level of congruency between the EDE-Q and EDE core attitudinal features of eating disorder psychopathology among the general population and in clinical samples of individuals suffering from Bulimia Nervosa and Binge Eating Disorder (Mond et al., 2004, 2006, 2008; Rose et al., 2013). Lastly, studies utilizing the EDE-Q measure to assess disordered eating behaviors and attitudes among athletes have reported similar rates, ranging from 17 – 25% (Beals & Hill, 2006; Darcy et al., 2013; Bruin et al., 2011; Thiemann et al., 2015). These findings indicate that the

EDE-Q measure has the capability to produce consistent results across studies (Berg et al., 2011; Rose et al., 2013).

Compulsive Exercise. To assess the levels of participants' compulsive exercise, the Compulsive Exercise Test (CET) was utilized in the study (Taranis et al., 2011). The CET comprises 24 items that evaluate the following features of excessive exercise as a symptom of an eating disorder: compulsivity, affect regulation, weight and shape driven exercise, and exercise rigidity (Goodwin et al., 2011). Taranis et al. (2011) define compulsivity as rigid adherence to a strict exercise routine, continuous engagement in exercise despite illness or injury, feelings of guilt in case of discontinued exercise participation, and absence of exercise enjoyment. Affect regulation refers to the positive (e.g., mood improvement) and negative (e.g., avoidance of withdrawal symptoms) reinforcement properties of exercise, while weight and shape driven exercise manifests through the use of excessive exercise solely for weight control purposes (Taranis et al., 2011). Exercise rigidity reflects one's level of rigid behavioral pattern in terms of exercise and inflexible attitudes towards changing an acquired regimented behavior (Meyer et al., 2011).

The 24-item CET includes the following five subscales: avoidance and rule-driven behavior (e.g., feelings of extreme guilt in case of a missed an exercise session; items 9, 10, 11, 15, 16, 20, 22, 23); weight control exercise (e.g., exercising in order to burn calories and lose weight; items 2, 6, 8, 13, 18); mood improvement (e.g., feeling less anxious after an exercise session; items 1, 4, 14, 17, 24); lack of exercise enjoyment (e.g., finding exercise a chore; items 5, 12, 21); and exercise rigidity (e.g., following a set routine for each exercise session; items 3, 7, 19). Each item of the CET is rated on a

Likert-type scale, with anchors ranging from 0 (never true) to 5 (always true). Reversed scoring is used for items 8 and 12. The CET results are interpreted through the CET global score, which is the sum of the mean item scores for each of the five subscales. Higher total scores reflect greater levels of compulsive exercise (Taranis et al., 2011).

The CET is a valid and reliable measure of problematic exercise (Goodwin et al., 2011; Formby, Watson, Hilyard, Martin, & Egan, 2014; Meyer et al., 2016). The CET is based on a cognitive-behavioral maintenance model of excessive exercise, which views compulsive exercise as a symptom of an eating disorder (Fairburn et al., 2003). Thus, the CET has been developed specifically for use in eating disorder research and assessment, relying on theoretical definitions of compulsive exercise and its maintenance factors (Formby et al., 2014; Taranis et al., 2011). The CET has also addressed some of the psychometric and conceptual shortcomings of existing measures (Goodwin et al., 2011, Taranis et al., 2011).

The CET categories were generated from an extensive review of eating disorder and compulsive exercise literature, consultation with clinicians specialized in eating disorders, interviews with patients at-risk for an eating disorder, and a critical review of existing scales (Goodwin et al., 2011; Formby et al., 2014; Meyer et al., 2016; Taranis et al., 2011). In Taranis et al.'s (2011) development and validation of the instrument, an initial factor analysis identified the five subscales. This initial factor structure was further supported for use among the samples of adult exercisers and athletes (Goodwin et al., 2011; Plateau et al., 2014). Furthermore, the CET demonstrated high internal consistency across three consecutively repeated studies (Taranis et al., 2011). In the context of eating disorders, sufficient reliability of the CET total scale and its subscales were found

(Goodwin et al., 2011; Taranis et al., 2011). Meyer et al. (2016) established discriminative and convergent validity of the CET by finding reliable differences in the total CET scores between clinical and non-clinical groups. Specifically, the clinical group exhibited significantly higher scores on four of the five subscales of the CET, as compared to the non-clinical group. These findings were consistent with a cognitive-behavioral conceptualization of excessive exercise, providing further support for the multi-dimensional nature of compulsive exercise (Meyer et al., 2016).

Furthermore, studies among eating disordered patients established the concurrent and convergent validity of the CET (Goodwin et al., 2011; Formby et al., 2014; Meyer et al., 2016). The CET was correlated with other well-established measures of compulsive exercise and eating disorder symptoms, such as the Commitment to Exercise Scale (CES; Davis, Brewer, & Ratusny, 1993), the Eating Disorder Inventory-2 (EDI-2), and the Eating Disorder Questionnaire (EDE-Q 6.0; Fairburn & Beglin, 2008). Specifically, Goodwin et al. (2011) supported the concurrent validity of the CET by finding a significant and positive correlation between the CET and CES total scores. In addition, Goodwin et al. (2011) confirmed the CET convergent validity by showing significant positive associations between the total CET score and the EDI-2 drive for thinness, bulimia, and body dissatisfaction subscales. Thus, the CET highly correlated in the expected direction with existing measures of compulsive exercise and pathological eating (Goodwin et al., Meyer et al., 2016).

Body Image Attitudes. To assess participants' self-attitudinal aspects of body image, the Multidimensional Body Self-Relations Questionnaire – Appearance Subscales (MBSRQ-AS) was utilized in the study (Cash, 2000). The MBSRQ-AS is a 34-item self-

report inventory that measures satisfaction and orientation with body appearance, as well as weight preoccupation (Nevill, Lane, & Duncan, 2015). The MBSRQ-AS comprises five subscales: Appearance Evaluation (items 3, 5, 9, 12, 15, 18, 19), Appearance Orientation (1, 2, 6, 7, 10, 11, 13, 14, 16, 17, 20, 21), the Body Areas Satisfaction Scale (BASS; items 26 – 34), Overweight Preoccupation (items 4, 8, 22, 23), and the Self-Classified Weight Scale (24, 25). The Appearance Evaluation subscale evaluates how attractive or unattractive, and how happy or unhappy individuals feel with their physical appearance (Cash, 2000). The Appearance Orientation subscale assesses the time and efforts spent by an individual to "look good." The Body Areas Satisfaction Scale (BASS) approaches body image evaluation as dissatisfaction-satisfaction with body areas and attributes (Cash, 2000). The Overweight Preoccupation Scale assesses fat anxiety, weight vigilance, dieting, and eating restraint, while the Self-Classified Weight Scale assesses self-appraisal of weight from "very underweight" to very "overweight."

Each item of the MBSRQ-AS is rated on a five-point Likert scale, with anchors ranging from 1 (definitely disagree) to 5 (definitely agree). The MBSRQ-AS results are presented as means and standard deviations for each subscale. Reversed scoring is used for items 11, 14, 16, and 18-20. High scores on the Appearance Evaluation and Body Areas Satisfaction subscales indicate positive feelings and satisfaction, while low scores reflect a general dissatisfaction (Cash, 2000). On the contrary, high scores on the Appearance Orientation, Overweight Preoccupation, and Self-Classified Weight subscales indicate general feelings of body image dissatisfaction, while low scores reflect positive feelings and satisfaction (Cash, 2000). There is no composite score for the MBSRQ-AS measure.

The MBSRQ-AS measure has been widely used in high-performance athlete populations (Costarelli, Demerzi, & Stamou, 2009; Galli, Petrie, Greenleaf, Reel, & Carter, 2014; Kato et al., 2011). It has been previously demonstrated to be a reliable and valid measure for assessing one's attitude towards body image, physical activity, and health (Argyrides & Kkeli, 2013; Nevill et al., 2015; Untas, Koleck, Rascle, & Borteyrou, 2009; Vossbeck-Elsebusch et al., 2014). The subscales of the questionnaire yielded good reliability and convergent and discriminant validity coefficients, with most items showing excellent characteristics (Argyrides & Kkeli, 2013; Vossbeck-Elsebusch et al., 2014). In addition, the MBSRQ-AS subscales have consistently shown high internal consistency, ranging from .76 to .89, confirming the MBSRQ-AS's high internal consistency (Argyrides & Kkeli, 2013; Cash, 2000).

Demographic Questionnaire. The participants completed a demographic questionnaire to report the following characteristics: age, gender, year in school, BMI, sport in which they participate, level of athletic participation, and years of overall experience participating in sport.

Data Analysis

Data Screening. Prior to performing analyses, standard data screening/cleaning procedures were applied. These procedures: screened the data for data-entry errors; checked for outliers; assessed the extent and pattern of missing data; created all summary scores needed for analysis; and checked that appropriate assumptions of normality are met. In all analyses, the assumptions underlying the application of the selected statistical methods used in the study were examined. Specifically, the data were tested for the following assumptions necessary for correlational analysis: having two continuous

variables; a linear relationship between the variables; and no significant outliers (Montgomery, Peck, & Vining, 2015). Furthermore, potential outliers were identified in the cumulative sample by examining quality assessment measures and flagging for further investigation subjects greater than two standard deviations from the mean on any one measure (i.e., behavioral performance). The final sample was examined in a similar fashion to determine whether any subjects warrant data cleaning or require exclusion from the final statistical analysis.

Statistical Procedures. The SPSS Statistics Software (version 25.0) was used to determine statistical significance for the variables of interest. First, descriptive statistics were calculated for each demographic variable. Second, internal consistency and reliability tests were performed for each subscale of the EDE-Q, CET, and MBSRQ-AS measures. The recommended Cronbach's alpha of 0.7 was used to assess the internal consistency of each subscale (Cho, 2016). Mean scale and subscale scores and standard deviations were computed for the EDE-Q, CET, and MBSRQ-AS measures (Fairburn & Beglin, 2008; Taranis et al., 2011).

Further, the total number of participants endorsing symptoms of disordered eating as well as participants meeting diagnostic criteria for an eating disorder were identified (Specific Aim 1). For the EDE-Q measure, the scores of four or higher on each subscale and global scale are indicative of a clinical eating disorder (Aardoom et al., 2012). To obtain subscale scores, the ratings for the relevant items are added together and the sum divided by the total number of items forming the subscale. A global score is the sum of the four subscale scores divided by the number of subscales (i.e., four). In addition, the frequency of compulsive exercise was determined (Specific Aim 2). For the CET

measure, higher total scores reflected greater levels of compulsive exercise (Taranis et al., 2011). A cut-off score of 15 has been determined as an appropriate cut-off point to determine whether an individual exercises compulsively (Meyer et al., 2016).

After testing the assumptions for conducting correlational analysis, Pearson Product-Moment Correlation was utilized to examine the associations among athletes' disordered eating, compulsive exercise, and body image scores, based on their age (Specific Aim 3). In addition, Independent two-sample and Welch's t-tests were conducted to investigate the possible differences between athletes' disordered eating, compulsive exercise, and body image scores, based on their gender and sport type (Specific Aim 3). Any statistically significant differences were reported for each subscale of the EDE-Q, CET, and MBSRQ-AS measures. Further, Pearson Product-Moment Correlation were utilized to examine the strength of the associations between disordered eating, compulsive exercise, and body image scores (Specific Aim 4). Lastly, due to having a mixed sample of collegiate and club athletes, additional statistical analysis was conducted. Specifically, Independent two-sample and Welch's t-tests were performed to explore possible differences in athletes' disordered eating, compulsive exercise, and body image attitudes, based on their level of athletic participation.

CHAPTER 4

RESULTS

The purpose of this study was to examine the rate of both eating disorders and eating disorder symptomatology in a sample of varsity and club sport student-athletes. A second aim was to explore athletes' engagement in compulsive exercise. Additional aims were: (1) to investigate the differences in athletes' disordered eating, compulsive exercise, and body image by gender and sport type; and (2) to assess the relationships among athletes' disordered eating, compulsive exercise, and body image, as well as associations between athletes' age and each of these three variables.

Demographic Data

The sample of 128 athletes included 67 males (52.34%), and 61 females (47.66%). Ages ranged from 18 to 22 years (M = 19.72, SD = 1.30). Participants' BMI ranged from 18.33 to 30.97 kg/m^2 (M = 24.06, SD = 2.60). Twenty-seven freshmen (21.09%), 33 sophomores (25.78%), 31 juniors (24.22%), and 37 seniors (28.91%) completed the questionnaires. Athletes participated in the following nine sports: soccer (n = 26; 20.31%), volleyball (n = 19; 14.84%), baseball (n = 15; 11.72%), gymnastics (n = 15; 11.72%), rugby (n = 13; 10.16%), track and field (n = 12; 9.38%), basketball (n = 11; 8.59%), lacrosse (n = 9; 7.03%) and ice hockey (n = 8; 6.25%). For secondary group comparisons, these nine sports were categorized as lean sports (i.e., volleyball, gymnastics, track and field, and rugby) and non-lean sports (i.e., basketball, baseball, soccer, lacrosse, and ice hockey). Sixty-nine athletes (53.91%) participated in lean sports, while 59 athletes (46.09%) participated in non-lean sports. Fifty-eight athletes (45.31%) competed at the Division I varsity level and 70 athletes (54.69%) competed at

the club level. Participants' athletic experience over the lifetime ranged from 2 to 19 years (M = 10.87, SD = 4.63).

Data Screening and Scale Reliability

Prior to performing the proposed statistical analyses, standard data screening procedures were applied. Specifically, no data-entry errors or outliers were identified. Summary and mean subscale scores were calculated. Further, appropriate assumptions for conducting correlational analyses were assessed and confirmed. The data met the following assumptions for correlational analyses discussed in Chapter 3: having two continuous variables; a linear relationship between the variables; and no significant outliers (Montgomery et al., 2015).

Independent two-sample or Welch's t-test were conducted to explore the differences in athletes' disordered eating, compulsive exercise, and body image attitudes, based on gender, sport type, and level of athletic participation. For these tests, the data were checked for the following assumptions: independence of observations, normal data distribution, and equal variances between comparison groups (Montgomery et al., 2015). While the data met the assumptions of independence and normality for all necessary comparisons, Levene's test for equal variances yielded different results. Based on these results, unequal variances were assumed for the EDE-Q Weight Concern ($F(1,126) = 5.99$, $p = .02$) and the CET Exercise Rigidity subscales ($F(1,126) = 6.49$, $p = .01$), when compared by gender (female vs. male). In addition, Levene's test showed unequal variances for sport type (lean vs. non-lean) on the Global EDE-Q scale ($F(1,126) = 28.50$, $p < .01$) and all remaining EDE-Q subscales, as well as the Appearance Evaluation, Overweight Preoccupation, and Self-Classified subscales of the MBSRQ-AS measure.

Considering the level of athletic participation (varsity vs. club), unequal variances were also assumed for the EDE-Q Eating Concern ($F(1, 126) = 5.21$, $p = .02$) and the MBSRQ-AS Overweight Preoccupation subscales ($F(1,126) = 4.42$, $p = .04$). Thus, Welch's t-tests (i.e., unequal variances t-test) were conducted for these group comparisons. Tables 1, 2, and 3 present Levene's test results for each subscale and scale, when comparing gender, sport type, and level of athletic participation, respectively.

Table 1. Levene's Test for Equality of Variances Results for the EDE-Q, CET, and MBSRQ-AS Subscales and Total Scales by Gender

Subscale / Total Scale	F**	p-value
EDE-Q Restraint	0.25	.62
EDE-Q Eating Concern	3.05	.08
EDE-Q Weight Concern	5.99	.02*
EDE-Q Shape Concern	1.70	.19
Global EDE-Q Scale	1.86	.18
CET Avoidance and Rule-Driven Behavior	0.01	.93
CET Weight Control	0.03	.86
CET Mood Improvement	2.11	.15
CET Lack of Exercise Enjoyment	1.09	.30
CET Exercise Rigidity	6.49	.01*
Total CET Scale	0.03	.87
MBSRQ-AS Appearance Evaluation	0.02	.90
MBSRQ-AS Appearance Orientation	0.35	.55
MBSRQ-AS Overweight Preoccupation	0.48	.49
MBSRQ-AS Self-Classified Weight	2.34	.13
MBSRQ-AS Body Areas Satisfaction	1.27	.26

Note. *Significant at the .05 alpha level; **df1 = 1; df2 = 126.

Table 2. Levene's Test for Equality of Variances Results for the EDE-Q, CET, and MBSRQ-AS Subscales by Sport Type

Subscale / Total Scale	F**	p-value
EDE-Q Restraint	20.70	<.001*
EDE-Q Eating Concern	12.94	<.001*
EDE-Q Weight Concern	24.82	<.001*
EDE-Q Shape Concern	22.18	<.001*
Global EDE-Q Scale	28.50	<.001*
CET Avoidance and Rule-Driven Behavior	0.18	.67
CET Weight Control	1.18	.28
CET Mood Improvement	0.10	.75
CET Lack of Exercise Enjoyment	1.81	.18
CET Exercise Rigidity	0.78	.38
Total CET Scale	0.38	.54
MBSRQ-AS Appearance Evaluation	4.49	.04*
MBSRQ-AS Appearance Orientation	2.31	.13
MBSRQ-AS Overweight Preoccupation	7.49	.01*
MBSRQ-AS Self-Classified Weight	16.46	.00*
MBSRQ-AS Body Areas Satisfaction	0.02	.89

Note. * Significant at the .05 alpha level; **df1 = 1; df2 = 126.

Table 3. Levene's Test for Equality of Variances Results for the EDE-Q, CET, and MBSRQ-AS Subscales and Total Scales by Level of Athletic Participation

Subscale / Total Scale	F**	p-value
EDE-Q Restraint	0.39	.53
EDE-Q Eating Concern	5.21	.02*
EDE-Q Weight Concern	0.18	.67
EDE-Q Shape Concern	0.77	.38
Global EDE-Q Scale	0.08	.78
CET Avoidance and Rule-Driven Behavior	1.80	.18
CET Weight Control	0.61	.44
CET Mood Improvement	0.60	.44
CET Lack of Exercise Enjoyment	1.55	.22
CET Exercise Rigidity	1.02	.32
Total CET Scale	0.01	.96

MBSRQ-AS Appearance Evaluation	0.20	.65
MBSRQ-AS Appearance Orientation	0.37	.55
MBSRQ-AS Overweight Preoccupation	4.42	.04*
MBSRQ-AS Self-Classified Weight	0.35	.55
MBSRQ-AS Body Areas Satisfaction	0.08	.78

Note. *Significant at the .05 alpha level; **df1 = 1; df2 = 126.

To test the internal consistency and reliability of the data, Cronbach's alpha coefficients were computed for each subscale of the EDE-Q, CET, and MBSRQ-AS. As recommended by Cho (2016), Cronbach's alpha level of .70 was used as the criterion for an appropriate level of internal consistency. The alpha levels for all subscales were greater than .70 and ranged from .71 to .90, suggesting high internal consistency. These are presented in Table 4.

Table 4. Internal Consistency Estimates of Subscales

Scale	Subscale	Number of items	Cronbach's α
Eating Disorder Examination Questionnaire	Restraint	5	.78
	Eating Concern	5	.71
	Weight Concern	5	.84
	Shape Concern	8	.90
Compulsive Exercise Test	Avoidance and Rule-driven Behavior	8	.87
	Weight Control Exercise	5	.75
	Mood Improvement	5	.77
	Lack of Exercise Enjoyment	3	.77
	Exercise Rigidity	3	.72
Multidimensional Body Self-Relations Questionnaire – Appearance Subscales	Appearance Evaluation	7	.88
	Appearance Orientation	12	.77
	Overweight Preoccupation	4	.72
	Self-Classified Weight Scale	2	.80
	Body Areas Satisfaction Scale	9	.84

Comparisons of Collegiate and Club Athletes

The level of athletic participation was categorized into two groups: Division I varsity athletes (n = 58; 45.3%) and club sport athletes (n = 70; 54.7%). According to Independent two-sample and Welch's t-tests, no statistically significant differences were found between collegiate and club athletes with respect to the Global EDE-Q score ($t(126) = .09$, $p = .92$) and all four EDE-Q subscales. In addition, no significant differences were found on the Total CET score ($t(126) = .83$, $p = .41$) and all five CET subscales, based on athletes' level of athletic participation. Lastly, t-tests revealed no significant differences between varsity and club athletes on all five MBSRQ-AS subscales. Due to the absence of significant differences between varsity and club athletes, these two groups were treated as a single group for all further analyses. Tables 5, 6, and 7 present Independent two-sample and Welch's t-test results for the EDE-Q, CET, and MBSRQ-AS subscales by the level of athletic participation (varsity v. club sport).

Table 5. Independent Two-Sample and Welch's T-Test Results for the EDE-Q Subscales and Global EDE-Q Scale by the Level of Athletic Participation (Varsity vs. Club)

Scale / Subscale	Mean Difference	Std. Error Difference	95% CI	t	df	p-value
Restraint	.02	.20	(-.36, .41)	.11	126	.92
Eating Concern*	-.13	.11	(-.34, .09)	-1.19	104.38	.24
Weight Concern	.03	.23	(-.44, .49)	.11	126	.91
Shape Concern	.14	.24	(-.33, .61)	.58	126	.56
Global EDE-Q Scale	.01	.17	(-.32, .35)	.09	126	.93

Note. * Welch's t-test for unequal variances was conducted only for the Eating Concern subscale.

Table 6. Independent Two-Sample T-Test Results for the CET Subscales and Total CET Scale by the Level of Athletic Participation (Varsity vs. Club)

Scale/ Subscale	Mean Difference	Std. Error Difference	95% CI	t	df	p-value
Avoidance and Rule-Driven Behavior	.16	.18	(-.20, .51)	.86	126	.39
Weight Control Exercise	.04	.18	(-.32, .40)	.21	126	.84
Mood Improvement	.10	.18	(-.26, .47)	.56	126	.58
Lack of Exercise Enjoyment	.02	.09	(-.16, .19)	.21	126	.83
Exercise Rigidity	.18	.18	(-.18, .54)	.98	126	.33
Total CET Score*	.50	.60	(-.68, 1.68)	.83	126	.41

Note. * For the CET Total Scale, all subscale mean scores were added together.

Table 7. Independent Two-Sample and Welch's T-Test Results for the MBSRQ-AS Subscales by the Level of Athletic Participation (Varsity vs. Club)

Scale/ Subscale	Mean Difference	Std. Error Difference	95% CI	t	df	p-value
Appearance Evaluation	-.06	.12	(-.30, .18)	-.53	126	.60
Appearance Orientation	.03	.10	(-.16, .23)	.36	126	.72
Overweight Preoccupation*	.04	.13	(-.22, .30)	.33	109.98	.74
Self-Classified Weight	.04	.10	(-.16, .23)	.35	126	.72
Body Areas Satisfaction	.01	.11	(-.21, .23)	-.44	126	.95

Note. * Welch's t-test for unequal variances was conducted only for the Overweight Preoccupation subscale.

Analysis of Disordered Eating Behaviors

To identify the number of athletes who exhibited clinical and subclinical symptoms of an eating disorder on the EDE-Q, mean scores were calculated for the Restraint, Eating Concern, Weight Concern, and Shape Concern subscales (Specific Aim

1). Further, the four subscale scores were added together and then divided by the total number of items comprising the subscale (i.e., 4) to reflect Global EDE-Q score. A cut-off of 4 or higher on at least one subscale or Global scale is indicative of clinically significant symptoms (Aardoom et al., 2012; Mond & Calogero, 2009).

In the total sample of 128 participants, 11 athletes (8.6%) scored in the clinical range on at least one EDE-Q subscale or the Global EDE-Q scale. Out of these 11 athletes, 2 athletes (1.6%) scored in the clinically significant range on the Global EDE-Q scale, 9 athletes (7.2%) on the Shape Concern subscale, 5 athletes (4%) on the Weight Concern subscale, 3 athletes (2.4%) on the Restraint subscale, and 1 athlete (0.8%) on the Eating Concern subscale. In addition, 2 athletes reported severe body image disturbances as assessed by the Weight Concern and Shape Concern subscales. However, they did not report binge eating episodes or the use of any compensatory behaviors.

Out of nine athletes who scored in the clinically significant range on at least one EDE-Q subscale, 4 athletes (3.2% of the total sample) met criteria for Bulimia Nervosa (BN), 3 athletes (2.4%) met criteria for Binge Eating Disorder (BED), and 2 athletes (1.6%) met criteria for Unspecified Feeding or Eating Disorder (UFED). All were women and they competed in varsity gymnastics (n = 3), varsity track and field (n = 2), or club volleyball (n = 4). Their ages ranged from 19 to 22 years. Table 8 presents the means and standard deviations for the Global EDE-Q scale and subscale scores for the entire sample. Table 9 presents demographic information for the athletes who met diagnostic criteria for an eating disorder.

Table 8. Means and Standard Deviations for the Global EDE-Q Scale and Subscale Scores

Scale/ Subscale M/ SD	Total Sample (n = 128)	Gender (Female; Male)	Sport Type (Lean; Non-Lean)	Level of Athletic Participation (Collegiate; Club)
Restraint	.88 (1.10)	.91 (1.09); .84 (1.12)	1.10 (1.36); .69 (.77)	.89 (1.17); .87 (1.04)
Eating Concern	.36 (.65)	.46 (.80); .26 (.45)	.51 (.84); .23 (.38)	.29 (.39); .41 (.80)
Weight Concern	1.11 (1.31)	1.46 (1.41); .78 (1.12)	1.54 (1.55); .74 (.93)	1.12 (1.29); 1.09 (1.34)
Shape Concern	1.26 (1.35)	1.64 (1.40); .92 (1.20)	1.68 (1.61); .90 (.95)	1.34 (1.37); 1.20 (1.33)
Global EDE-Q	.90 (.95)	1.12 (1.02); .70 (.85)	1.21 (1.18); .64 (.60)	.91 (.91); .89 (1.00)

Table 9. Demographic Information about Athletes with an Eating Disorder

Athlete	Eating Disorder	Gender	Age	Sport
1	BN	Female	19	Gymnastics
2	BN	Female	21	Gymnastics
3	BN	Female	21	Volleyball
4	BN	Female	22	Gymnastics
5	BED	Female	19	Track & Field
6	BED	Female	19	Volleyball
7	BED	Female	20	Track & Field
8	UFED	Female	19	Volleyball
9	UFED	Female	20	Volleyball

Note. BN – Bulimia Nervosa; BED – Binge Eating Disorder; UFED – Unspecific Feeding or Eating Disorder.

The types and frequencies of disordered eating behaviors were also explored (Specific Aim 1). Table 10 presents the percentages of athletes who reported any occurrence or regular occurrence of disordered eating behaviors. Regular occurrence of binge eating episodes, self-induced vomiting, and laxative misuse was defined as at least 4 occurrences over the past 28 days (Fairburn & Beglin, 2008). Regular occurrence of excessive exercise was defined as exercising in a "driven" or "compulsive" way as a means of controlling your weight, shape, or amount of fat, or burning off calories for at

least 4 times over the past 20 days (Fairburn & Beglin, 2008). Regular occurrence of dietary restraint was defined as going for long periods of time (8 hours) without eating anything to influence shape or weight for at least 4 times over the past 13 days (Fairburn & Beglin, 2008). Reporting regular occurrence of at least one disordered eating behavior over the past 28 days is indicative of subclinical symptoms of an eating disorder.

Based on these criteria, 40 athletes (31.3%) reported symptoms of an eating disorder. Specifically, 13.3% of athletes reported regular occurrence of binge eating episodes during the previous 4 weeks. Nearly 12% of athletes reported regular engagement in excessive exercise. In addition, 10.2% reported regular occurrence of dietary restraint. The majority of athletes who engaged in dietary restraint (10 out of 13; 10.2%) also reported excessive exercise engagement. Only 1 athlete regularly misused laxatives or diuretics and 1 athlete engaged in self-induced vomiting over the past 4 weeks.

Table 10. Frequencies of Disordered Eating Behaviors

Disordered Eating Behavior	Any Occurrence N / (%)	Regular Occurrence N / (%)
Binge eating episodes	36 (28.1%)	17 (13.3%)
Excessive exercise	30 (23.4%)	15 (11.7%)
Dietary restraint	25 (19.5%)	13 (10.2%)
Self-induced vomiting	4 (3.1%)	1 (0.8%)
Laxative/ diuretic misuse	2 (1.6%)	1 (0.8%)

Analysis of Compulsive Exercise Behavior

To identify the number of athletes who engaged in compulsive exercise as assessed by the CET (Specific Aim 2), the sum subscale scores were calculated for the Avoidance and Rule-Driven Behavior, Weight Control Exercise, Mood Improvement,

Lack of Exercise Enjoyment, and Exercise Rigidity subscales. The Total CET scores were computed by adding all mean subscale scores together. Previous studies have used a cut-off of 15 on the Total CET scale as a marker of compulsive exercise (Meyer et al., 2016; Taranis et al., 2011). Using this criterion, 19 of the 128 athletes (14.84%) scored in the clinically significant range. The mean CET subscale and Total CET scale scores were further compared across the clinical and non-clinical samples using a series of Mann–Whitney U Tests. Significant differences were found between the two groups on all five CET subscales as well as the Total CET scale. Specifically, athletes scoring above the CET proposed cut-off of 15 scored significantly higher on all CET subscales and the Total CET scale, as compared to athletes scoring below the proposed cut-off. Table 11 presents the CET Total scale and subscale means, standard deviations, and Mann-Whitney U test results for the clinical and non-clinical groups.

Table 11. Means, Standard Deviations, and Group Comparisons for the CET subscales and the Total CET Scale

	Clinical (n = 19) M (SD)	Non-Clinical (n = 109) M (SD)	Mann-Whitney U statistic	Z score	p-value
Avoidance & Rule-Driven Behavior	2.94 (.98)	1.49 (1.02)	1681.00	4.74	< .001*
Weight Control Exercise	3.60 (.43)	2.20 (.80)	1886.00	6.15	< .001*
Mood Improvement	4.31 (.76)	3.01 (1.03)	1743.00	5.17	< .001*
Lack of Exercise Enjoyment	1.98 (.97)	1.61 (.94)	1513.00	3.68	< .001*
Exercise Rigidity	4.01 (.80)	2.71 (1.16)	1704.00	4.92	< .001*
Total CET Scale**	17.23 (1.85)	10.57 (2.51)	1980.00	6.79	< .001*

Note. *Significant at the .001 alpha level.
**For the Total CET Scale, all subscale mean scores were added together.

Analysis of Disordered Eating Behaviors Based on Gender

To examine the differences in disordered eating between female and male athletes (Specific Aim 3), either Independent two-sample or Welch's t-tests were conducted for each EDE-Q subscale and Global EDE-Q score. The alpha level of .05 was used and the results are presented in Table 12 below. From the Independent two-sample t-tests, statistically significant differences were found between female and male athletes on the Global EDE-Q scale ($t(126) = 2.52$, $p < .01$) and the Shape Concern subscale ($t(126) = 3.13$, $p < .01$). Welch's t-test revealed statistically significant differences for the Weight Concern ($t(114.27) = 3.02$, $p < .01$) subscale. Specifically, female athletes scored significantly higher than males on Global EDE-Q ($M = 1.12$, $SD = 1.02$ vs. $M = .70$, $SD = .85$), Weight Concern ($M = 1.46$, $SD = 1.42$ vs. $M = .78$, $SD = 1.12$), and Shape Concern ($M = 1.64$, $SD = 1.40$ vs. $M = .92$, $SD = 1.20$). No significant differences between males and females were seen on the Restraint ($t(126) = .33$, $p = .75$) and Eating Concern subscales ($t(126) = 1.73$, $p = .09$).

Table 12. Independent Two-Sample and Welch's T-Test Results for the EDE-Q Subscales and Global Scale by Gender (Male vs. Female)

Scale / Subscale	Mean Difference	Std. Error Difference	95% CI	t	df	p-value
Restraint	.06	.20	(.32, .45)	.33	126	.75
Eating Concern	.20	.12	(.03, .42)	1.73	126	.09
Weight Concern**	.69	.23	(.24, 1.14)	3.02	114.27	< .01*
Shape Concern	.72	.24	(.26, 1.18)	3.13	126	< .01*
Global EDE-Q Scale	.42	.17	(.09, .74)	2.52	126	<.01*

Note. *Significant at the .01 alpha level.
**Welch's t-test for unequal variances was conducted only for the Weight Concern subscale.

Analysis of Disordered Eating Behaviors Based on Sport

Welch's t-tests for unequal variances were conducted to explore differences in disordered eating behaviors by sport type (Specific Aim 3). Two sport categories were used: lean sports (i.e., volleyball, gymnastics, track and field, and rugby) and non-lean sports (i.e., basketball, baseball, soccer, lacrosse, and ice hockey). Welch's t-tests revealed statistically significant differences in the mean scores on the Global EDE-Q scale ($t(83.42) = 3.34$, $p < .01$), as well as the Restraint ($t(88.63) = 2.04$, $p = .04$), Eating Concern ($t(77.66) = 2.33$, $p = .02$), Weight Concern ($t(91.62) = 3.48$, $p < .01$), and Shape Concern subscales ($t(90.71) = 3.27$, $p < .01$). Specifically, and as seen in Table 13, lean-sport athletes scored significantly higher than non-lean sport athletes on Global EDE-Q ($M = 1.21$, $SD = 1.18$ vs. $M = .64$, $SD = .60$), Restraint ($M = 1.10$, $SD = 1.36$ vs. $M = .69$, $SD = .77$), Eating Concern ($M = .51$, $SD = .84$ vs. $M = .23$, $SD = .38$), Weight Concern ($M = 1.54$, $SD = 1.55$ vs. $M = .74$, $SD = .93$), and Shape Concern ($M = 1.68$, $SD = 1.61$ vs. $M = .90$, $SD = .95$).

Table 13. Welch's T-Test Results for the EDE-Q Subscales and Global Scale by Sport Type (Lean vs. Non-Lean)

Scale / Subscale	Mean Difference	Std. Error Difference	95% CI	t	df	p-value
Restraint	.41	.20	(.01, .81)	2.04	88.63	.04**
Eating Concern	.28	.12	(.04, .51)	2.33	77.66	.02**
Weight Concern	.80	.23	(.34, 1.26)	3.48	91.62	< .01*
Shape Concern	.78	.24	(.31, 1.25)	3.27	90.71	< .01*
Global EDE-Q Scale	.57	.17	(.23, .90)	3.34	83.42	< .01*

Note. *Significant at the .01 alpha level.
**Significant at the .05 alpha level.

Analysis of Disordered Eating Behaviors Based on Age

Pearson Product-Moment Correlation were performed to examine the associations among athletes' disordered eating patterns based on their age (Specific Aim 3). As seen in Table 14, no correlation was found between athletes' age and the Global EDE-Q scale ($r(126) = .03$, $p = .73$). Age also was not associated with athletes' disordered eating scores on all four EDE-Q subscales: Restraint ($r(126) = -.03$, $p = .73$), Eating Concern ($r(126) = -.02$, $p = .86$), Weight Concern ($r(126) = .07$, $p = .43$), and Shape Concern ($r(126) = .05$, $p = .54$).

Table 14. Pearson Product-Moment Correlation Results for EDE-Q subscales and Global EDE-Q scale by Age

	Restraint	Eating Concern	Weight Concern	Shape Concern	Global EDE-Q
Age	-.03	-.02	.07	.05	.03

Note. None of the results are significant at the .05 alpha level.

Analysis of Compulsive Exercise Based on Gender

To explore the differences in compulsive exercise engagement between female and male athletes (Specific Aim 3), either Independent two-sample or Welch' t-tests were conducted for each CET subscale and the CET Total score. No statistically significant differences were found for the Total CET scale ($t(126) = -.61$, $p = .55$), as well as Avoidance and Rule-Driven Behavior ($t(126) = .53$, $p = .60$), Weight Control Exercise ($t(126) = -.92$, $p = .36$), Mood Improvement ($t(126) = -.69$, $p = .49$), and Lack of Exercise Enjoyment subscales, ($t(126) = -1.48$, $p = .14$). Welch's t-test found no significant differences between the genders on the Exercise Rigidity subscale ($t(120.43) = -.18$, $p = .86$). Table 15 presents results of the Independent two-sample and Welch's t-tests for the CET subscale and Total CET scale differences based on athletes' gender.

Table 15. Independent Two-Sample and Welch's T-Test Results for the CET Subscales and Total CET Score by Gender (Male vs. Female)

Scale/ Subscale	Mean Difference	Std. Error Difference	95% CI	t	df	p-value
Avoidance and Rule-Driven Behavior	.10	.18	(-.26, .45)	.53	126	.60
Weight Control Exercise	-.17	.18	(-.53, .19)	-.92	126	.36
Mood Improvement	-.13	.18	(-.49, .24)	-.69	126	.49
Lack of Exercise Enjoyment	-.13	.09	(-.30, .04)	-1.48	126	.14
Exercise Rigidity*	-.03	.18	(-.39 .33)	-.18	120.43	.86
Total CET Score**	-.36	.60	(-1.54, .82)	-.61	126	.55

Note. * Welch's t-test for unequal variances was conducted only for the Exercise Rigidity subscale.
** For the Total CET Scale, all subscale mean scores were added together.

Analysis of Compulsive Exercise Based on Sport

Independent two-sample t-tests were conducted to explore possible differences in athletes' compulsive exercise engagement based on their sport type (Specific Aim 3). Independent two-sample t-tests revealed no differences between lean and non-lean sport athletes on the Total CET Score ($t(126) = .84$, $p = .40$). In addition, no statistically significant differences by sport type were found on the Avoidance and Rule-Driven Behavior ($t(126) = .88$, $p = .38$), Weight Control Exercise ($t(126) = 1.87$, $p = .06$), Mood Improvement ($t(126) = .84$, $p = .41$), Lack of Exercise Enjoyment ($t(126) = 1.85$, $p = .07$), and Exercise Rigidity subscales ($t(126) = -1.25$, $p = .22$). Table 16 presents Independent two-sample t-test results for the CET subscale and Total CET scale mean differences by sport type.

Table 16. Independent Two-Sample T-Test Results for the CET Subscales and Total CET Score by Sport Type (Lean vs. Non-Lean)

Scale/ Subscale	Mean Difference	Std. Error Difference	95% CI	t	df	p-value
Avoidance and Rule-Driven Behavior	.16	.18	(.20, .52)	.88	126	.38
Weight Control Exercise	.34	.18	(-.02, .70)	1.87	126	.06
Mood Improvement	.15	.18	(.21, .52)	.84	126	.41
Lack of Exercise Enjoyment	.08	.09	(-.09, .25)	1.85	126	.07
Exercise Rigidity	-.22	.18	(-.59, .13)	-1.25	126	.22
Total CET Score*	.50	.60	(-.68, 1.68)	.84	126	.40

Note. * For the Total CET Scale, all subscale mean scores were added together.

Analysis of Compulsive Exercise Patterns by Age

Pearson Product-Moment Correlations were performed to investigate the associations between athletes' compulsive exercise and their age (Specific Aim 3). No correlation was found between athletes' age and the Total CET score ($r(126) = -.02$, $p = .82$). Age was not associated with athletes' compulsive exercise scores on all five CET subscales: Avoidance and Rule-Driven Behavior ($r(126) = -.02$, $p = .85$), Weight Control ($r(126) = -.02$, $p = .79$), Mood Improvement ($r(126) = .04$, $p = .67$), Lack of Exercise Enjoyment ($r(126) = .03$, $p = .70$), and Exercise Rigidity ($r(126) = -.08$, $p = .37$). Table 17 presents Pearson Correlation results for the associations among each CET subscale and the Total CET score based on athletes' age.

Table 17. Pearson Product-Moment Correlation Results for the CET subscales and the Total CET Score by Age

	Avoidance and Rule-Driven Behavior	Weight Control Exercise	Mood Improvement	Lack of Exercise Enjoyment	Exercise Rigidity	Total CET Scale
Age	-.02	-.02	.04	.03	-.08	-.02

Note. None of the results are not significant at the .05 alpha level.

Analysis of Body Image Concerns by Gender

To explore athletes' body image concerns, the mean subscale scores were calculated for each MBSRQ-AS subscale: Appearance Evaluation, Appearance Orientation, Overweight Preoccupation, Body Areas Satisfaction, and Self-Classified Weight. Higher scores on the Appearance Evaluation and Body Areas Satisfaction subscales indicate positive feelings and satisfaction, while lower scores reflect a general dissatisfaction with one's body image (Cash, 2000). In contrast, higher scores on the Appearance Orientation, Overweight Preoccupation, and Self-Classified Weight subscales reflect greater investment in one's appearance and greater concerns about body weight and shape (Cash, 2000). Results are presented as means and standard deviations for each MBSRQ-AS subscale. There is no composite score for the MBSRQ-AS measure (Cash, 2000).

To examine the differences in body image concerns by gender (Specific Aim 3), independent two-sample t-tests were conducted for each MBSRQ-AS subscale. Statistically significant differences were found between female and male athletes on the Appearance Evaluation ($t(126) = 2.23$, $p = .03$), Overweight Preoccupation ($t(126) = -2.45$, $p < .02$), Self-Classified Weight ($t(126) = -2.49$, $p < .01$), and Body Areas Satisfaction subscales ($t(126) = 2.95$, $p < .01$). As compared to female athletes, male athletes reported significantly higher Appearance Evaluation ($M = 3.69$, $SD = .65$ vs. $M = 3.42$, $SD = .68$) and Body Areas Satisfaction scores ($M = 3.71$, $SD = .67$ vs. $M = 3.40$, $SD = .53$). This suggests that male athletes had a significantly greater satisfaction with body areas and overall physical appearance. In addition, male athletes reported significantly lower Overweight Preoccupation ($M = 1.95$, $SD = .67$ vs. $M = 2.26$, $SD = .74$) and Self-

Classified Weight scores than females (M = 3.03, SD = .56 vs. M = 3.27, SD = .53), indicating that male athletes had significantly lower weight vigilance, lower eating restraint, and more positive self-appraisal than females. Table 18 presents results of Independent two-sample t-tests for the MBSRQ-AS subscales when comparing male and female athletes.

Table 18. Independent Two-Sample T-Test Results for the MBSRQ-AS Subscales by Gender (Male vs. Female)

Scale / Subscale	Mean Difference	Std. Error Difference	95% CI	df	t	p-value
Appearance Evaluation	.26	.12	(.03, .49)	126	2.23	.03*
Appearance Orientation	.03	.10	(-.16, .22)	126	.28	.78
Overweight Preoccupation	-.31	.13	(-.56, -.06)	126	-2.45	.02*
Self-Classified Weight	-.24	.10	(-.43, -.05)	126	-2.49	<.01*
Body Areas Satisfaction	.32	.11	(.10, .53)	126	2.95	<.01*

Note. *Significant at the .05 alpha level.

Analysis of Body Image Concerns by Sport

Either Independent two-sample or Welch's t-tests were conducted to explore possible differences in athletes' body image concerns by sport type (Specific Aim 3). The alpha level of .05 was used for these tests. Two sport categories were used: lean sports (i.e., rugby, volleyball, gymnastics, and track and field) and non-lean sports (i.e., baseball, basketball, ice hockey, lacrosse, and soccer). Statistically significant differences between lean and non-lean sport athletes were found on the Overweight Preoccupation (t(106.21) = 2.20, p = .03) and Self-Classified Weight subscales (t(95.83) = 2.18, p = .03). Specifically, lean-sport athletes reported significantly higher scores on the Overweight Preoccupation (M = 2.25, SD = .81 vs. M = 1.97, SD = .61) and Self-

Classified Weight subscales (M = 3.26, SD = .67 vs. M = 3.04, SD = .43), as compared to non-lean sport athletes. Higher scores on these subscales indicate more negative body image perceptions and greater weight vigilance among lean-sport athletes as compared to non-lean sport athletes. No statistically significant differences in the mean scores were found on the Appearance Evaluation (t(106.38) = -1.93, p = .06), Appearance Orientation (t(126) = 1.87, p = .06), and Body Areas Satisfactions subscales (t(126) = -1.20, p = .23). Table 19 presents Independent two-sample and Welch's t-test results for the MBSRQ-AS subscale mean differences for lean and non-lean sport athletes.

Table 19. Independent Two-Sample and Welch's T-Test Results for the MBSRQ-AS Subscales by Sport Type (Lean vs. Non-lean)

Scale / Subscale	Mean Difference	Std. Error Difference	95% CI	t	df	p-value
Appearance Evaluation	-.23	.12	(-.48, .01)	-1.93	106.38	.06
Appearance Orientation**	.18	.10	(-.01, .37)	1.87	126	.06
Overweight Preoccupation	.28	.13	(.03, .54)	2.20	106.21	.03*
Self-Classified Weight	.22	.10	(.02, .42)	2.18	95.83	.03*
Body Areas Satisfaction**	-.13	.10	(-.35, .09)	-1.20	126	.23

Note. *Significant at the .05 alpha level.
** Independent two-sample t-test for equal variances was conducted only for the Appearance Orientation and Body Areas Satisfaction subscales.

Analysis of Body Image Concerns by Age

Pearson Product-Moment Correlations were conducted to examine the associations among athletes' body image concerns and age (Specific Aim 3). Appearance Orientation was negatively associated with athletes' age (r(126) = -.22, p < .01), suggesting that younger athletes were more invested in their physical appearance and body image than older athletes. No correlation was found between athletes' age and each

of the remaining MBSRQ-AS subscales: Appearance Evaluation ($r(126) = -.11$, $p = .23$), Overweight Preoccupation ($r(126) = .03$, $p = .70$), Self-Classified Weight ($r(126) = .07$, $p = .46$), and Body Areas Satisfaction ($r(126) = -.07$, $p = .46$). Table 20 presents Pearson Correlation results for the associations among each MBSRQ-AS subscale by athletes' age.

Table 20. Pearson Product-Moment Correlation Results for the MBSRQ-AS subscales by Age

	Appearance Evaluation	Appearance Orientation	Weight Preoccupation	Self-Classified Weight	Body Areas Satisfaction
Age	-.11	-.22*	.03	.07	-.07

Note. *Significant at the .01 alpha level.

Associations Between Disordered Eating, Compulsive Exercise, and Body Image

To examine the relationships among athletes' disordered eating, compulsive exercise, and body image (Specific Aim 4), Pearson Product-Moment Correlations were conducted. Global EDE-Q scores were positively correlated with the Total CET scores ($r(126) = .53$, $p < .01$). In addition, Global EDE-Q scores were negatively associated with the Appearance Evaluation ($r(126) = -.66$, $p < .01$) and Body Areas Satisfaction ($r(126) = -.51$, $p < .01$) of the MBSRQ-AS scale, indicating that greater eating disorder pathology is associated with more negative body image. Positive associations were found between the Global EDE-Q scores and the following MBSRQ-AS subscales: Appearance Orientation ($r(126) = .30$, $p < .01$), Overweight Preoccupation ($r(126) = .77$, $p < .01$), and Self-Classified Weight subscales ($r(126) = .55$, $p < .01$). This suggests that greater levels of eating disorder pathology are correlated with higher weight vigilance, more time invested in physical appearance, and greater body image dissatisfaction.

Furthermore, Global EDE-Q scale scores were positively correlated with the following CET subscales: Avoidance and Rule-Driven Behavior ($r(126) = .41$, $p < .01$), Weight Control Exercise ($r(126) = .69$, $p < .01$), Mood Improvement ($r(126) = .27$, $p < .01$), and Lack of Exercise Enjoyment ($r(126) = .40$, $p < .01$). Similarly, Total CET scale scores were positively associated with the following EDE-Q subscales: Restraint ($r(126) = .42$, $p < .01$), Eating Concern ($r(126) = .35$, $p < .01$), Weight Concern ($r(126) = .47$, $p < .01$), and Shape Concern ($r(126) = .52$, $p < .01$). These findings indicate that greater eating disorder symptoms are associated with more rigid exercise engagement for weight control and lower levels of exercise enjoyment.

Lastly, associations were found between the Total CET and the following MBSRQ-AS subscales: Appearance Evaluation ($r(126) = -.32$, $p < .01$), Appearance Orientation ($r(126) = .22$, $p < .01$), and Overweight Preoccupation ($r(126) = .44$, $p < .01$). Specifically, higher scores on the compulsive exercise measure were negatively correlated with Appearance Evaluation, suggesting that greater levels of compulsive exercise are correlated with greater physical appearance dissatisfaction. In addition, higher scores on the Total CET scale were positively associated with Appearance Orientation and Weight Preoccupation. Higher scores on Appearance Orientation and Overweight Preoccupation subscales indicate greater investment in physical appearance, weight vigilance, and concerns about body weight and shape. Tables 21 – 24 present Pearson Product-Moment Correlations between the measures.

Table 21. Pearson Product-Moment Correlation Results for the Associations Among the Global EDE-Q Score, CET subscales, and the Total CET Score

	Global EDE-Q	Avoidance and Rule-Driven Behavior	Weight Control Exercise	Mood Improvement	Lack of Exercise Enjoyment	Exercise Rigidity
Avoidance and Rule-Driven Behavior	.41*					
Weight Control Exercise	.69*	.46*				
Mood Improvement	.27*	.55*	.22*			
Lack of Exercise Enjoyment	.40*	.24*	.53*	.25*		
Exercise Rigidity	.16	.54*	.25*	.64*	.16	
Total CET Score	.53*	.81*	.67*	.78*	.51*	.77*

Note. *Significant at the .01 alpha level.

Table 22. Pearson Product-Moment Correlation Results for the Associations Among the Global EDE-Q Score and MBSRQ-AS Subscales

	Global EDE-Q	Appearance Evaluation	Appearance Orientation	Overweight Preoccupation	Self-Classified Weight
Appearance Evaluation	-.66*				
Appearance Orientation	.30*	-.06			
Overweight Preoccupation	.77*	-.52*	.30*		
Self-Classified Weight	.55*	-.44	-.03	.45*	
Body Areas Satisfaction	-.51*	.72*	-.23*	-.42*	-.24*

Note. *Significant at the .01 alpha level.

Table 23. Pearson Product-Moment Correlation Results for the Associations among the EDE-Q Subscales and Total CET Score

	Total CET Score	Restraint	Eating Concern	Weight Concern
Restraint	.42*			
Eating Concern	.35*	.43*		
Weight Concern	.47*	.55*	.66*	
Shape Concern	.52*	.61*	.62*	.91*

Note. *Significant at the .01 alpha level.

Table 24. Pearson Product-Moment Correlation Results for the Associations among the MBSRQ-AS subscales and Total CET Score

	Total CET Score	Appearance Evaluation	Appearance Orientation	Overweight Preoccupation	Self-Classified Weight
Appearance Evaluation	-.32*				
Appearance Orientation	.22*	-.06			
Overweight Preoccupation	.44*	-.52*	.30*		
Self-Classified Weight	.16	-.44*	.03	.45*	
Body Areas Satisfaction	-.17	.72*	-.33*	-.42*	-.34*

Note. *Significant at the .01 alpha level.

CHAPTER 5

DISCUSSION

The purpose of the current study was to explore the occurrence of eating disorders and eating disorder symptomatology in a sample of collegiate and club athletes (Specific Aim 1). The second specific aim was to investigate the frequency of engagement in compulsive exercise. Additional aims were to explore possible differences in athletes' disordered eating, compulsive exercise, and body image by gender, sport type, and level of athletic participation (Specific Aim 3); and to assess the relationships among athletes' disordered eating, compulsive exercise, and body image attitudes, as well as the relationships between athletes' age and each of these three variables (Specific Aim 4).

Specific Aim 1

Eleven athletes (8.6%) scored in the clinical range on at least one EDE-Q subscale or Global EDE-Q scale, suggesting the possible presence of an eating disorder. All were women. Of the 11 athletes, 4 met criteria for Bulimia Nervosa, 3 met criteria for Binge Eating Disorder, and 2 met criteria for Unspecified Feeding or Eating Disorder. The women participated in varsity gymnastics (n = 3), varsity track and field (n = 2), and club volleyball (n = 4). Two of these athletes did not report binge eating episodes or any compensatory behaviors, which precluded an eating disorder diagnosis.

Forty athletes (31.3%) scored in the subclinical range for an eating disorder, suggesting that they regularly engaged in maladaptive eating behaviors as well as reported a preoccupation with food and weight. Twenty-seven were women who competed in lean sports (i.e., gymnastics, track and field, and volleyball). Thirteen were men who participated in lean (i.e., rugby) and non-lean sports (i.e., soccer and baseball).

The most frequently reported disordered eating behaviors were binge eating (13.3%), excessive exercise (11.7%), and dietary restraint (10.2%). As would be expected, the student-athletes who met criteria for an eating disorder and those with subclinical features, as compared to those without symptoms, reported greater preoccupation with food, feelings of guilt about eating, desire to lose weight, and body image dissatisfaction.

The percentage of individuals with eating disorders in the current study (8.6%) was slightly higher, but largely comparable, to that seen in other studies of college athletes (0 – 7.1%) (Anderson & Petrie, 2012; Carter & Rudd, 2005; DiPasquale & Petrie, 2013; Greenleaf et al., 2009; Petrie et al., 2008; Reinking & Alexander, 2005; Sanford-Martens et al., 2005). The percentage of athletes who reported symptoms of disordered eating (31.3%) also was comparable to previous studies, where up to 26% of athletes reported symptoms (Anderson & Petrie, 2012; DiPasquale & Petrie, 2013; Hinton et al., 2004; Greenleaf et al., 2009; Petrie et al., 2008; Sanford-Martens et al., 2005).

The rates of clinical and subclinical disorders in the current study were obtained through the EDE-Q, a widely used self-report measure of eating pathology. In previous studies evaluating psychometric properties of the measure, the EDE-Q has shown high internal consistency in both non-clinical and clinical samples, as well as strong test-retest reliability, temporal stability, convergent validity, and sensitivity to change (Peterson et al., 2007; Reas, Wisting, Kapstad, & Lask, 2011; Rose et al., 2013). Studies also have confirmed the accuracy of the EDE-Q interpretation for clinical diagnoses (Calugi et al., 2017; Darcy et al., 2013). Thus, the use of the psychometrically valid and reliable measure in the current study lends confidence to the observation that while less than 10%

of athletes appear to meet criteria for an eating disorder, one-third exhibit symptoms, leaving them at risk for the development of an eating disorder over time.

The initial proposed sample for the study was Division I varsity athletes. However, the current study was a part of a larger study designed to investigate the relationship between traumatic brain injury and substance abuse among student-athletes. The parent study recruited both varsity and club sport athletes. During the data collection period for this study, 58 varsity and 70 club athletes enrolled and completed the assessments for this study. Potential differences in disordered eating, compulsive exercise, and body image concerns of the two groups were compared. Varsity and club sport athletes did not differ with respect to the major variables of interest. Similarly, Holm-Denoma et al. (2009) did not find significant differences with respect to eating disorder symptoms between varsity and club athletes. Thus, the two groups were combined in all subsequent analyses.

Specific Aim 2

Specific Aim 2 investigated the frequency of compulsive exercise among student-athletes. Based on responses to the Compulsive Exercise Test (CET), 19 athletes (15%) reached the clinical cut-off score, suggesting high levels of engagement in compulsive exercise. Of 19 athletes who exercised compulsively, 4 female athletes met diagnostic criteria for Bulimia Nervosa, 3 female athletes met diagnostic criteria for Binge Eating Disorder, and 2 female athletes met criteria for Unspecified Feeding or Eating Disorder. These women participated in varsity gymnastics, varsity track and field, and club volleyball. The other 10 athletes (8 females and 2 males) exhibited subclinical symptoms of an eating disorder, as assessed by the EDE-Q. Athletes in the clinical group for

compulsive exercise scored significantly higher than the non-clinical group on all five CET subscales and the Total CET scale. Clinical group athletes reported exercising in an excessive, compulsive manner as a means of controlling or attaining a certain body weight and shape. In addition, athletes who exercised compulsively reported a relative lack of enjoyment in exercise. These athletes also experienced anxiety relief after each exercise session as well as feelings of guilt if they missed a scheduled session. This finding suggests that, in addition to exercising for weight control, athletes may also use compulsive exercise as a mood regulatory strategy.

Athletes in the current study reported comparable subscale and Total CET scores, as seen in a larger study of student-athletes (Plateau et al, 2014). In contrast, athletes in the current study scored higher on all subscales of the CET as compared to non-athletes similar in age (Goodwin et al., 2011). Specifically, athletes reported higher levels of exercise rigidity, lack of exercise enjoyment, and excessive daily exercise for weight loss than a general adolescent population. This finding is particularly worrisome for varsity athletes, who engage in up to 20 hours of mandatory physical training per week ("2018-19 NCAA Division I manual," 2018). Continuous engagement in compulsive exercise in conjunction with the required 20-hour weekly training can further result in adverse health consequences, as well as poor academic and athletic performance (Joy et al., 2016).

Specific Aim 3

Specific Aim 3 was designed to explore the differences in athletes' disordered eating, compulsive exercise, and body image concerns, based on their gender and sport type. The two demographic variables were hypothesized to be associated with disordered eating, compulsive exercise, and body image dissatisfaction (Hypothesis 3a and 3b). The

two hypotheses were largely supported. Significant differences in disordered eating and body image concerns were found based on athletes' gender and sport type. However, no differences were found in compulsive exercise by gender and sport type. These relationships are discussed below.

Disordered Eating and Demographic Variables. Female athletes reported more severe eating disorder symptomatology and more frequent engagement in compensatory exercise behaviors than male athletes. Among 61 women surveyed, 11 (18%) scored in the clinical range on at least one EDE-Q subscale and 27 (44.3%) scored in the subclinical range for an eating disorder. Eleven women (18%) reported irregular occurrence of disordered eating and compensatory behaviors, while 12 women (19.7%) exhibited no symptoms of disordered eating. The most frequently reported maladaptive behaviors reported by women were binge eating followed by excessive exercise and dietary restraint. Among the 67 male athletes, none reached criteria for an eating disorder but 13 (19%) reported regular occurrence of binge eating and compensatory behaviors. Also, 16 men (24%) indicated at least one disordered eating behavior, while 38 men (57%) reported no symptoms of an eating disorder.

Women, as compared to men, scored significantly higher on the Global EDE-Q, Weight Concern, and Shape Concern subscales. Specifically, women reported significantly greater dissatisfaction with their weight and shape, more negative perceptions of their weight, and a stronger desire to lose weight, as compared to men. These findings are consistent with previous studies involving gender comparisons of disordered eating among collegiate athletes (Bratland-Sanda & Sundgot-Borgen, 2013; Carter & Rudd, 2005; Gomes et al., 2011; Krebs et al., 2019). One interpretation of these

findings is that female athletes are more affected by the socio-cultural pressure to be thin, while male athletes tend to be more concerned with physical fitness and masculinity (Bratland-Sanda & Sundgot-Borgen, 2013; Krebs et al., 2019; Stiles-Shields et al., 2012).

Sport type was also associated with maladaptive eating behaviors. Lean-sport athletes, in contrast to non-lean sport athletes, reported significantly higher rates of disordered eating and compensatory behaviors. In particular, those participating in gymnastics, volleyball, rugby, and track and field, were more likely to engage in dietary restraint and excessive exercise, as compared to athletes competing in soccer, baseball, lacrosse, and ice hockey. These observations are consistent with previous research, where athletes participating in lean sports that emphasize low body weight for speed (i.e., track and field, rugby), sports that emphasize physical appearance for aesthetics (i.e., gymnastics), and sports that require physique-revealing uniforms (i.e., volleyball), had higher rates of disordered eating than non-lean sport athletes (Bratland-Sanda & Sungdot-Borgen, 2013; Carter & Rudd, 2005; Sundgot-Borgen & Torstveit, 2004; Thiemann et al., 2015). A plausible explanation for this finding is that lean-sport athletes are pressured to attain a low body weight for optimal performance and aesthetics, which puts them at a higher risk for the development of an eating disorder (Currie, 2010; Thiemann et al., 2015). For instance, judged sports, such as gymnastics, place more importance on the athlete's body appearance, which may contribute to increased levels of body image dissatisfaction and subsequent disordered eating behaviors (Kato et al., 2011).

Compulsive Exercise and Demographic Variables. Significant differences in compulsive exercise by gender and sport type also were predicted. These hypotheses were not supported. Specifically, female athletes did not differ from males with respect

to the self-reported frequency of compulsive exercise. Also, lean-sport athletes (e.g., rugby, gymnastics, volleyball, and track and field) did not report significant differences in their compulsive exercise behaviors, as compared to non-lean sport athletes (i.e., baseball, basketball, ice hockey, lacrosse, and soccer). The study findings indicate that athletes, regardless of their gender and sport type, engaged in similar amounts of compulsive exercise. Possibly, some athletes viewed this behavior as a strategy to improve athletic performance rather than control weight (Thompson & Sherman, 2010). Engagement in additional training outside of practice is often perceived by coaches as a sign of athletes' dedication to sport (Thompson & Sherman, 2010). Thus, athletes may label compulsive exercise as a characteristic of being a "good athlete" rather than a maladaptive behavior.

Body Image Concerns and Demographic Variables. A part of Specific Aim 3 was to explore the differences in athletes' body image based on their gender and sport type. These two demographic variables were anticipated to be associated with body image concerns. This hypothesis was partially supported. Significant differences in athletes' body image concerns were found by gender and sport type. Female athletes reported greater concerns about their physical appearance than males. More specifically, women reported higher levels of weight vigilance, preoccupation with food, and greater desire to lose weight, as assessed by the MBSRQ-AS. These findings are consistent with the previous studies of body image disturbances in college athletes (Galli et al., 2014; Kato et al., 2011; Milligan & Pritchard, 2006). For example, Milligan and Pritchard (2006) found that female athletes reported higher body dissatisfaction than their male counterparts and engaged in weight control behaviors more frequently.

The assessment of body image based on sport type revealed that lean-sport athletes reported more negative body image, greater weight vigilance, and greater desire to lose weight than non-lean sport athletes. In similar studies, athletes from lean sports also reported higher levels of body dissatisfaction and weight preoccupation than athletes from non-lean sports (Bruin et al., 2011; Kong & Harris, 2015). The sports environment can significantly heighten body shape and weight concerns due to the pressure from coaches, frequent result comparisons with teammates, team weigh-ins (e.g., gymnastics), and physique-revealing uniforms (e.g., volleyball and track and field) (Bruin et al., 2011; Joy et al., 2016; Kong & Harris, 2015). Consequently, participation in lean-sports may increase the risk of body image dissatisfaction and other untoward psychological responses that contribute to the development of an eating disorder.

Specific Aim 4

The fourth aim of the study was to explore relationships between disordered eating, compulsive exercise, and body image concerns, as well as relationships between athletes' age and these three variables (Specific Aim 4). Based on previous research (Lichtenstein et al., 2107; Meyer et al., 2011; Plateau et al., 2014), it was hypothesized that athletes' eating disorder symptomatology would be associated with compulsive exercise and body image dissatisfaction (Hypothesis 4a). This hypothesis was confirmed. Athletes who reported greater symptoms of disordered eating exhibited significantly higher levels of compulsive exercise and stronger feelings of guilt in case of a missed exercise session, as compared to those who reported fewer symptoms. In addition, athletes with more symptoms of an eating disorder indicated lower levels of exercise enjoyment than those with fewer symptoms. Athletes who reported more symptoms also

engaged in exercise more frequently to avoid negative emotions, such as anxiety and irritability, as compared to athletes with fewer symptoms.

In addition, associations were found between compulsive exercise and body image. More specifically, athletes who reported higher frequencies of compulsive exercise also reported greater body image dissatisfaction. This replicates findings from several other studies (Lichtenstein et al., 2107; Meyer et al., 2011; Plateau et al., 2014), confirming that eating disorder symptoms, such as drive for thinness, physical appearance concern, and body image dissatisfaction, all contribute to an individual's desire to attain a certain body weight or shape through excessive exercise.

Greater symptoms of disordered eating were also associated with body image dissatisfaction. Athletes with more symptoms of an eating disorder expressed greater body image dissatisfaction and appearance self-criticism than athletes with fewer symptoms. This finding is not surprising and is consistent with previous research (Bruin et al., 2011; Karr et al., 2013; Kong & Harris, 2015). Extreme body image dissatisfaction is a symptom of both Anorexia Nervosa and Bulimia Nervosa (APA, 2013). It is also seen in individuals who engage in binge eating and other disordered eating behaviors (Goltz, Stenzel, & Schneider, 2013; Mond & Calogero, 2009).

It was also hypothesized that athletes' age would be associated with their disordered eating, compulsive exercise, and body image (Hypothesis 4b). This hypothesis was not supported. No association was found between athletes' age and their disordered eating. This observation is consistent with previous research findings (Greenleaf et al., 2009; Pettersen et al., 2016; Petrie et al., 2008). All athletes in the sample were between the ages of 18 and 22. While this was anticipated secondary to the

sampling methods for the study, reliance on a sample of college-aged athletes resulted in a truncated age distribution, which did not allow for a sufficient analysis of this hypothesis.

Consistent with previous findings (Greenleaf et al., 2009; Petrie et al., 2008; Pettersen et al., 2016), age and compulsive exercise were not associated. The study findings indicate that athletes, regardless of their age, engaged in similar amounts of compulsive exercise. All athletes in the sample were in their early adulthood, which may explain why age was not related to symptoms of disordered eating. It may be that young adult athletes possess higher levels of self-esteem than adolescent athletes, which could serve as a protective mechanism against the development of an eating disorder (Pettersen et al., 2016). However, self-esteem was not assessed in the present study.

A correlation was found between age and the Appearance Orientation subscale of the MBSRQ-AS, with younger athletes reporting greater investment in their physical appearance. Younger athletes also reported more frequent dietary restraint and compulsive exercise. In a similar study with a wider age range of athletes (13-30 years old), Kantanista et al. (2018) also found greater investment in physical appearance among younger female athletes (13-19 years old) than older athletes (20-30 years old). However, no associations were found between athletes' age and the other subscales of the MBSRQ-AS: Appearance Evaluation, Weight Preoccupation, Self-Classified Weight, and Body Areas Satisfaction. This is consistent with the findings of Bruin et al. (2011). The present findings suggest that age may not be a contributing factor to the development of body image disturbances in college-aged athletes, although, as above, this interpretation must be tempered secondary to the truncated age distribution of the sample.

In summary, based on the study findings, maladaptive behaviors, such as disordered eating, compulsive exercise, and body image dissatisfaction are common behaviors among student-athletes, at both varsity and club levels. In addition, women and lean-sport athletes appear to engage in higher frequencies of disordered eating and compensatory behaviors, as compared to men and non-lean sport athletes. Associations among eating disorder symptomatology, compulsive exercise, and body image concerns suggest that athletes with more symptoms of an eating disorder exhibit significantly greater levels of body image dissatisfaction and higher compulsive exercise engagement than athletes with fewer symptoms. However, age may not serve as a risk-factor for the development of an eating disorder in competitive collegiate athletes.

Strengths and Limitations

The study had a number of methodological strengths. First, the study utilized the EDE-Q (6.0), a widely used, reliable, and valid self-report measure of eating disorders (Fairburn & Beglin, 2008). The EDE-Q not only provides a continuous assessment of relevant symptoms, but also allows for categorization of individuals with clinical, subclinical, and no symptoms of an eating disorder. Utilizing the EDE-Q, the current study found comparable rates of clinical and subclinical eating disorders with previous studies of student-athletes (Anderson & Petrie, 2012; Carter & Rudd, 2005; DiPasquale & Petrie, 2013; Greenleaf et al., 2009; Petrie et al., 2008; Sanford-Martens et al., 2005). Studies have also confirmed the accuracy of the EDE-Q interpretation scores for clinical diagnoses (Calugi et al., 2017; Darcy et al., 2013), providing a high level of confidence in the validity of the current study findings.

Second, utilizing the CET measure, the study explored the frequency of compulsive exercise in a novel population, collegiate student-athletes. This behavior is highly prevalent but often undetected in competitive athletes (Goodwin et al., 2011; Plateau et al., 2014; Thompson & Sherman, 2010). Previous studies in athlete populations utilized solely an eating disorder measure, such as the Questionnaire for Eating Disorder Diagnoses (Q-EDD), Eating Disorder Examination Questionnaire (EDE-Q), or Eating Attitudes Test (EAT) (Anderson & Petrie, 2012; Carter & Rudd, 2005; DiPasquale & Petrie, 2013; Fairburn & Beglin, 2008; Greenleaf et al., 2009). However, eating disorder measures only assess the frequency of excessive exercise for weight control (Fairburn & Beglin, 2008). In contrast, the CET provides a multi-dimensional definition of compulsive exercise by not only assessing the frequency of excessive exercise, but also its severity, intensity, and effects on psychological functioning (Goodwin et al., 2011; Plateau et al., 2014). Thus, the CET measure provided important data on the use of exercise for weight control, mood regulation, and avoidance of withdrawal symptoms.

Third, the current study investigated the differences in disordered eating, compulsive exercise, and body image by a number of theoretically relevant variables, including gender, sport type, and level of athletic participation. Such group comparisons provide a more clear understanding of disordered eating and compulsive exercise patterns based on athletes' demographic characteristics. Specifically, female and lean-sport athletes reported significantly higher rates of disordered eating, compulsive exercise, and body image dissatisfaction, as compared to male and non-lean sport athletes.

The current study also had several limitations. First, although a mixed sample of athletes were recruited for the study, the overall sample size was substantially smaller as compared to some of the previous studies (Greenleaf et al., 2019; Petrie et al., 2008; Plateau et al., 2014). Data collection occurred between September 25th and December 18th of 2019; a longer period of data collection would have resulted in a larger sample size. A larger sample size would have increased the power for the statistical comparisons carried out. For example, the p-values for the two CET subscales, Weight Control Exercise and Lack of Exercise Enjoyment, for group comparison by sport type, were .06 and .07, respectively. It is possible that these differences would have reached statistical significance at the .05 alpha level with a larger sample size.

A second limitation is the potential for self-report bias. Athletes are believed to underreport their maladaptive eating and compensatory behaviors to protect themselves from negative reactions from coaches and teammates (Sundgot-Borgen & Torstveit, 2010; Thompson & Sherman, 2010). Although the confidentiality of the responses was guaranteed to the participants through the informed consent process, it is possible that the varsity athletes, in particular, may have underreported their symptoms out of concern that the investigators would share the results with their coaches or administrators from the university's athletic department.

Clinical Implications

The current study findings have several important implications for coaches, athletic trainers, nutrition consultants, and mental health professionals who work closely with collegiate athletes. First, the study found that varsity and club student-athletes represent a vulnerable group of young adults who are affected by disordered eating and

compulsive exercise. Coaches and athletic administration staff need to understand that varsity athletes are at a particular risk for disordered eating due to substantial time demands and socio-cultural pressures associated with their sport participation (Meeusen et al., 2013; Power et al., 2020). Although in-season student-athletes are restricted to 20 hours of weekly physical workload, including the time spent in competition, nearly 75% of Division I student-athletes report spending as much time on sport-related training during the off-season as during their competitive season (NCAA, 2016). Coaches and athletic trainers should be aware that compulsive exercise in conjunction with the required sport training can result in detrimental health consequences and further diminish athletic performance (Chatterton & Petrie, 2013; Sundgot-Borgen & Torstveit, 2010).

The roles of athletic trainers, nutritionists, and mental health professionals are paramount in recognizing detrimental eating and exercise patterns and providing athletes with the necessary professional assistance (Currie, 2010; Power et al., 2020). First, nutritionists can play an important role in teaching and reinforcing athletes' knowledge about proper nutrition habits, maladaptive eating behaviors, and their health consequences (Nattiv et al., 2007). Athletic trainers can educate athletes on how to discern between healthy amounts of physical training and compulsive exercise. Mental health professionals, such as clinical psychologists, can provide at-risk athletes with professional assistance in a timely manner.

NCAA institutions vary greatly with respect to human resources available to them. Currently, every NCAA Division I university offers athletic training services (NCAA, 2018). However, only a small number of Division I athletes have access to nutritional or mental health services. For instance, 10 out of 12 universities (83%) in the

Pacific-12 Conference (PAC-12), a member of the "Power Five" conferences, provide nutritional services, while 8 out of these 12 universities (67%) also have a clinical psychologist on staff (NCAA, 2018). In contrast, only 4 out of 13 universities (31%) in the American Athletic Conference (AAC), the conference of the university where this study occurred, have either a mental health professional or a licensed psychologist assisting student-athletes (NCAA, 2018). The lack of a sufficient support system leaves athletes from smaller programs at a higher risk for the development of mental health issues, including eating disorders (Thompson, 2014).

Food insecurity is another important factor to consider in addressing the issue of disordered eating. Up to 50% of undergraduate college students, including athletes, do not have access to a sufficient quantity of affordable, nutritious food (Broton & Goldrick-Rab, 2017). Household food insecurity is associated with preoccupation with food and food hoarding in collegiate athletes (Poll, Holben, Valliant, & Joung, 2020). Food insecurity also appears to be related to disordered eating behaviors in collegiate athletes (Birkenhead & Slater, 2015; Poll et al., 2020). Athletes represent an especially vulnerable group of individuals due to the high amount of nutrients necessary for energy balance and optimal athletic performance (Hinton et al., 2004). Thus, developing and implementing an NCAA-wide screening program for food security could be a beneficial strategy in identifying athletes who may be experiencing food insecurity. In addition, nutrition education for athletes should not only include proper dietary guidelines, but also strategies for shopping on a budget.

It is also important to understand the role of competitive college participation in a varsity athlete's post-collegiate life. Nearly 98% of all NCAA student-athletes transition

out of sport after their senior year, while fewer than 2% advance to the professional level (NCAA, 2018). Although a varsity athlete's competitive career is short (i.e., up to 4 years of eligibility), there is a relatively high possibility of developing a mental health issue due to sport-related pressures (Klenck, 2014; Thompson, 2014). Nearly 25% of varsity athletes appear to suffer from depressive symptoms (Wolanin, Hong, Marks, Panchoo, & Gross, 2016). Mental health issues, including eating disorders, may further impact athletes' physical and psychosocial functioning later in adulthood (Joy et al., 2016; Nattiv et al., 2007). Thus, the goal of each athletic department should be to ensure that student-athletes' health is of the utmost importance. Athletes must not only be provided with the necessary resources, but they must also be informed on how to access them.

The study findings also have implications for addressing disordered eating in club athletes. Both club and varsity athletes in the sample reported similar levels of eating disorder symptomatology and body image dissatisfaction. In contrast to varsity sports, which the NCAA regulates, many club sports are student-sponsored organizations and receive little financial aid from the university (Granholm, 2020). Thus, club athletes often cannot access the resources that are readily available to varsity athletes. It is important for each university to also provide professional assistance to club athletes to prevent the development of any mental health issue, including an eating disorder. This can be accomplished by a collaboration of the club sports' governing body with the existing on-campus services, such as university counseling services or student health services. Ensuring access to mental health services for club athletes will create more

equitable care across all athlete populations within universities and promote student-athletes' mental health and well-being.

Changing perspectives on competitive sport participation for athletes and coaches could be another strategy for eating disorder prevention (Power et al., 2020). Specifically, the focus of athletic participation should not be placed on the desire to attain a certain body weight and shape for performance enhancement. Thompson and Sherman (2010) found that athletes tend to underreport their eating disorder symptoms due to the misconception that dietary restraint and excessive exercise will result in improved performance. Athletes and coaches often reinforce maladaptive behaviors (i.e., dietary restriction, excessive exercise) because they believe that certain aspects of sport participation, such as mental toughness and repetitive engagement in intense training, are pivotal for optimal performance (Plateau et al., 2014). As a result, athletes may perceive compulsive exercise as a part of their daily athletic routines, rather than a symptom of an eating disorder (Bruin et al., 2007; Jones, Glintmeyer, & McKenzie, 2005). Thus, coaches need to create a positive and pressure-free training environment, where athletes feel valued for their individual contributions to the team, regardless of performance outcome (Power et al., 2020). Coaches who provide athletes with positive feedback, sufficient social support, and emphasize effort over winning can reduce the amount of sport-related pressure experienced by athletes (Horn, 2008; Yukhymenko-Lescroart, Brown, & Paskus, 2015).

Proactive steps on behalf of the university athletic staff are necessary for early identification and prevention of eating disorders (Bonci et al., 2008; McLester et al., 2014; Power et al., 2020). Prompt detection of unhealthy eating behaviors through

screening protocols has been associated with more effective treatment outcomes (Bonci et al., 2008; Thiemann et al., 2015). For instance, the Preparticipation Physical Examination (PPE) monograph, created by the American Medical Society for Sports Medicine (AMSSM) and the American College of Sports Medicine (ACSM), can serve as an effective screening tool for identification of disordered eating behaviors (Bernhardt et al., 2010). This instrument assesses whether athletes suffer from body weight pre-occupation, restrict their caloric intake, use nutritional supplements for weight loss, or undergo pressure to lose weight by outside sources (Bernhardt et al., 2010).

The Female Athlete Triad Coalition developed an 11-question screening tool that could be successfully employed as a part of the Preparticipation Physical Examination (De Souza et al., 2014). This measure evaluates a female athlete's pre-occupation with body weight, dietary restraint, menstrual dysfunction, bone injuries, and low bone mineral density. Although these screening protocols have been available for several years, NCAA Division I institutions are encouraged, but not required, to utilize them (Thompson, 2014). Currently, less than 15% of all NCAA Division I universities employ screening tools for eating disorder symptoms (Thompson, 2014). Use of these screening tools could play a key role in identifying at-risk athletes and providing immediate treatment prior to the competitive season.

Directions for Future Research

A number of recommendations for future research can be made. First, representative samples by gender, sport type, and level of athletic participation should be recruited in future studies on disordered eating and compensatory behaviors. Collecting responses from large samples of both female and male athletes will ensure appropriate

statistical power to evaluate differences in disordered eating, compulsive exercise, and body image attitudes between subgroups. In addition, representative samples of athletes from both lean and non-lean sport types, as well as athletes from both collegiate and club levels should be included in future studies to provide a clearer understanding of disordered eating behaviors and body image differences among these groups of athletes.

Further studies investigating disordered eating behaviors in conjunction with compulsive exercise in collegiate athletes are necessary for two reasons (Power et al., 2020). First, it is important to provide athletes, coaches, athletic trainers, and athletic administrators with accurate information regarding the severity of maladaptive eating and exercise in collegiate athletes. Second, various socio-cultural and sport-specific pressures have been identified as potential risk factors for the onset of eating disorders in athletes, allowing researchers to examine the links between these risk factors and the development of disordered eating behaviors (Currie, 2010; El Ghoch et al., 2013; Stoving et al., 2011).

The current study explored the impact of gender, sport type, and age on athletes' maladaptive eating patterns and contributed to the understanding of disordered eating in these subgroups. However, wide gaps still exist in the literature. For instance, including findings from the present study, the rates of clinical and subclinical eating disorders still vary greatly, 0 – 8.6%, and 6.5 – 49.1%, respectively (Anderson & Petrie, 2012; Carter & Rudd, 2005; DiPasquale & Petrie, 2013 Hinton et al., 2004; Greenleaf et al., 2009; Kato et al., 2011; Petrie et al., 2008; Reinking & Alexander, 2005; Sanford-Martens et al., 2005). This inconsistency can be explained by the use of different eating disorder measures, such as the Questionnaire for Eating Disorder Diagnoses (Q-EDD), Eating Disorder Examination Questionnaire (EDE-Q), and Eating Attitudes Test (EAT). Each

instrument provides different subscales and scoring procedures, which could result in inaccurate identification of at-risk individuals. Hence, researchers should utilize one instrument across several studies in an effort to more specifically identify the rate of eating disorders among student-athletes.

Lastly, future researchers should include additional measures for investigating other contributing factors to disordered eating, compulsive exercise, and body image dissatisfaction in athletes. For instance, measures such as The Coach – Athlete Relationship Questionnaire (CART-Q; Jowett & Ntoumanis, 2004) or the Revised Leadership Scale for Sports (Zhang, Jensen, & Mann, 1997) would assess the level of coerciveness and negative reinforcement exhibited by an athlete's coach. These behaviors have been previously identified as sport-specific pressures that could initiate dieting, compulsive exercise, and negative body image perceptions in athletes (Bratland-Sanda & Sungdot-Borgen, 2013; Carter & Rudd, 2005; Sundgot-Borgen & Torstveit, 2004; Thiemann et al., 2015). Consequently, exploring a coach-athlete relationship could help researchers gain a better understanding of the sport-related risk-factors for the development of maladaptive eating habits in athletes.

Conclusion

The current study contributed to the existing literature on eating disorders and compensatory behaviors in competitive athletes. The study found that a substantial minority of collegiate athletes suffer from clinical and subclinical symptoms of an eating disorder (8.6% and 31%, respectively). Approximately 13% of athletes reported regular occurrence of binge eating, 11.7% used excessive exercise as a weight control measure, and 10.2% engaged in dietary restraint, which are common features of

eating disorders. Engagement in maladaptive eating and compensatory behaviors has been associated with adverse health consequences, as well as poor academic and athletic performance (Joy et al., 2016).

The current study also found that lean-sport athletes are at a significantly higher risk for maladaptive eating than non-lean sport athletes. This is consistent with previous research findings (Bratland-Sanda & Sungdot-Borgen, 2013; Carter & Rudd, 2005; Sundgot-Borgen & Torstveit, 2004; Thiemann et al., 2015). One explanation for this is that athletes who participate in sports that emphasize physical appearance (e.g., gymnastics), low body weight for speed (e.g., track and field, rugby), or require physique-revealing uniforms (e.g., volleyball), undergo substantial pressure to maintain a low body weight for performance enhancement (Joy et al., 2016). Attaining a low body weight through restrictive dieting and excessive exercise may produce adverse health consequences (El Ghoch et al., 2013; Joy et al., 2016).

Finally, this study replicated others in finding associations between eating disorder symptomatology and compulsive exercise, as well as between disordered eating and body image dissatisfaction (Meyer et al., 2011; Formby et al., 2014; Mond & Calogero, 2009). In particular, athletes who reported clinical and subclinical symptoms of an eating disorder in the sample scored significantly higher on all subscales of the eating disorder and body image measures, as compared to athletes with fewer or no symptoms. Similarly, athletes who reached the clinical cut-off for compulsive exercise scored significantly higher on the EDE-Q and MBSRQ-AS measures than athletes who reported lower frequencies of compulsive exercise.

The observations support the need for additional educational programs for eating disorder prevention as well as screening protocols for prompt identification of at-risk athletes. Exploring the frequency and severity of disordered eating behaviors in athletes through screening protocols can help coaches and athletic trainers to identify eating disordered and symptomatic individuals. This finding is paramount for early identification of at-risk athletes and implementation of effective treatment programs.

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APPENDICES

A. DATA COLLECTION MEASURES: INSTRUMENT 1

The Eating Disorder Examination Questionnaire (EDE-Q 6.0).

Reference: Fairburn, G., & Beglin, S. (2008). In Fairburn, C. G. (Ed.). *Cognitive Behavior Therapy and Eating Disorders*. New York, NY: Guilford Press.

Instructions: The following questions are concerned with the past four weeks (28 days) only. Please read each question carefully. Please answer all of the questions. Please only choose one answer for each question. Thank you.

Questions 1 to 12: Please circle the appropriate number on the right. Remember that the questions only refer to the past four weeks (28 days) only.

	On how many of the past 28 days…	**No days**	**1-5 days**	**6-12 days**	**13-15 days**	**16-22 days**	**23-27 days**	**Every day**
1	Have you been deliberately trying to limit the amount of food you eat to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
2	Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?	0	1	2	3	4	5	6
3	Have you tried to exclude from your diet any foods that you like in order to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
4	Have you tried to follow definite rules regarding your eating (for example, a calorie limit) in order to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
5	Have you had a definite desire to have an empty stomach with the aim of influencing your shape or weight?	0	1	2	3	4	5	6

6	Have you had a definite desire to have a totally flat stomach?	0	1	2	3	4	5	6
7	Has thinking about food, eating or calories made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?	0	1	2	3	4	5	6
8	Has thinking about shape or weight made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?	0	1	2	3	4	5	6
9	Have you had a definite fear of losing control over eating?	0	1	2	3	4	5	6
10	Have you had a definite fear that you might gain weight?	0	1	2	3	4	5	6
11	Have you felt fat?	0	1	2	3	4	5	6
12	Have you had a strong desire to lose weight?	0	1	2	3	4	5	6

Questions 13-18: Please fill in the appropriate number in the boxes on the right. Remember that the questions only refer to the past four weeks (28 days).

Over the past four weeks (28 days)…….

13	Over the past 28 days, how many times have you eaten what other people would regard as an unusually large amount of food (given the circumstances)?	
14	On how many of these times did you have a sense of having lost control over your eating (at the time that you were eating)?	
15	Over the past 28 days, on how many **DAYS** have such episodes of overeating occurred (i.e. you have eaten an unusually large amount of food and have had a sense of loss of control at the time)?	
16	Over the past 28 days, how many times have you made yourself sick (vomit) as a means of controlling your shape or weight?	
17	Over the past 28 days, how many times have you taken laxatives as a means of controlling your shape or weight?	
18	Over the past 28 days, how many times have you exercised in a "driven" or "compulsive" way as a means of controlling your weight, shape or amount of fat or to burn off calories?	

Questions 19-21: Please circle the appropriate number. Please note that for these questions the term "binge eating" means eating what others would regard as an unusually large amount of food for the circumstances, accompanied by a sense of having lost control over eating.

19	Over the past 28 days, on how many days have you eaten in secret (i.e., furtively)?.....Do not count episodes of binge eating	No days	1-5 days	6-12 days	13-15 days	16-22 days	23-27 days	Every day
		0	1	2	3	4	5	6
20	On what proportion of the times that you have eaten have you felt guilty (felt that you've done wrong) because of its effect on your shape or weight? .....Do not count episodes of binge eating	None of the times	A few of the times	Less than half	Half of the times	More than half	Most of the time	Every time
		0	1	2	3	4	5	6
21	Over the past 28 days, how concerned have you been about other people seeing you eat? .....Do not count episodes of binge eating	Not at all		Slightly		Moderately		Markedly
		0	1	2	3	4	5	6

Questions 22-28: Please circle the appropriate number on the right.
Remember that the questions only refer to the past four weeks (28 days)

	On how many of the past 28 days ….……	Not at all		Slightly		Moderately		Markedly
22	Has your weight influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
23	Has your shape influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
24	How much would it have upset you if you had been asked to weigh yourself	0	1	2	3	4	5	6

	once a week (no more, or less, often) for the next four weeks?							
25	How dissatisfied have you been with your weight?	0	1	2	3	4	5	6
26	How dissatisfied have you been with your shape?	0	1	2	3	4	5	6
27	How uncomfortable have you felt seeing your body (for example, seeing your shape in the mirror, in a shop window reflection, while undressing or taking a bath or shower)?	0	1	2	3	4	5	6
28	How uncomfortable have you felt about others seeing your shape or figure (for example, in communal changing rooms, when swimming, or wearing tight clothes)?	0	1	2	3	4	5	6

What is your weight at present? (Please give your best estimate). _____

What is your height? (Please give your best estimate). _____

If female: Over the past three-to-four months have you missed any menstrual periods? _____

If so, how many? _____. Have you been taking the "pill"? _____.

THANK YOU!

B. DATA COLLECTION MEASURES: INSTRUMENT 2

Compulsive Exercise Test (CET)

Reference: Taranis, L., Touyz, S., & Meyer, C. (2011). Disordered eating and exercise: Development and preliminary validation of the Compulsive Exercise Test. *European Eating Disorders Review, 19,* 256–68.

Instructions: Please read each statement, and select the number from 0 (never True of you) to 5 (always true of you).

	Never true	Rarely true	Some-times true	Often true	Usually true	Always true
1. I feel happier and/or more positive after I exercise	0	1	2	3	4	5
2. I exercise to improve my appearance	0	1	2	3	4	5
3. I like my days to be organized and structured of which exercise is just one part	0	1	2	3	4	5
4. I feel less anxious after I exercise	0	1	2	3	4	5
5. I find exercise a chore	0	1	2	3	4	5
6. If I feel I have eaten too much, I will do more exercise	0	1	2	3	4	5
7. My weekly pattern of exercise is repetitive	0	1	2	3	4	5
8. I do not exercise to be slim	0	1	2	3	4	5
9. If I cannot exercise I feel low or depressed	0	1	2	3	4	5
10. I feel extremely guilty if I miss an exercise session	0	1	2	3	4	5
11. I usually continue to exercise despite injury unless I am very ill or too injured	0	1	2	3	4	5
12. I enjoy exercising	0	1	2	3	4	5
13. I exercise to burn calories and lose weight	0	1	2	3	4	5
14. I feel less stressed and/or tense after I exercise	0	1	2	3	4	5

15. If I miss an exercise session, I will try and make up for it when I next exercise	0	1	2	3	4	5
16. If I cannot exercise I feel agitated and/or irritable	0	1	2	3	4	5
17. Exercise improves my mood	0	1	2	3	4	5
18. If I cannot exercise, I worry that I will gain weight	0	1	2	3	4	5
19. I follow a set routine for my exercise sessions (e.g. walk or run the same route, particular exercises, same amount of time, and so on)	0	1	2	3	4	5
20. If I cannot exercise I feel angry and/or frustrated	0	1	2	3	4	5
21. I do not enjoy exercising	0	1	2	3	4	5
22. I feel like I've let myself down if I miss an exercise session	0	1	2	3	4	5
23. If I cannot exercise I feel anxious	0	1	2	3	4	5
24. I feel less depressed or low after I exercise	0	1	2	3	4	5

THANK YOU!

C. DATA COLLECTION MEASURES: INSTRUMENT 3

Multidimensional Body Self-Relations Questionnaire – Appearance Scales (MBSRQ-AS).

Reference: Cash, T.F. (2000). *MBSRQ users' manual*. Norfolk, VA: Old Dominion University.

Instructions: Please answer each statement below by circling the number that best applies to you.

1 Definitely Disagree	**2** Mostly Disagree	**3** Neither agree nor disagree	**4** Mostly agree	**5** Definitely agree

1) Before going out in public, I always notice how I look.	1	2	3	4	5
2) I am careful to buy clothes that will make me look at my best	1	2	3	4	5
3) My body is sexually appealing.	1	2	3	4	5
4) I constantly worry about becoming fat.	1	2	3	4	5
5) I like my looks just the way they are.	1	2	3	4	5
6) I check my appearance on the mirror whenever I can	1	2	3	4	5
7) My physical endurance is good.	1	2	3	4	5
8) I am very conscious of even small changes of my weight.	1	2	3	4	5
9) Most people would consider me good looking	1	2	3	4	5
10) It is important that I always look good	1	2	3	4	5
11) I use very few grooming products	1	2	3	4	5
12) I like the way I look without my clothes on.	1	2	3	4	5
13) I am self-conscious if my grooming isn't right.	1	2	3	4	5
14) I usually whatever is handy without caring how it looks.	1	2	3	4	5

15) I like the way my clothes fit me	1	2	3	4	5
16) I don't care what people think about my appearance.	1	2	3	4	5
17) I take special care with my hair grooming.	1	2	3	4	5
18) I dislike my physique.	1	2	3	4	5
19) I am physically unattractive.	1	2	3	4	5
20) I never think about my appearance.	1	2	3	4	5
21) I am always trying to improve my physical appearance	1	2	3	4	5
22) I am on a weight loss diet.	1	2	3	4	5

Please circle your answer

23) I have tried to lose weight by fasting or going on crash diet

1- Never
2- Rarely
3- Sometimes
4- Often
5- Very often

24) I think I am:

1- very underweight
2- somewhat underweight
3- normal weight
4- somewhat overweight
5- Very overweight.

25) From looking at me, most people think I am:

1- Very underweight
2- Somewhat underweight
3- Normal weight
4- Somewhat overweight
5- Very overweight

For questions 26-34, choose 1-5 scale to choose how satisfied or dissatisfied you are with each of the following areas of your body.

26) Face (features and complexions)	1	2	3	4	5
27) Hair (color, thickness, texture)	1	2	3	4	5
28) Lower torso (buttocks, hips, thighs, legs).	1	2	3	4	5
29) Mid torso (waist, stomach).	1	2	3	4	5
30) Upper torso (chest or breasts, shoulders, arms).	1	2	3	4	5
31) Muscle tone.	1	2	3	4	5
32) Weight.	1	2	3	4	5
33) Height.	1	2	3	4	5
34) Overall appearance.	1	2	3	4	5

THANK YOU!