

Regis University

## ePublications at Regis University

---

Regis University Student Publications

---

Spring 2021

# THE REAL HUNGER GAMES: DISORDERED EATING IN MALE ENDURANCE ATHLETES AND IMPLICATIONS FOR BONE HEALTH

Sarah Smagacz  
*Regis University*

Follow this and additional works at: <https://epublications.regis.edu/theses>



Part of the [Endocrine System Commons](#), [Mental and Social Health Commons](#), and the [Musculoskeletal System Commons](#)

---

### Recommended Citation

Smagacz, Sarah, "THE REAL HUNGER GAMES: DISORDERED EATING IN MALE ENDURANCE ATHLETES AND IMPLICATIONS FOR BONE HEALTH" (2021). *Regis University Student Publications*. 1014.  
<https://epublications.regis.edu/theses/1014>

This Thesis - Open Access is brought to you for free and open access by ePublications at Regis University. It has been accepted for inclusion in Regis University Student Publications by an authorized administrator of ePublications at Regis University. For more information, please contact [epublications@regis.edu](mailto:epublications@regis.edu).

**THE REAL HUNGER GAMES: DISORDERED EATING IN MALE  
ENDURANCE ATHLETES AND IMPLICATIONS FOR BONE HEALTH**

**A thesis submitted to  
Regis College  
The Honors Program  
in partial fulfillment of the requirements  
for Graduation with Honors**

**by**

Sarah Smagacz

**May 2021**

**Thesis written by**

Sarah Smagacz

**Approved by**

---

\_\_\_\_\_ Thesis Advisor

---

\_\_\_\_\_ Thesis Reader or Co-Advisor

**Accepted by**

---

\_\_\_\_\_ Director, Regis College Honors Program

## TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	3
I.INTRODUCTION.....	4
II. DATA BIAS IN RESEARCH ABOUT EATING DISORDERS .....	8
III. FEMALE ATHLETES: EATING DISORDER ETIOLOGY AND PHYSIOLOGICAL MECHANISMS.....	10
III. POSSIBLE MECHANISM IN MALE ATHLETES.....	13
IV. MUSCLE DYSMORPHIA .....	16
V. LONG TERM PSYCHOLOGICAL AND PSYCHOLOGICAL CONSEQUENCES OF RESTRICTIVE EATING.....	18
VI. SOCIOCULTURAL FACTORS .....	21
VII. PROPOSED SOLUTIONS.....	27
BIBLIOGRAPHY.....	31

## **Acknowledgements**

I would like to thank all the people who have supported me in this project. Firstly, my advisor, Dr. McCall, for reading this more times than I can count and graciously offering feedback. Dr. Winterrowd, for her kind time in reading my thesis in various stages. I would also like to thank Dr. Howe, Dr. Narcissi, and the rest of the honors faculty for their endless support and patience during this process. My writing group and classmates saw this thesis in all of its stages and supported and guided me, without fail, to this point. I would like to thank my friends and family for their emotional support and letting me vent throughout this process. None of this would be possible without you all.

## **I. Introduction**

What does an athlete look like? What does it mean to have an “athletic body type”? Because of prevalent stereotypes, our culture has deeply ingrained expectations of what an athlete should look like. There is variance by sport, for example, you probably picture a football player looking differently from a cross country runner. I am choosing to write about disordered eating and the patterns of low testosterone and likelihood of bone injury specifically in male endurance athletes. It interests me because of the intersection of sociology, psychology, and biology (specifically endocrinology). The many factors that affect body image and eating behaviors are complex, and therefore isolating causes of eating disorders is difficult. I enjoy the challenge of analyzing the interaction between different variables that may be causes for certain behaviors (engagement in endurance sports in this case) and physical ailments (such as bone injury). I am hoping to parse out the roles that psychology, sociology, and endocrinology play in bone injury in male athletes, although they are intertwined at many points.

I developed a personal interest in this topic during adolescence, as I became aware of my own family’s expectations about athletic performance and body physique. When I began running cross country in middle school, and during the following nine years as I continued to compete, I observed damaging stereotypes about runners. Being a thin white individual, these stereotypes were usually in my favor. People often commented that I “looked like a runner” or that my participation in endurance running

“made sense, given my body type”. In contrast, I observed others who looked different from me, both in race and body type, being told by others that they were surprised by their sport choice because they “didn’t look like a runner”. Furthermore, I witnessed coaches and other athletes perpetuating these stereotypes from within athletic teams. As a collegiate athlete, I observed coaches praising thin athletes for being in better shape than less thin athletes, and making comments related to athletes’ weights. These microaggressions may seem harmless, but the repetitive nature of microaggressions take a toll on mental health and self concept of recipients (Friedlaender, 2018).

As a participant in cross country from middle school through college, I also experienced pressure from coaches and teammates to fight against the female body’s natural peripubescent weight gain, which is often viewed as a hindrance to athletic performance. In my early years as a high school athlete, I was warned by older teammates that I could not look forward to the four year trajectory of consistent improvement that the boys had. The older girls on the team told me I would gain weight and my running times would slow significantly before the end of my time in high school. I observed teammates trying to counteract their physiology to maximize their performance, with mixed results. Negative body talk was commonplace in the girls locker room. I assumed the negative body talk and dissatisfaction was more or less limited to the girl’s team.

Despite believing I was fairly aware of the pressures facing athletes about weight and body types, I was surprised to learn how much more explicit weight loss

encouragement was in wrestling, a male dominated sport. My brother began wrestling when he was in high school, and chose to take extreme measures to lose weight. He was thin and muscular to begin with, but had quite a struggle to lose weight and weigh 106 lbs during the sport season. He was 5'8" at the time. Using the Center for Disease Control and Prevention's body mass index calculator for youth, this would place him at 16.1 body mass index and in the first percentile for boys of the same age (Centers for Disease Control and Prevention). He and his teammates exercised in extreme heat, ate no more than one small meal of vegetables per day, avoided doctor appointments, and did not drink water in the days leading up to competitions, all in an effort to weigh as little as possible on the day of competitions. Some of the wrestlers would spit out their saliva instead of swallowing it in order to retain as little water weight as possible. The reason wrestlers try to lose so much weight is to get into a low weight class on the day of the competition. In a wrestling match, the larger wrestler has an advantage over the smaller one. To make competitions fair and have wrestlers compete with people who are about their same size, there are weight classes. A wrestler only wrestles others in his or her same weight class. The goal for losing weight is to weigh into a low weight class and wrestle people who are smaller than themselves so they have an advantage.

When it came time for me to pick a topic for my thesis, I easily landed on disordered eating in athletes because of the hormonal, societal, psychological and physiological components. When I began exploring the literature to see exactly what question I wanted to answer in my research, I discovered that although there are still



many questions yet to be answered about eating disorders in female athletes, there was a much greater dearth in research on men. Basic questions I had were, and continue to be, unanswered in the literature.

I will use this thesis as an opportunity to address a curtailed subject: body image and restrictive eating in the male athlete. In this thesis, I aim to identify the social factors that cause men with disordered eating and negative body images to be neglected in research, explain a possible mechanism for bone injuries in male endurance athletes, and identify sociocultural factors that could make subpopulations of athletes more susceptible to disordered eating, hormone dysfunction, and bone injuries. The consequences of the physiological dysfunction resulting from disordered eating is not limited to the time in which the individual has disordered eating, but can impact the individual for the rest of their life. I will summarize research about female athletes' patterns of disordered eating and bone injury, and compare and contrast it with research about male athletes. I will then propose some steps to remedy the research gaps and societal unawareness in this topic. I will advocate for including men in research about disordered eating, body image, and relative energy deficiency in sport (RED-S) and better education of coaches, medical practitioners, and athletic trainers. I will also propose identifying and correcting internalized stereotypes about what athletes should look like, as well as what constitutes a victim.

This thesis adds to the current body of literature because it addresses an underrecognized issue in both research and society: males as victims of negative body

image and disordered eating, which can result in physiological complications. It is important for coaches, parents, athletic trainers and athletes to be aware of the consequences of body images issues, which, at the extreme, can lead to eating disorders. Anorexia nervosa is the most fatal of psychological disorders, and even more fatal for men than women (Quatromoni 2018). Recovery from anorexia is grim: only 46% of people make a full recovery from anorexia, 33% partially recover, and 20% will live with the disorder until they die, or die from the disorder itself, either by starvation or suicide (Arcelus 2011). Overall, I am hoping that this thesis draws awareness and attention to eating disorders and body image issues in males, specifically athletes. I will also advocate for more research to be done to determine the specific bone related physiological changes that occur as a result of caloric deficiency in males, and the specific factors that influence disordered eating behaviors.

## **II. Data Bias in Research About Eating Disorders**

In almost all areas of research there are discrepancies in populations that are researched. Often gender, socioeconomic class, or racial/ ethnic backgrounds are not studied in the proportions that they exist in the general population (Konkel, 2015; Scharff, 2010). Males are typically default in research subjects, both for human and nonhuman studies. Upchurch writes that “the selection of research participants, an androcentric, or male-focused, bias has historically led researchers to conduct their observations on males, both in biomedical studies and in research on social or

behavioral phenomena” (Upchurch 2020). In research, men are much more represented than women, in part because male bodies are considered more “normal” than females. Female bodies experience shifts in hormones on well understood cycles. Despite having a clear understanding of these hormonal cycles, researchers are concerned that these shifts will complicate and confound research observations. In an attempt to simplify research findings, men are often used in research and the findings are generalized to both genders. Research has long considered “women as imperfect men” (Bueter 2017). An example is heart attack symptoms, which are often misdiagnosed in women because heart attack symptoms that are specific to women are considered “abnormal”. Although over half of the population is female, emergency room physicians are trained to recognize heart attacks based on male symptoms (Criado Perez 2019).

Despite the largely androcentric patterns of physiological research, there are a few topics in which males remain understudied. Stereotype plays a large role in the selection of females for certain studies. This is a result of pervasive stereotypes of women being victims. For example, almost all research about sexual assault is on women (Cyrus-Hollingsworth, 2021). Males are largely unrecognized as victims of sexual crimes or domestic violence situations (Detschelt 2002). People, including in the scientific community, associate women with weakness and victimhood, and men as perpetrators of crime or violence. Indeed, Gorris states the “conflation of gender, identity and body silences male victims because they do not fit the ‘identity’ of the

‘violated body’ [meaning] frameworks structurally discriminate against men as victims of sexual violence” (Gorris 2014). A 2015 study on invisibility of male victims of sexual violence claims “scholars and activists working on male sexual victimization argue that men constitute ‘unrecognized’ or ‘invisible’ victims of conflict-related sexual violence” (Gorris 2014). Clark identifies men as the neglected victims of rape, and states “literature on rape is predominantly centered on women and female experiences of sexual violence” (Clark 2014).

Research about men with eating disorders and physical insecurities follows much the same pattern. Although research on women with eating disorders is not exhaustive, it is much more comprehensive than research on men (Strother 2012). Simple metrics, such as the number of males that suffer from eating disorders are unknown. Because males experience shame and denial about eating disorders, they are less likely to be diagnosed and treated (Strother, 2012; Grossbard, 2009). Shame and denial about eating disorders is not limited to men, but it may be heightened in men due to the omnipresent notion that primarily women suffer from eating disorders. Given the association between femininity and eating disorders, men are afraid of being perceived as “feminine”, which is yet another incentive for men to hide eating disorders and other psychological disorders (Strother, 2012). The lack of research on men, compounded with the social stereotype that only or mostly women suffer from eating disorders creates unique challenges for men, including reducing their likelihood of seeking treatment. As will be discussed later, men are often encouraged to lose weight or teased

about their weight in social or athletic settings because the public is less aware of men's physical insecurities.

### **III. Female Athletes: Eating Disorder Etiology and Physiological**

#### **Mechanisms**

In female athletes, the Female Athlete Triad (FAT) is a series of criteria used to assess bone health. The triad has three key components: caloric intake, bone density, menstruation (Manore, 2002). These three components are connected and when caloric intake does not meet energy expenditure, both menstruation and bone health can be affected. When athletes do not eat enough to replace the calories they expend, they develop a syndrome called relative energy deficiency in sport, or RED-S. Disordered eating in the context of this thesis is restrictive eating, which in athletes, causes RED-S. Restrictive eating is certainly a component of anorexia, but all people with restrictive eating have an eating disorder. When female endurance athletes are not getting enough calories to sustain their exercise regimen, they may develop amenorrhea (loss of menstruation) via a hormone cascade. Decreased levels of gonadotropin releasing hormone cause a decrease of luteinizing hormone which can cause a reduction of estrogen (Warren, 1999). The evolutionary purpose of amenorrhea is, theoretically, to conserve energy and prevent pregnancy at a time when the body perceives a scarcity in food and energy resources. The body enters a "conservation mode" and reserves resources for essential functions which do not include reproduction (Schneider, 2004).

For females, reproduction is energetically costly. A healthy pregnancy requires 27,000 additional calories over the course of the pregnancy, and additional nutrition and energy is needed to breastfeed as well (Emerson, 1972). It is theorized that the body's means of preventing pregnancy is to reduce estrogen in order to prevent ovulation and menstruation.

The function of estrogen is not limited to reproductive function. Estrogen is crucial for maintaining healthy bones. In both males and females, estrogen helps close and seal growth epiphyseal (growth) plates at the end of puberty, and prevents bone reabsorption (Väänänen, 1996). Women with low estrogen levels have increased bone reabsorption, which results in a loss of bone density (Väänänen, 1996). It is thought that estrogen inhibits osteoclasts, the cells that consume bone tissue (Manolagas, 2013). Estrogen is needed to prevent osteoclasts from destroying bone tissue. When there is a lack of estrogen, osteoclasts are active, and break down bone matter to generate energy for the body (Miller, 1999). An animal study demonstrated that when deprived of estrogen, a cytokine called interleukin-6 was released and caused osteoclastogenesis (formation of new osteoclasts) and increased bone reabsorption (Jilka, 1992). Weak bones are at an increased risk for bone injury, particularly at risk are collegiate athletes, who spend up to 20 hours per week exercising and are prone to overuse injuries even without energy deficiency (Barrow, 1988). In fact, 49% of collegiate runners with very irregular periods had stress fractures compared to 29% of runners with regular periods (Barrow, 1988). The same study demonstrated that 47% of the amenorrheic group

admitted to having been diagnosed with an eating disorder, compared to 7% of the regular groups, suggesting a strong correlation between menstrual dysfunction, bone weakness and disordered eating (Barrow, 1988). Women with amenorrhea are at an increased risk for bone injury due to reduced estrogen. The risk for bone injuries is further increased in sports where repetitive motion and weight bearing stresses bones, such as running. Osteoporosis and bone fractures are often observed in athletes with amenorrhea.

The symptoms addressed in the FAT (restrictive eating, amenorrhea, and loss of bone density) describe the link between energy deficiency (which could be the result of clinical or subclinical disordered eating), and bone injury, through estrogen dysfunction. It is important to differentiate between eating disorders and disordered eating. While many people with negative body image may not have restricted eating, and not all people with restricted eating meet criteria for an eating disorder, both negative body image and restrictive eating are correlated with eating disorders. People who have restrictive eating, even without an eating disorder, are susceptible to the physiological complications which will be addressed later.

Testosterone and estrogen have very similar molecular structures, and function in similar ways in the body. Could there be a similar pattern between restrictive eating and bone injuries in males to what is observed in females?

#### **IV. Possible Mechanism in Male Athletes**

The physiological mechanisms that cause a relationship between amenorrhea, bone injury and disordered eating in women may have more relevance to men than one might guess. Although testosterone and estrogen are often thought of as “opposites”, they have very similar structures and may play similar roles in maintaining bone health. Testosterone, the male sex hormone, also plays a role in promoting bone density much like estrogen does in women (Tenforde, 2016). Just as with women, caloric deficiency places the male body in a stressed state, where the body conserves resources for essential functioning, which does not include reproductive functions (Tenforde, 2016). Testosterone levels drop, leading to physical symptoms that are often more difficult to recognize than an estrogen drop in women, because there is no male equivalent to menstrual function (Hooper, 2017). Furthermore, Heikura (2018) showed that although testosterone levels drop significantly in response to low energy availability, they may remain above the threshold for clinical concern, meaning medical professionals may not be as likely to identify energy deficiency, whereas one might be identified in a female counterpart. A separate study showed that men who had participated in an endurance sport for more than five years had significantly lower testosterone and free testosterone levels than sedentary men, but levels still remained in normal clinical levels (Hackney, 1998). Dipla (2020) proposed that in males and females alike, low energy availability would reduce hypothalamic release of gonadotropin releasing hormone, which would cause a loss of luteinizing hormone and follicle stimulating hormone. Luteinizing hormone and follicle stimulating hormone play a role in testosterone production



(Simoni, 1999). Logue's (2020) research provides further evidence for this hormone cascade.

When testosterone levels lower, men may experience changes in libido and mood, which often go undetected, or are attributed to the emotional stress of being in a competitive sport season (Tenforde, 2016). Men's sperm count dropped 43% after a period of overtraining (Tenforde, 2016). Theoretically, male athletes who are calorically deficient may be more likely to suffer from bone injuries than well nourished peers (Tenforde, 2016; Barrack, 2017). One study on mice showed that testosterone inhibits osteoclasts; therefore testosterone may affect bone density similar to the way estrogen does in women (Chen, 2001). Because both estrogen and testosterone are needed for bone health, and both sex hormone levels drop when the body is in a caloric deficit, it seems likely that men would be at an increased risk for bone injury, like women, when testosterone levels drop. Indeed, Heikura et al. (2018) found that men with low testosterone levels in blood were 4.5 times more likely to experience a bone injury than those with normal testosterone levels, which is equivalent to the increased likelihood for bone injury in women with low estrogen compared to a control group.

Because male physiology is different from females, the question remains, are male lean sport athletes who suffer from disordered eating more likely to experience a bone-related injury? A study of adolescent male runners showed that they weighed less and had lower bone mineral density than non running counterparts (Barrack, 2017). Low bone mineral density was shown to increase participants' risk of stress fractures

(Barrack, 2017). Though some aspects of disordered eating have been studied in men, the overall connection between disordered eating and bone injury has yet to be assessed. Bratland-Sanda (2013) and Glazer (2008) showed that male athletes had higher rates of eating disorders than the general population. This is significant because it contradicts the common assumption that female athletes are more susceptible than male athletes to eating disorders. However, other studies have found that disordered eating behavior is more common in a control population compared to athletes (Martinsen, 2010). There is conflicting research regarding prevalence of low body satisfaction and eating disorders in athletes. Some studies show that physical fitness associated with sport competition reduces risk, while other studies show that coach's pressure, stereotypes about what an athlete should look like, and attempting to achieve an "ideal weight" make eating disorders more common among athletes (Hausenblas, 2010; Sungdot-Borgen, 2004). In any case, from a clinical perspective, eating disorders may present slightly differently in males than females.

## **V. Muscle Dysmorphia**

There may be another type of eating disorder which is not recognized in the Diagnostic and Statistical Manual (DSM) that presents in athletes. Because media portrayals of conventionally attractive of male and female bodies are quite different, the eating patterns of men to adhere to social pressures may be quite different than females' (Murray, 2017). Media portrayals of men are often unrealistically muscular as

compared to women, which are unrealistically thin (Parent, 2016). Men who diet to gain weight and muscle may experience dysfunctional behavior and significant distress that warrants a diagnosis, even if the symptoms are not consistent with those outlined in current DSM (Leit, 2002). Men diet more often with the goal of gaining weight than losing weight (Cafri, 2005).

Specifically, researchers have identified a trend in male athletes, but it has yet to be considered an official diagnosis. This condition resembles anorexia nervosa because people see their bodies unrealistically and go to extreme measures to alter, hide, or monitor their bodies. In a study by Pope (1997), participants used special diets, extreme exercise regimens, constant mirror and scale checks, and clothing to disguise their bodies. The main goal for people with this pathology is gaining muscle weight and bulking up, unlike anorexia. However, the same distress, body dysmorphia and rigid behaviors are observed. Pope (1997) describes muscle dysmorphia, which is characterized by “a chronic preoccupation that one is insufficiently muscular (or sometimes, especially in the case of women, both muscular and lean). This preoccupation persists and causes significant impairment or distress, even though the individual is far more muscular than average.” (Pope, 1997). There are parallels between obsessive compulsive disorder (OCD) and muscle dysmorphia because there are unwanted and intrusive thoughts that cause the person distress (Pope, 1997). Additionally, Pope (2005) found people with muscle dysmorphia often engaged in compulsive behaviors, experienced high levels of distress, and many participants in the

study had attempted suicide. They concluded that “preoccupation with additional body areas, combined with additional time-consuming compulsive behaviors (excessive weightlifting, exercising, and dieting), amplifies the distress and impairment typically experienced by individuals with BDD” (Pope, 2005). With muscle dysmorphia, these thoughts are about masculinity and body appearance. The anxiety caused by the thoughts is temporarily relieved by the compulsion, in this case comparing one’s body to images, checking weight, and exercising. In Pope’s study, researchers found that ten percent of the participants met criteria for muscle dysmorphia, all of which were male (Pope, 1997). It appears that men are at particular risk for this disorder because the idealized male body is muscular (often unrealistically so) as opposed to the idealized female body which is lean (Hargreaves, 2004). While there are few studies about muscle dysmorphia, future research could reveal that people who do not have anorexia could still be suffering from significant psychological distress regarding body shape. More research is needed on this topic to better understand how idealized body images affect body image and eating habits of males. Additionally, more research could inform practices for identifying and treating people with muscle dysmorphia for mental health and medical professionals.

## **VI. Long-term Physiological and Psychological Consequences of Restrictive Eating**

There are medical concerns for people with RED-S, both those who do and do not meet criteria for an eating disorder. The decreased bone density that puts athletes at greater risk for bone injuries can cause harm that lasts throughout the lifetime, as athletes that have stress fractures have bones weak enough to be diagnosed with osteoporosis, setting them up for an injury prone future (Warren, 1999). Warren found severe low bone density in women could be so irreparable, and left women at a greater risk for fractures throughout their entire lives (Warren, 1999). Because the hormones that affect bone density and maintenance are different in males and females, findings in studies that use female participants cannot be generalized to males. It is unknown if men who have low bone density as young athletes will be at risk for bone health problems later in life. Additionally, the lack of estrogen and testosterone in females and males, respectively, can cause other issues later in their life, including infertility (DeSouza, 2019). DeSouza (2019) found that men with low testosterone levels resulting from high training volumes had poor semen quality and decreased sperm motility, both of which are associated with infertility. The same study also showed that men recovered from low reproductive hormone levels faster than women did, with serum testosterone increasing to normal levels after just a week of rest (DeSouza, 2019). It is therefore unclear if fertility problems could persist after bouts of intense training for men. Burke (2018) reports that male cyclists with low energy availability had lower bone mineral density in their spines, and it remains unclear if reduced bone mineral density is temporary or permanent. In women with anorexia, amenorrhea may persist after

weight gain, but hormone replacement therapy may be used to initiate ovulation (Katz, 2000). In males and females, nutrient deficiencies, risk of injury and infection, and psychological distress may linger after an athlete has RED-S (DeSouza, 2014).

Sustained energy deficiency can also affect the heart. Cardiovascular effects of RED-S in amenorrheic include unfavorable lipid profiles and increased risk of cardiovascular disease (Vopat, 2021). It is thought that hypoestrogenism may negate the cardiovascular benefits of exercise (Vopat, 2021). O'Donnell (2015) found athletes with amenorrhea had impaired cardiovascular functioning, especially in relation to blood pressure due to the role estrogen plays in the renin-angiotensin system. It is unclear if this finding persists upon restoration of normal estrogen levels. It is unknown if men experience similar risks or if testosterone affects blood pressure through the renin-angiotensin system. This is another topic in which no studies have been done on males so it remains unknown if males experience any of the consequences described above as a result of RED-S.

Psychological problems can result from RED-S and psychological pathologies are common comorbidities for females with RED-S (Vopat, 2021). Female athletes with RED-S were more likely to report symptoms of depression, as well as social insecurities, and fear of weight gain (Vopat, 2021). Psychological impacts on males with RED-S is lacking (Vopat, 2021). In a study of both male and female athletes who reported having RED-S, or having had it in the past, all participants reported negative psychological

consequences, including irritability, hopelessness, despair, and preoccupation with food and weight (Langbein, 2021). The authors describe the consequences as such:

“Over time, withdrawal from social situations (particularly those involving food) and intimate relationships (attributed to poor self confidence or loss of libido) led to feelings of disillusionment. Symptoms of depression were reported in the majority of the sample with three athletes reporting clinical diagnosis and others comparing periods of intense sadness to reaching ‘rock bottom’. [...] Anxiety, worry, and concern about health were also described, with several participants articulating a sense of being trapped in their own minds” (Langbein, 2021).

For some exercise became a compulsive behavior. One athlete said “Exercise then became a punishment really. I used to, well, whip myself with it. I think I’d got self destruction down to a fine art by then, so it was basically self harming.” (Langbein, 2021). This study found several factors contributed to recovery from RED-S, including encouragement from close friends or significant others and seeking out professional help (Langbein, 2021). However, even the athletes who considered themselves recovered struggled with eating enough and described internal conflict about eating enough and weight gain (Langbein, 2021). Some reported that remaining competitive athletes helped them recover, because they desired to be strong enough to compete and knew their behaviors were not sustainable (Langbein, 2021). Others had the opposite experience, believing that their “natural weight” was too high for them to be a

competitive athlete (Langbein, 2021). More research is needed to determine how long or to what severity the symptoms persist after experiencing RED-S, as well as how they may vary between genders.

## **VII. Sociocultural Factors**

The norms and subcultures found in competitive sport settings may influence one's chances of developing an eating disorder. Lean sports, where thinness is emphasized as a benefit in competition, include cross country, swimming, diving, dance, rowing, wrestling, and gymnastics. Petrie defines a lean sport as one in which "weight or appearance was central to success" and non lean sports as all others (Petrie, 1996). Lean sport athletes are more likely than non lean sport counterparts to suffer from amenorrhea and eating disorders (Beals, 2006; Sundgot-Borgen, 1993). In addition, endurance (lean sport) athletes are more likely to spend more time training for competition (Sundgot-Borgen, 1993). Further complicating the issue, social stereotypes, stigmas, and misinformation have led athletes to use unhealthy eating restrictions to manage their weight. Some coaches and athletes go as far as to believe that women who have seasonal amenorrhea ("run off their period") are in optimal shape (Raymond-Parker 2007). In one study, over  $\frac{2}{3}$  of elite female athletes with eating disorders were dieting in order to comply with orders from a coach (Sundgot-Borgen 1993). Galli et al. claims "70% of male athletes reported pressure from their coaches to attain an ideal body weight, shape, or size" (2013). Female, lean sport athletes have



lower scores on body satisfaction as well as lower actual and desired body weight compared to non lean sport athletes (Reinking 2005). It is unclear if these patterns are also true for males, as they have not been studied. This phenomenon is particularly prevalent in lean sports, such as swimming, diving, wrestling, cycling, dancing, and running, where having a lean and muscular physique is encouraged (Byrne, 2006; Sundgot-Borgen, 1993), although athletes in all sports are at an increased risk of eating disorders (Sundgot-Borgen, 2004). It is unclear whether the sport and team culture cause the eating disorder, or if people who are predisposed to an eating disorder seek out a sport that enables them to sustain an eating disorder (Baum, 2006). Additionally, college athletes are often living away from home for the first time, which in combination with academic stress, can leave little time or desire for meals (Quatromoni, 2016).

The pervasive stereotype that people who struggle with eating disorders being thin women has created a lack of awareness for other populations who suffer from eating disorders including people who are average or overweight, racial and ethnic minorities, and men. Unfortunately, many people believe that eating disorders affect only women, which has led athletic trainers, coaches, healthcare professionals to not direct enough attention to males who are at risk of eating disorders (Quatromoni, 2018; Quatromoni, 2016). Male athletes themselves may remain in denial or delay treatment due to these stereotypes. In fact, males are more likely than females to die of anorexia, in part because they may fail to seek treatment (Quatromoni, 2016). Even extreme signs of starvation, such as emaciation are “approached by researchers, clinical

interventionists, and sports insiders as a feminine pathology within hyper-feminized sports such as figure skating and gymnastics” (Atkinson, 2011). Coaches are less likely to show concern for males with restrictive eating behaviors, and may praise or encourage the behaviors (Quatromoni, 2016). In Quatromoni’s case study “A Tale of Two Runners: A Case Report of Athletes’ Experiences with Eating Disorders Case Study in College”, two athletes are described (2016). Both are athletes at the same Division I university. They both run track under the same coach, with the same teammates, and same sports medicine professionals. The female was referred to a registered dietitian and sports psychologist soon after the beginning of her freshman year. She weighed just over 100 lbs and had been diagnosed with anorexia nervosa. She continued to lose weight for a period of time, and her competitions were suspended and was only allowed to race after she had completed a treatment plan and gained weight. She suffered a stress fracture, but was able to continue gaining weight while recovering from the bone injury. During senior year, she had broken several school records and weighed 119 pounds. By her dietitian’s account, she had a successful recovery from anorexia nervosa and a fruitful athletic career.

On the contrary, the male athlete had been teased by both teammates and coaches for gaining weight in his first few months in the US (he was an international student). He weighed himself multiple times a day and restricted his calories to 500-1200 per day. He was diagnosed with fat phobia, malnutrition, and eating disorder not otherwise specified (EDNOS). A particularly telling quote reads:

“Important people in his life who were inside the sport environment encouraged and praised his weight loss, whereas family and friends perceived his restrictive eating and consequent weight loss to be a sign of his commitment to sport and the rigors of training. Over holiday break, he collapsed while out on a long run after 3 days of not eating.”(Quatromoni, 2016).

After attending weekly consultations with a psychologist and dietitian, he agreed to increase the amount of variety of foods he ate. He regained ten pounds and was making good progress with eating disorder recovery, but his athletic performances suffered briefly in his sophomore year, which his coach attributed to his recent weight gain. His coach urged him to lose his recently gained weight, which led to a relapse in recovery, during which time the male athlete suffered psychological distress, restrictive eating and weight loss. By his senior year, the male athlete had returned to a normal weight and his athletic performances were excellent. However, his second relapse occurred after he had broken his school’s record in the mile, at which time his coach encouraged weight loss again.

One particularly enlightening publication by Quatromoni (2016) speaks to how differently the male and female athletes were perceived by coaches, family, and teammates. The author sums up the psycho-social response of the female athlete in this way: “Individuals inside and outside of the sport environment expressed concern over her low-weight status and observed inadequate food intake” and male athlete like such:

“Individuals inside the sport environment encouraged and praised his weight loss, and those outside the sport environment perceived his restrictive eating to be a sign of commitment to sport and rigor of training” (Quatromoni, 2016). Quatromoni (2016) concludes “striking differences were apparent in their cases that suggest sex differences in how eating disorders present in athletes and are addressed in the collegiate sports environment” .

Another study describes this athlete-coach interaction:

“One wrestler reported being on-line to purchase laxatives with a team-mate, only to be observed by their coach. The coach literally, and figuratively, looked the other way. This tacit approval of disordered eating and exercise is often practiced by coaches and trainers who do not wish to expose this, as their goals are more frequently focused on the success of their team, than on the overall, long-term health and wellbeing of the individual athlete.” (Baum, 2006).

Because eating disorders are less common in male than female athletes, they are at risk for being missed by coaches, trainers, and physicians, especially in sports where low body fat is advantageous (Strother, 2012). The two examples provided above demonstrate just how lacking coach concern for male disordered eating can be.

Furthermore, people may be more aware of women’s desire to be attractive than men’s. In reality, men are equally as likely as women to feel pressure to look “good”

(Furnham, 1998), and are as likely to be dissatisfied with their bodies (Frederick, 2007; Garner, 1997). Disturbingly, this pressure affects people from a young age, and as many as one-third of adolescent boys say they are dissatisfied with their bodies (Presnell, 2004). Idealized body images bombard people now more than ever, with the popularity of social media and constant exposure to the internet. The media often portrays desirable women as ultrathin and men as muscular with low body fat. According to Johnson (2007) and Hargreaves (2004) the more exposure men have to these idealized body images, the more likely they are to have depression, anxiety, and low self esteem. Furthermore, Rodgers (2010) found that media consumption was positively correlated with disordered eating behaviors. Overall, both males and females care about appearance and are influenced by media and idealized body images.

Two of the strongest factors which are correlated with disordered eating are self-objectification and high capacity for internalization (Dakanalis 2015). This means that the people who are most likely to suffer from disorder eating and eating disorders are people who objectify themselves (find value in their appearance) and those who are most impacted by external messages about body image. These two factors can apply to anyone, regardless of race, gender, or athletic participation. While sexual objectification can be communicated in interpersonal interactions, it is most ubiquitous in the media. According to Dakanalis (2015), media images often “equate an individual’s worth with the extent to which he/she fits the promoted standard of body size/shape”. The types and amount of media people consumed has changed in recent years. Dakanalis (2015)

describes a positive relationship between the amount of media consumed at propensity to self objectivity, which in turn is correlated with disordered eating. Self objectification leads to shame and appearance anxiety which may lead to diet restriction as an attempt to adhere to the idealized body images. There has been a significant increase in media consumption may leave people more vulnerable to disordered eating behaviors, as described by Dakanalis (2015). Women may be more likely to face body judgement in interpersonal situations, but both genders are increasingly bombarded with objectification by the mass media (Benowitz-Fredericks 2012). The recent increase in media consumption, combined with its correlation with self-objectification is a concern for increased disordered eating behaviors.

Comparing men and women's internalization of messages about desirable appearances, it seems that women are more likely to internalize messages about thinness and men were more likely to internalize messages about strength (Dakanalis, 2015). Internalization of either expectation, masculinity or thinness was correlated with disordered eating behaviors (Dakanalis, 2015). Based on contrasting portrayals of male and female ideal bodies, it is not hard to see the connection between media consumption and disordered eating behaviors consistent with muscle dysmorphia as described by Pope (1997). A meta analysis of media and body image studies discovered that "young men's body satisfaction can be negatively affected by exposure to images of ideal male bodies" and that the amount of mass media people are consuming is ever increasing, thanks to social media, the internet, magazines, advertisement and more

(Blond, 2008). The media's messages about what bodies should look like, combined with norms of sport teams, can make a "perfect storm" for athletes in terms of eating habits and self concept.

### **VIII. Proposed Solutions**

There is a deficit in research of athletic males with respect to the impacts of disordered eating and eating disorders on endocrinology, energy availability, and bone health (Murray, 2017). Murray reports that "less than 1% of research on anorexia nervosa has been conducted in males." (Murray, 2016). This is problematic because diagnostic criteria was developed almost entirely based on female populations which may not be appropriate for males (Murray, 2016). Disordered eating behavior is far more prevalent than eating disorder diagnosis, suggesting that there is an underdetection of eating disorders in males (Mitchison, 2014). This disparity will only increase, as prevalence of dieting and purging are increasing more quickly in males than females (Mitchison, 2014). The commonly accepted estimate is 10% of people with eating disorders are male, but more recent surveys suggest that  $\frac{1}{4}$  to  $\frac{1}{3}$  of cases of bulimia nervosa and anorexia nervosa are males (Hudson, 2007; Mitchison, 2015).

In the athletic community, RED-S was not recognized in males until 2014, after it was accepted that males could experience energy deficits (Tenforde 2016). Tenforde (2016) sums it up this way: "While the Triad has been researched and characterized extensively, particularly among collegiate and young adult athletes, male athletes may

also experience similar conditions, although the characteristics, prevalence, and clinical significance are largely unknown.”. Although it does seem that the prevalence of female athletes identified as “at risk” for an eating disorder is greater than males (21% and 9%, respectively), it is possible that these statistics could underestimate the prevalence of males who are at risk for eating disorders (De Souza, 2019). The surveys used to assess both male and females for eating concerns are largely developed based on eating habits of women, and may miss traits more common in men, such as those observed in muscle dysmorphia (De Souza, 2019; Spillane, 2004).

Athletes often face pressures and messages from within their sport teams. Lean sport athletes, in particular, face pressures about maintaining a low weight. Kinningham (2001) found that the methods among wrestlers for weight loss were pathological, and that 72% of high school wrestlers had engaged in a harmful method of weight loss on a weekly basis. The explicit or implicit encouragement of athletes to maintain a low body weight puts them at risk for disordered eating, eating disorders, and bone injury. Galli sums it up quite nicely: “coaches should emphasize optimal physical functioning over aesthetic form and physical well-being over performance to create a healthful competitive environment for male athletes.” (2013).

This issue is further compounded by the public’s enduring belief that people who suffer from eating disorders are female. Medical professionals, athletic trainers, and coaches, are not exempt from these beliefs and may be less likely to recognize eating disorders in male athletes (Mitchison, 2014). In fact, males are less likely to receive a



diagnosis than women with identical symptoms (Currin, 2007). The tendency of believing only women can be victims is also seen in rape and sexual assault, and it reveals an uncomfortable truth about our strength-oriented society: we see women as weak victims who must be protected, and men as perpetrators who do not succumb to victimhood or feelings.

Another problem is brought to light in this thesis: the perpetuation of idealized and unrealistic body images of both men and women, as well the message that people's value, attractiveness, and lovability hinge on their physical appearance.

In order to repair the issue of underdetection and treatment for males with disordered eating, I propose more research to better understand how eating disorders may present differently in males than females. Muscle dysmorphia should be further studied and possibly added to the Diagnostic and Statistical Manual. More research is also needed to understand the specific workings of the hormone cascade in men that may cause energy deficiency to cause bone injury, which could inform treatment. For both males and females, more research could reveal at what stages in life athletes with energy deficiency are at most risk and incur the most long term risks to bone health. Because pre-, peri-, and post-pubescent all have different levels of reproductive hormones, I would be interested to see how sport involvement and eating habits influence bone health during each of these stages.

Coaches and medical professionals should be more aware of eating disorders, specifically in male athletes. Medical professionals are not immune to believing that

eating disorders primarily affect females, which may lead them to underdiagnose eating disorders in males. In an effort to take better care of all aspects of health: mental, physical, and emotional, providers should screen athletes of all genders for disordered eating, rapid weight loss and body dissatisfaction. Coaches and athletic trainers should be educated on the effect of weight loss and energy deficiency on bone health. Additionally, I advocate for coaches to be more concerned with current and future health of athletes rather than immediate performance results. Galli argues that coaches should care for the whole individual, rather than seeking only their athletic abilities by arguing: “coaches should emphasize optimal physical functioning over aesthetic form and physical well-being over performance to create a healthful competitive environment for male athletes” (Galli, 2014). Also needed to know how to best look out of the interest of athletes is more research. Because there is so little research on the relationship between restrictive eating and bone health in male athletes, there needs to be more research to understand parallels of the female athlete triad in male athletes, as well the long term medical and psychological consequences of restrictive eating.

## Bibliography

- Arcelus, J., Mitchell, A. J., Wales, J., & Nielsen, S. (2011). Mortality rates in patients with anorexia nervosa and other eating disorders: a meta-analysis of 36 studies. *Archives of general psychiatry*, 68(7), 724-731.
- Atkinson, M. (2011). Male athletes and the cult (ure) of thinness in sport. *Deviant behavior*, 32(3), 224-256.
- Barrack, M. T., Fredericson, M., Tenforde, A. S., & Nattiv, A. (2017). Evidence of a cumulative effect for risk factors predicting low bone mass among male adolescent athletes. *British Journal of Sports Medicine*, 51(3), 200-205.
- Barrow, Gray W., and Subrata Saha. "Menstrual Irregularity and Stress Fractures in Collegiate Female Distance Runners." *The American Journal of Sports Medicine*, vol. 16, no. 3, May 1988, pp. 209–216, doi:[10.1177/036354658801600302](https://doi.org/10.1177/036354658801600302).
- Baum, A. Eating Disorders in the Male Athlete. *Sports Med* 36, 1–6 (2006).
- Beals, K. A., & Hill, A. K. (2006). The Prevalence of Disordered Eating, Menstrual Dysfunction, and Low Bone Mineral Density among US Collegiate Athletes, *International Journal of Sport Nutrition and Exercise Metabolism*, 16(1), 1-23. Retrieved Sep 25, 2020, from
- Benowitz-Fredericks, Carson A. "Body Image, Eating Disorders, and the Relationship to Adolescent Media Use." *Pediatric Clinics of North America*, vol. 59, no. 3, June 2012.
- Blond, Anna. "Impacts of Exposure to Images of Ideal Bodies on Male Body Dissatisfaction: A Review." *Body Image*, vol. 5, no. 3, Sept. 2008.
- Bratland-Sanda, S., & Sundgot-Borgen, J. (2013). Eating disorders in athletes: overview of prevalence, risk factors and recommendations for prevention and treatment. *European journal of sport science*, 13(5), 499-508.
- Bueter, A. (2017). Androcentrism, feminism, and pluralism in medicine. *Topoi*, 36(3), 521-530.
- Burke, L. M., Close, G. L., Lundy, B., Mooses, M., Morton, J. P., & Tenforde, A. S. (2018). Relative energy deficiency in sport in male athletes: a commentary on its presentation among selected groups of male athletes. *International journal of sport nutrition and exercise metabolism*, 28(4), 364-374.

- Byrne, Susan, and Neil McLean. "Eating Disorders in Athletes: A Review of the Literature." *Journal of Science and Medicine in Sport*, Elsevier, 22 Feb. 2006,
- Cafri, G., Thompson, J. K., Ricciardelli, L., McCabe, M., Smolak, L., & Yesalis, C. (2005). Pursuit of the muscular ideal: Physical and psychological consequences and putative risk factors. *Clinical psychology review*, 25(2), 215-239.
- Centers for Disease Control and Prevention. (2010). BMI Percentile calculator for child and teen: Results.
- Chen, Qingxiang, et al. "Testosterone inhibits osteoclast formation stimulated by parathyroid hormone through androgen receptor." *FEBS letters* 491.1-2 (2001): 91-93.
- Clark, J. N. (2014). A crime of identity: Rape and its neglected victims. *Journal of Human Rights*, 13(2), 146-169.
- Criado-Perez, C. (2019). Invisible women: Data bias in a world designed for men.
- Currin, L., Schmidt, U., & Waller, G. (2007). Variables that influence diagnosis and treatment of the eating disorders within primary care settings: a vignette study. *International Journal of Eating Disorders*, 40(3), 257-262.
- Cyrus-Hollingsworth, B. (2021). An Evaluation of Implicit Bias Towards Male Sexual Assault Survivors (Doctoral dissertation, Spalding University).
- Dakanalis, A., Carrà, G., Calogero, R. *et al.* The developmental effects of media-ideal internalization and self-objectification processes on adolescents' negative body-feelings, dietary restraint, and binge eating. *Eur Child Adolesc Psychiatry* 24, 997–1010 (2015).
- De Souza, M. J., Koltun, K. J., & Williams, N. I. (2019). The role of energy availability in reproductive function in the female athlete triad and extension of its effects to men: an initial working model of a similar syndrome in male athletes. *Sports Medicine*, 1-13.
- De Souza, M. J., Williams, N. I., Nattiv, A., Joy, E., Misra, M., Loucks, A. B., ... & McComb, J. (2014). Misunderstanding the female athlete triad: refuting the IOC consensus statement on Relative Energy Deficiency in Sport (RED-S).
- Detschelt, A. (2002). Recognizing domestic violence directed towards men: Overcoming societal perceptions, conducting accurate studies, and enacting responsible legislation. *Kan. JL & Pub. Pol'y*, 12, 249.
- Dipla, K., Kraemer, R. R., Constantini, N. W., & Hackney, A. C. (2020). Relative energy deficiency in sports (RED-S): Elucidation of endocrine changes affecting the health of males and females. *Hormones*, 1-13.
- Emerson, K., Saxena, B. N., & Poindexter, E. L. (1972). Caloric cost of normal pregnancy. *Obstetrics & Gynecology*, 40(6), 786-794.

- Frederick, David. "Female Body Dissatisfaction and Perceptions of the Attractive Female Body in Ghana, the Ukraine, and the United States." *Psychological Topics*, vol. 17, no. 2, 2008.
- Friedlaender, C. (2018). On microaggressions: Cumulative harm and individual responsibility. *Hypatia*, 33(1), 5-2
- Furnham, Adrian, and Alison Calnan. "Eating Disturbance, Self-Esteem, Reasons for Exercising and Body Weight Dissatisfaction in Adolescent Males." *European Eating Disorders Review*, vol. 6, no. 1, Mar. 1998.
- Galli, N., Petrie, T. A., Reel, J. J., Chatterton, J. M., & Baghurst, T. M. (2014). Assessing the validity of the Weight Pressures in Sport Scale for Male Athletes. *Psychology of Men & Masculinity*, 15(2), 170.
- Garner, D. (1997). Body image survey results. *Psychology Today- New York-*, 30, 30-45.
- Gorris, E. A. P. (2015). Invisible victims? Where are male victims of conflict-related sexual violence in international law and policy?. *European Journal of Women's Studies*, 22(4), 412-427.
- Glazer, J. L. (2008). Eating disorders among male athletes. *Current sports medicine reports*, 7(6), 332-337.
- Grossbard, J. R., Lee, C. M., Neighbors, C., & Larimer, M. E. (2009). Body image concerns and contingent self-esteem in male and female college students. *Sex roles*, 60(3-4), 198-207.
- Hackney, A. C., Fahrner, C. L., & Gullledge, T. P. (1998). Basal reproductive hormonal profiles are altered in endurance trained men. *The Journal of sports medicine and physical fitness*, 38(2), 138.
- Hargreaves, D. A., & Tiggemann, M. (2004). Idealized media images and adolescent body image: "Comparing" boys and girls. *Body image*, 1(4), 351-361.
- Hausenblas, H. A., & McNally, K. D. (2004). Eating disorder prevalence and symptoms for track and field athletes and nonathletes. *Journal of Applied Sport Psychology*, 16(3), 274-286.
- Heikura, Ida A., et al. "Low Energy Availability Is Difficult to Assess but Outcomes Have Large Impact on Bone Injury Rates in Elite Distance Athletes." *Human Kinetics*, Human Kinetics, 1 July 2018.
- Hooper, D.R., Kraemer, W.J., Saenz, C. *et al.* The presence of symptoms of testosterone deficiency in the exercise-hypogonadal male condition and the role of nutrition. *Eur J Appl Physiol* 117, 1349–1357 (2017).
- Hudson, J. I., Hiripi, E., Pope Jr, H. G., & Kessler, R. C. (2007). The prevalence and correlates of eating disorders in the National Comorbidity Survey Replication. *Biological psychiatry*, 61(3), 348-358.

- Jilka, R. L., Hangoc, G., Girasole, G., Passeri, G., Williams, D. C., Abrams, J. S., Boyce, B., Broxmeyer, H., & Manolagas, S. C. (1992). Increased osteoclast development after estrogen loss: mediation by interleukin-6. *Science*, 257(5066), 88+.
- Johnson, P. J., McCreary, D. R., & Mills, J. S. (2007). Effects of exposure to objectified male and female media images on men's psychological well-being. *Psychology of Men & Masculinity*, 8(2), 95.
- Katz, M. G., & Vollenhoven, B. (2000). The reproductive endocrine consequences of anorexia nervosa. *BJOG: An International Journal of Obstetrics & Gynaecology*, 107(6), 707-713.
- Kinningham, R. B., & Gorenflo, D. W. (2001). Weight loss methods of high school wrestlers. *Medicine and science in sports and exercise*, 33(5), 810-813.
- Konkel, L. (2015). Racial and ethnic disparities in research studies: the challenge of creating more diverse cohorts.
- Langbein, R. K., Martin, D., Allen-Collinson, J., Crust, L., & Jackman, P. C. (2021). "I'd got self-destruction down to a fine art": a qualitative exploration of relative energy deficiency in sport (RED-S) in endurance athletes. *Journal of Sports Sciences*, 1-10.
- Leit, R. A., Gray, J. J., & Pope Jr, H. G. (2002). The media's representation of the ideal male body: A cause for muscle dysmorphia?. *International Journal of Eating Disorders*, 31(3), 334-338.
- Logue, D. M., Madigan, S. M., Melin, A., Delahunt, E., Heinen, M., Donnell, S. J. M., & Corish, C. A. (2020). Low energy availability in athletes 2020: an updated narrative review of prevalence, risk, within-day energy balance, knowledge, and impact on sports performance. *Nutrients*, 12(3), 835.
- Manolagas, S. C., O'brien, C. A., & Almeida, M. (2013). The role of estrogen and androgen receptors in bone health and disease. *Nature Reviews Endocrinology*, 9(12), 699.
- Manore, M.M. Dietary recommendations and athletic menstrual dysfunction. *Sports Med* 32, 887–901 (2002).
- Martinsen, M., Bratland-Sanda, S., Eriksson, A. K., & Sundgot-Borgen, J. (2010). Dieting to win or to be thin? A study of dieting and disordered eating among adolescent elite athletes and non-athlete controls. *British journal of sports medicine*, 44(1), 70-76.
- Miller, Evonne & Halberstadt, Jasmin (2005) Media Consumption, Body Image and Thin Ideals in New Zealand Men and Women. *New Zealand Journal of Psychology*, 34(3), pp. 189-195.

- Miller, K. K., & Klibanski, A. (1999). Amenorrheic bone loss. *The Journal of Clinical Endocrinology & Metabolism*, 84(6), 1775-1783.
- Mitchison, D., Hay, P., Slewa-Younan, S., & Mond, J. (2014). The changing demographic profile of eating disorder behaviors in the community. *BMC Public Health*, 14(1), 1-9.
- Mitchison, D., & Mond, J. (2015). Epidemiology of eating disorders, eating disordered behaviour, and body image disturbance in males: a narrative review. *Journal of eating disorders*, 3(1), 1-9.
- Murray, S., Griffiths, S., & Mond, J. (2016). Evolving eating disorder psychopathology: Conceptualising muscularity-oriented disordered eating. *British Journal of Psychiatry*, 208(5), 414-415. doi:10.1192/bjp.bp.115.168427
- Murray, S. B., Nagata, J. M., Griffiths, S., Calzo, J. P., Brown, T. A., Mitchison, D., ... & Mond, J. M. (2017). The enigma of male eating disorders: A critical review and synthesis. *Clinical psychology review*, 57, 1-11.
- O'Donnell, E., Goodman, J. M., Mak, S., Murai, H., Morris, B. L., Floras, J. S., & Harvey, P. J. (2015). Discordant orthostatic reflex renin–angiotensin and sympathoneural responses in premenopausal exercising-hypoestrogenic women. *Hypertension*, 65(5), 1089-1095.
- Parent, M. C., Schwartz, E. N., & Bradstreet, T. C. (2016). Men's body image.
- Petrie, T. A. (1996). Differences between male and female college lean sport athletes, nonlean sport athletes, and nonathletes on behavioral and psychological indices of eating disorders. *Journal of Applied Sport Psychology*, 8(2), 218-230.
- Pope, Courtney G., et al. "Clinical features of muscle dysmorphia among males with body dysmorphic disorder." *Body image* 2.4 (2005): 395-400.
- Pope, Harrison. "Muscle Dysmorphia: an underrecognized form of body dysmorphic disorder." *Psychosomatics*, vol. 38, no. 6, 1997.
- Presnell, K., Bearman, S. K., & Stice, E. (2004). Risk factors for body dissatisfaction in adolescent boys and girls: A prospective study. *International Journal of eating disorders*, 36(4), 389-401.
- Quatromoni, Paula. "A Tale of Two Runners: A Case Report of Athletes' Experiences with Eating Disorders Case Study in College." *Journal of the Academy of Nutrition and Dietetics*, vol. 117, no. 1, Sept. 2016, sites.bu.edu/nutritionalepilab/files/2017/03/tale-of-two-runners.pdf.
- Quatromoni, Paula. "Why are male athletes at risk for eating disorders?" *Walden Eating Disorders*, 10 Sept. 2018,

- Raymond-Barker, P., Petroczi, A. & Quested, E. Assessment of nutritional knowledge in female athletes susceptible to the Female Athlete Triad syndrome. *J Occup Med Toxicol* 2, 10 (2007).
- Reinking, M. F., & Alexander, L. E. (2005). Prevalence of Disordered-Eating Behaviors in Undergraduate Female Collegiate Athletes and Nonathletes. *Journal of athletic training*, 40(1), 47–51.
- Rodgers, R. F., Paxton, S. J., & Chabrol, H. (2010). Depression as a moderator of sociocultural influences on eating disorder symptoms in adolescent females and males. *Journal of Youth and Adolescence*, 39(4), 393-402.
- Scharff, D. P., Mathews, K. J., Jackson, P., Hoffsuemmer, J., Martin, E., & Edwards, D. (2010). More than Tuskegee: understanding mistrust about research participation. *Journal of health care for the poor and underserved*, 21(3), 879.
- Schneider, J. E. (2004). Energy balance and reproduction. *Physiology & behavior*, 81(2), 289-317.
- Simoni, M., Weinbauer, G. F., Gromoll, J., & Nieschlag, E. (1999, July). Role of FSH in male gonadal function. In *Annales d'endocrinologie* (Vol. 60, No. 2, pp. 102-106).
- Spillane, N. S., Boerner, L. M., Anderson, K. G., & Smith, G. T. (2004). Comparability of the Eating Disorder Inventory-2 between women and men. *Assessment*, 11(1), 85-93.
- Strother, E., Lemberg, R., Stanford, S. C., & Turberville, D. (2012). Eating disorders in men: underdiagnosed, undertreated, and misunderstood. *Eating disorders*, 20(5), 346-355.
- Sundgot-Borgen, Jorunn. "Risk and trigger factors for the development of eating disorders in female elite athletes." *Medicine and Science in Sports and Exercise*. [http://general.utpb.edu/FAC/eldridge\\_j/KINE6362/Readings/Unit5\\_2.Pdf](http://general.utpb.edu/FAC/eldridge_j/KINE6362/Readings/Unit5_2.Pdf), American College for Sports Medicine, Sept. 1993.
- Sundgot-Borgen, J., & Torstveit, M. K. (2004). Prevalence of eating disorders in elite athletes is higher than in the general population. *Clinical journal of sport medicine*, 14(1), 25-32.
- Tenforde, A.S., Barrack, M.T., Nattiv, A. *et al.* Parallels with the female athlete triad in male athletes. *Sports Med* 46, 171–182 (2016).
- Tenforde, Adam S., et al. "Parallels with the female athlete triad in male athletes." *Sports Medicine* 46.2 (2016): 171-182.
- Upchurch, M. (2020). Gender bias in research. *Companion to Women's and Gender Studies*, 139-154.
- Väänänen HK, Härkönen PL. Estrogen and bone metabolism. *Maturitas*. 1996 May;23 Suppl:S65-9. doi: 10.1016/0378-5122(96)01015-8. PMID: 8865143.



- Vopat, L., Mackay, M. J., Vopat, B. G., & Mulcahey, M. K. (2021). Relative energy deficiency in Sport: an orthopaedic perspective. *JAAOS-Journal of the American Academy of Orthopaedic Surgeons*, 29(1), e14-e21.
- Warren, M. P. (1999). Health issues for women athletes: exercise-induced amenorrhea. *The journal of clinical endocrinology & metabolism*, 84(6), 1892-1896.