

The Effect of Eating Disorders on Sports Performance in Elite or College Athletes.

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Abstract

As the sports world has pushed performance levels to new heights, elite athletes are pushing boundaries to find ways to increase their performance. With increased pressure on elite performance, the importance of understanding eating disorders in elite or college athletes has become increasingly important. Analysis of previous research of eating disorders in elite athletes has shown that performance decreases as the prevalence of eating disorders or disordered eating is shown in elite athletes. Research also shows an increase in mental and emotional health challenges when elite athletes have eating disorders or experience disordered eating habits. It has been suggested that to prevent future eating disorders in elite athletes, education of all athletic personnel and athletes is vital to keeping athletes safe. The purpose of this synthesis was to review the literature on how eating disorders affect the performance of elite and college athletes.

Chapter 1- Introduction

Eating disorders among college and elite athletes has been well-documented over the last few decades. Disordered eating (DE) or eating disorders, are one of the most common mental illnesses shown by elite athletes (Robin, Yannis, Erich, & Christian, 2020). Research has shown that elite athletes are more prone to develop an eating disorder than the general population (Quatromoni, 2017). Eating disorders are considered “life-threatening psychiatric conditions with conspicuously high mortality rates” (Quatromoni, 2017). It has been estimated that 11 million Americans suffer from a significant eating disorder in their lifetime (Quatromoni, 2017).

When looking at competing in sports, an athlete’s body is a valued possession. There are numerous factors that go into determining how elite an athlete is, and nutrition and eating habits are on that list. Eating provides athletes’ bodies with the fuel necessary to compete at an elite level (Giel, Herman, Mayer, Diehl, Schneider, Theil, & Zipfel, 2016). “Despite the recognized importance for nutrition for athletic performance, numerous research studies have shown that a high percentage of athletes do not meet the energy requirements of their sport” (Giel, et al., 2016). In some sports, leanness and weight play a factor into an athlete's performance which could cause pressure for athletes to alter their diet and physical appearance (Giel, et al., 2016). A study involving Norwegian adolescent athletes showed that performance enhancement was the most important factor for athletes’ dieting (Krentz & Warschburger, 2013).

Elite athletes feel pressured to look a certain way, and this oftentimes will lead them to disordered eating habits. Elite athletes also feel like they need to achieve the ideal body type, and can skew their viewpoints of themselves which can lead to unhealthy eating habits (Sundgot-Borgen & Torstveit, 2010). Studies have shown that athletes experiencing anorexia believe that

they are overweight while being 15% or more below their ideal body weight (Sundgot-Borgen & Torstveit, 2010).

Historically, eating disorders in female elite athletes have been documented more than male elite athletes (Robin, et al., 2020). To many, eating disorders are primarily associated with female elite athletes which has caused extensive research to be done in this specific field. While much attention has been given to elite female athletes, it has been shown in some studies that 32.5% of elite male athletes exhibited behaviors of clinical eating disorders (Robin, et al., 2020). Although research has proven that male athletes have been understudied, male elite athletes have been considered similarly vulnerable when compared to female elite athletes (Quatromoni, 2017).

Rates of eating disorders in elite athletes vary from sport to sport. Research has presented that aesthetic sports, such as figure skating or dance, have shown high percentages of athletes who are experiencing eating disorders or disordered eating (Krentz & Warschburger, 2013). Elite athletes who also compete in weight class sports have revealed that 70% of the athletes participate in abnormal eating behaviors leading up to competition (Sundgot-Borgen & Torstveit, 2010). While “ballgame” sports have less athletes experiencing eating disorders or disordered eating when compared to aesthetic sports, it was still prevalent in these athletes (Krentz & Warschburger, 2013). Elite athletes will often associate a lean body with high performance, which can cause disordered eating in athletes and begin the process of bad habits (Krentz & Warschburger, 2013). Evidence also proved that there is “an association between performance pressure and disordered eating as higher levels of competition have been associated with more DE symptoms” (Robin, et al., 2020).

Coaches play an important role in monitoring athletes' health. Elite athletes who are experiencing anorexia or bulimia have been shown to exercise excessively in order to achieve their desired performance levels (Sundgot-Borgen & Torstveit, 2010). While athletes who are experiencing anorexia may be easier to identify, athletes who are experiencing bulimia may show a typical body weight. Coaches need to keep an eye on the intensity and overtraining of their athletes to help prevent these eating disorders or disordered eating from happening (Sundgot-Borgen & Torstveit, 2010).

Research in the area of eating disorders in elite athletes has given data that these elite athletes are more likely to develop an eating disorder than the general population (Quatromoni, 2017). The desire to compete at a higher level and to be more successful has led athletes to change their typical eating habits and put their bodies at risk of developing disordered eating habits or an eating disorder (Giel, et al., 2016).

Statement of the Problem

Elite athletes worldwide are experiencing pressures to perform at an elite level. While the reasons behind the pressures may vary from sport to sport, elite athletes have been distorting their bodies to meet the "needs" of their sport (Sundgot-Borgen & Torstveit, 2010). This has led to an alarming amount of elite athletes with anorexia, bulimia, and other forms of disordered eating or unhealthy eating habits (Robin, et al., 2020). These conditions have led certain athletes to be placed in life-threatening conditions.

Coaches of these elite athletes often spend more time with the athlete than their own families. Verbal interactions of coaches to players have affected many elite athletes and some researchers have cited this being a direct correlation to developing an eating disorder (Millar, 2010). With the pressures elite athletes are facing, coaches are key to being positive influences

on the physical and mental choices that their athletes are making in order to keep them safe physically and mentally.

Keeping an athlete competitive in the field is important in elite athletics, but maintaining the mental and physical health of an athlete should always come first. In order to keep these elite athletes healthy, it's vital to understand how eating disorders impact the performance of these athletes and the different ways coaches can support these elite athletes in their journey.

Purpose of the Synthesis

The purpose of this synthesis project is to review the literature on the effects of eating disorders on sports performance in college and elite athletes.

Operational Definitions

1. Eating disorder: "refers mainly to the clinical diagnoses of anorexia nervosa and bulimia nervosa." (Krentz & Warschburger, 2013)
2. Disordered eating (DE): a term which includes broader conditions. There is "an assumption of a continuum between healthy and pathological eating patterns". (Krentz & Warschburger, 2013)
3. Anorexia nervosa: "characterized by self-starvation and a disturbance in the experience of one's body weight". (Arthur-Cameselle, Sossin, & Quatromoni, 2017)
4. Bulimia nervosa: "binge-purge cycle...contributes to gastrointestinal maladies, severe dehydration, and electrolyte disturbance". (Arthur-Cameselle, et al., 2017)

Research Questions

The following research questions will be the focus of this literature review:

1. Do eating disorders or disordered eating affect the overall performance of an elite athlete?

2. What challenges do elite athletes with eating disorders face?
3. How can coaches provide ways for athletes to maintain healthy eating habits?

Delimitations

1. The articles used in this synthesis were both peer reviewed and full text.
2. The articles that were reviewed were published between 2010-2021.
3. Peer reviewed scholarly articles focused on eating disorders in elite athletes, how coaches respond to athletes in these positions, and ways the eating disorders impacted the elite athletes.

Chapter 2: Methods

The purpose of this synthesis project is to review the methods and procedures used to determine the effects of eating disorders in college and elite athletes on sport performance. An extensive search was completed to gain the necessary information for this synthesis project. This chapter will explain in depth the methods used to obtain the information for this synthesis project.

The first step that was completed for this synthesis project was using the EBSCO database of SUNY Brockport's Drake Memorial Library website. To narrow the search, the first subject that was selected was Kinesiology, Sport Studies, & Phys. Ed. Once selected, the two databases that were searched through were SportDiscus and Academic Search Complete. Each database produced thousands of results pertaining to eating disorders.

To narrow down the search, keywords were necessary to sort through results. These keywords included *eating disorders*, *elite athletes*, *college athletes*, *performance*, and *disordered eating*. I selected these keywords due to the relevance to the research questions that were developed. *Eating disorders* and *elite athletes* were the two most important search words used to begin the research process. After that, the keywords *college athletes*, *performance*, and *disordered eating* were used to narrow down the search even further to produce results specific to the research topic.

The first search that was conducted was using SportsDiscus in the Kinesiology, Sport Studies, & Phys. Ed database. The keywords that were used first were *eating disorders* and *elite athletes*. This search returned 207 results. To narrow down the results, filters were added. Results were limited to full-text only, articles that were peer reviewed, and articles that were published

between 2010-2021. After applying these filters, the results dwindled to 44. Of the 44 results produced, four of the articles were used for this synthesis.

The second search was also conducted in the SportsDiscus database. The same filters were applied: full-length articles, peer reviewed, and articles published between 2010-2021. The keywords used this time were *disordered eating* and *elite athletes*. With these keywords and filters in place, 20 results were produced. Of these 20 results, one was selected and used in this synthesis.

The third search was conducted using the Academic Search Complete database under the Kinesiology, Sports Studies, & Phys. Ed. database. Originally, I used the keywords *eating disorders* and *elite athletes*. This returned 135 results. To limit the results, I put the same filters as above; articles with full-text, articles that were peer reviewed, and articles that were published between 2010-2021. After applying the filters, 33 articles were presented. Of these 33 articles, four were used in this synthesis.

The fourth search that was conducted was again done by using Academic Search Complete. The filters of full-text articles, peer-reviewed articles, and articles published between 2010-2021 were applied. This time, the keywords used in the search were *eating disorders*, *elite college athletes*, and *performance*. This produced nine articles. Of the nine articles produced, one was used in this synthesis.

In total, there were 10 articles that were deemed appropriate for the synthesis, along with five critical mass articles that were used for background information in Chapter 1. Articles were selected based on appropriateness to the topic and had to pass the filters applied in the databases. The articles selected had to include the effects of eating disorders or disordered eating on elite or

college athletes. Articles were also selected that talked about sports performance in relation to eating disorders or disordered eating.

Articles that were selected were produced from journals that included: *Eating Disorders*, *Romanian Journal of Cognitive-Behavioral Therapy & Hypnosis*, *International Journal of Eating Disorders*, *Scandinavian Journal of Medicine & Science in Sports*, *Journal of Sport & Exercise Psychology*, *Journal of Sports Sciences*, *Journal of the Academy of Nutrition and Dietetics*, *Brazilian Journal of Kineanthropometry & Human Performance*, *Schweizerische Zeitschrift Fur Sportmedizin & Sprttaumatologie*, *European Journal of Sport Science*, *SportLogia*, and *Journal of Child & Family Studies*.

The critical mass for this synthesis is comprised of 6,641 individuals who were considered elite athletes. The majority of the athletes involved in the critical mass were between the ages of 13-26, with some outliers being younger and older. Data was derived from athletes of multiple sports, with gymnastics being the most frequently studied sport. Other sports in the critical mass included ice skating, diving, bowling, ballet, roller skating, rhythmic gymnastics, “ball sports”, track and field, cross country, basketball, crew, soccer, and tennis. Elite athletes were derived from multiple levels of competition, including elite youth sports, Division I athletics, Division III athletics, professional athletics, and the Olympics. The demographic regions of the critical mass were worldwide, with the majority of the results coming from the Eastern United States.

The articles included in this research were a mix of quantitative and qualitative approaches and one case study. In the literature review, there were seven qualitative articles, and three mixed methods studies. Studies included in the review used a variety of ways to collect data, including surveys, questionnaires, article reviews, among others. The majority of the

articles used in this research primarily talked about reasons why elite athletes experience eating disorders or disordered eating and ways that athletes can try to avoid these behaviors.

Chapter 3- Review of Literature

The focus of this chapter is to review the literature studying the effects of eating disorders on collegiate and elite athletes. Eating disorders in athletes are prevalent and there have been many studies completed regarding the affect eating disorders have on the overall performance of an athlete, the many challenges they may face, and the need for coaches and leaders to encourage healthy eating habits and prevention. In particular, this synthesis will focus on what sport disciplines see a higher level of disordered eating, the effects it has on performance, the health challenges that these athletes may face, the prevalence of eating disorder pathology in males versus in females, predicting factors, and the education and prevention of eating disorders.

Often, collegiate and elite athletes are viewed as strong and invincible. What viewers do not see, or are not aware of is the overwhelming amount of eating disorders among college and elite athletes. This often affects the overall performance of the athlete in many ways. The first component of the affect of disordered eating on overall performance of these athletes is the different sport disciplines relation to eating disorder pathology.

Sport Disciplines Relation to Eating Disorder Pathology

Does the discipline that an athlete is competing in increase the likelihood of disordered eating? Giel, et al. (2016) completed a quantitative study with adolescent German elite athletes competing in the Winter Olympics of 2010 or the Summer Olympics of 2011. In the study of 1,843 eligible athletes from 51 sports disciplines, there was a 61.8% response rate. There were six different disciplines that they focused on; technical sports, endurance sports, aesthetic sports, weight dependent sports, ball games, and power sports. The athletes disclosed their Body Mass Index (BMI), completed the Frankfurt Body Concept Scales (FKKS), a Patient Health Questionnaire-4 (PHQ-4), the Structured Inventory for Anorexic and Bulimic Disorders (SIAB-

S), and the SCOFF, a “self -report screening instrument which assesses five core symptoms of eating disorders.” It was found that the athletes who compete in weight dependent sports may be at an elevated risk to show eating disorder pathology. This means that the athletes in the weight dependent sports discipline affirmed two or more SCOFF questions, showed a negative body concept on the FKKS subscale, and reported one or more weight control behaviors.

Similarly, Krentz & Warschburger (2013) researched aesthetic sports and their risk factors for eating disorders. This study involved 65 elite adolescent athletes with 38 female and 27 male athletes. A year-long longitudinal study was conducted to assess risk factors over time. In this qualitative study, athletes completed questionnaires at two different assessment points to help researchers determine if there were any risk factors relating to athletes performing in an aesthetic sport. The aesthetic sports that were studied included gymnastics, figure skating, diving, and ballet. Results from the questionnaires were assessed using the SPSS 17.0. Results showed that athletes in aesthetic sports are more at risk compared to other sports due to the historic thought of “thin is going to win”. Athletes in aesthetic sports are judged on appearance, which causes athletes to skew their body image and make drastic changes. The study showed that the desire to be leaner to improve performance was directly correlated with an increase in eating disorders.

Francisco, Narciso, & Alarcão (2013) studied parental influences on elite aesthetic athletes and its correlation to eating disorders or disordered eating. In this study, 85 elite aesthetic athletes were studied along with 142 controls, 223 mothers of athletes and 198 fathers of athletes. The two sports that the elite athletes participated in were gymnastics and dance and both male and female athletes were studied. In this qualitative study, athletes and controls completed questionnaires involving direct influences of their parents, perceived quality of their

relationship with each parent, their personal thoughts on their body image, and questions related to eating disorders or disordered eating. Parents also answered questions related to their own body image and eating habits associated with eating disorders or disordered eating.

Also, Kampouri, Kotopoulea-Nikolaïdi, Daskou, & Giannopoulou (2019) showed that eating disorders were more prevalent in certain sports compared to others. In this qualitative study there were 175 total female participants. 53 were elite basketball players, 42 elite volleyball players, 34 elite water polo players, and 46 non-athlete controls. Athletes completed an eating disorder questionnaire along with a physical activity questionnaire which were analyzed using the SPSS 17.0. Results showed that elite female athletes in team sports with a higher body weight and body mass index exhibited more disordered eating behavior when compared to the controls. Results also showed that water polo female athletes, which is considered a sport that has an “ideal” body type, were more likely to develop an eating disorder when compared to female athletes in basketball and volleyball.

Martinsen (2010) showed mixed results when examining leanness vs. non-leanness sports and the prevalence of eating disorders or disordered eating. In this study, 606 Norwegian elite athletes from 50 different sports, along with 355 controls were interviewed to determine if there were differences between leanness and non-leanness sports. In this qualitative study, participants completed a questionnaire regarding training patterns, menstrual status and history, dieting, and a drive for thinness. Results showed that a higher prevalence of the control group was classified with an eating disorder or disordered eating when compared to the elite athlete group, which is contrary to other results shown. The study showed that there were no differences in the prevalence of eating disorders between leanness and non-leanness sports. 79% of athletes were from intact families, while 11% were from single parent families. Results were analyzed using

the SPSS 18.0 and showed that direct parent influences were a significant family variable, and showed that the pressure to be thin from their parents and family was found within elite aesthetic athletes.

Predicting Factors

What are factors that help predict the onset of eating disorders or disordered eating in elite athletes? Arthur-Cameselle, et al. (2017) completed a study involving collegiate aged female athletes at the Division I & III level as well as a control group of female college aged non-athletes. Every participant in the study had previously met the criteria for anorexia nervosa, bulimia nervosa, or binge eating disorder that is presented by the *Diagnostic and Statistical Manual of Mental Disorders*. In the study, participants were involved in a 35-45 minute semi-structured interview where they answered questions related to factors believed to cause eating disorders. Results showed that there were a number of factors that led to these eating disorders or disordered eating habits. Low self-worth was present in 100% of the athletes who participated in the study, with poor body image being the primary reason for low self-worth. However, the study shows that the majority of the participants were never overweight before. One participant cited losing weight made them feel “superior and special” which led her to continue these behaviors. Other major factors in the study included changes in weight, pressure from peers, and performance pressure which were reasons they believed led to the start of their disordered eating habits.

Similarly, Mockdece Neves, Fernandes Filgueiras Meireles, Berbert de Carvalho, Sousa Almeida, & Caputo Ferreira (2016) completed a study involving factors related to the prevalence of eating disorders in elite artistic gymnastics. In the study, there were 413 male and female participants. The gymnasts were broken up into three groups; elite gymnasts, non-elite gymnasts,

and a control group of similar aged participants that were not involved in artistic gymnastics. In this mixed methods study, participants filled out multiple questionnaires related to their body and eating habits including: Body Shape Questionnaire, Sociocultural Attitudes Towards Appearance Questionnaire, Eating Attitudes Test, Multidimensional Perfectionism Scale, and Brunel Mood Scale. Participants also had their body mass index, weight, height, and skinfolds collected. Data was analyzed using the SPSS 19.0 software. Results showed that elite athletes had the highest perfectionism score, mood disorder score, eating disorder score, and recorded the lowest average body mass index scores when compared to non-elite athletes and the control group. The data also showed that 54% of elite athletes showed risk behaviors for eating disorders. In addition to this, results showed that the primary predicting factors for eating disorders were body dissatisfaction, media influence, perfectionism and mood states.

Health Challenges

What are different health challenges that arise from elite athletes with eating disorders or disordered eating? Giel, et al. (2016) states that an athlete's body is their vehicle to perform in sports. Nutrition and eating are a big part of this in regard to improvement of bodily functions. Rapid weight loss through the use of weight control behaviors, often dehydration methods in these athletes, has extensive consequences for performance in sports as well as physical and mental health.

Melin, Tornberg, Skouby, Møller, Sundgot, Faber, Sidemann, Aziz, & Sjödin (2015) examined energy availability in elite endurance female athletes. This mixed methods study examined 40 Danish and Swedish women who were elite endurance athletes. Participants in the study were examined in multiple ways; bone health, blood work, reproductive function, energy metabolism, aerobic capacity, and prevalence of eating disorders. Participants also completed

questionnaires related to energy intake and the amount of exercise they were performing on a daily basis during the completion of the study. Results showed that subjects with lower energy availability had a 22-33% lower energy intake when compared to groups of optimal energy availability. Less food intake resulted in lower energy availability, causing poor performance in the athletes. The study suggested that groups with high prevalence of eating disorders or disordered eating emphasize the importance of prevention, early detection, and early treatment.

Arthur-Cameselle, et al. (2017) showed that 58% of athletes in the study reported having depression, depression symptoms, or anxiety due to their respective sports and their thought that in order to be competitive, they needed to lose a certain amount of weight or look a certain way. Similarly, Giel, et al. (2016) states that depression and anxiety can be a direct result of higher levels of eating disorder pathology, especially in weight dependent sports. These mental health challenges were correlated with a decrease in physical performance in their respective sports.

Alternatively, Muia, Wright, Onywera, & Kuria (2016) approaches this topic through a different lens. Their study included athletes and non-athletes (the control group) with a median age of 16. These individuals were from four boarding schools and two secondary schools in Kenya. In order to qualify as an athlete, participants had to have competed at a regional or higher level in the previous year. Through a series of questionnaires, including a socio-demographic questionnaire focused on training hours, stress fractures, type of school attended, number of siblings, and parent education, they gathered information about their participants. They focused on menstrual patterns, disordered eating, body composition, and energy availability. It was found that energy availability and energy intake was much lower in athletes than non-athletes. In turn, exercise energy expenditure was higher. Low-energy availability was identified in 76% of participants. In addition, the average age of menarche for both athletes and non-athletes was

fourteen, but many more athletes reported clinical menstruation dysfunction than non-athletes. This was in the form of amenorrhea and secondary amenorrhea. Menstrual cycle changes during their competitive season were reported by 45% of athletes. It was found that although physical activity promotes good health and it is encouraged, “excessive physical activity without a concomitant increase in appropriate dietary intake is... associated with energy deficiency” (pg. 598). It was discussed that a possible contributing factor to low energy could be ignorance of athletes and parents regarding their energy needs or deliberative undereating to attain a lean physique. They state that a high percentage of the participants reported dietary restraint and a high drive for thinness. This is also associated with a disruption in menstrual function. To conclude, this group of adolescent athletes had concerning insufficient levels of energy intake and disordered eating.

Kampouri, et al. (2019) showed that athletes in water polo did not meet the energy requirement of their sport and showed negative energy balance. In such a physically demanding sport, an energy deficiency showed to decrease sports performance and cause athletes to increase fatigue levels and psychological stress.

Prevalence in Males versus Females

Are eating disorders more prevalent in male athletes or female athletes? Giel, et al. (2016) found results in their study of eating disorder pathology in elite adolescent athletes supporting a higher prevalence in female athletes than male athletes. In their study, one fifth of athletes were flagged as having a positive SCOFF screening result. They showed some or all of the five core symptoms of eating disorders. The question that was answered “yes” the most was “Would you say that food dominates your life?”. This positive screening rate that they found was

twice as high in females than male athletes. In addition, female athletes were identified as a higher risk group for constantly working to lose weight.

Arthur-Cameselle, et al. (2017) also supported the results that eating disorders in elite athletes is more prevalent in females than males. When comparing male and female athletes in the study, male athletes showed a significant decrease of eating disorders or disordered eating habits when compared to female athletes in the same study. Results showed that female athletes were more prone to social pressures of their performance environment than males studied in the same field. This showed a priority on the desire to be leaner to improve sports performance.

Similar to the previous studies conducted by Arthur-Cameselle, et al. (2017), Martinsen (2010) supported the idea that eating disorders are more prevalent in female elite athletes than male elite athletes. The results showed that female athletes were at a 5:1 ratio with their male athletes in the same sport discipline. When comparing the male and female athletes, female athletes cited improving their appearance as the primary reason for changing their eating habits while male athletes cited improved sport performance as the driving factor of changing their eating habits.

Francisco, et al. (2013) also agreed that eating disorders are more prevalent in female athletes. In the study, it was found that females reported a lower body mass index and showed higher levels of restraint and eating control when compared to male athletes in the same sport discipline.

The number of women participating in sports has increased drastically over the last few decades. Although sports and physical activity have many benefits for women, studies clearly indicate some harmful side effects. In Ponorac, Spremo, and Sobot's (2018) study there were two groups; the female athlete group and the control group. The athlete group was composed of 34

female athletes who competed in the ball game discipline, 27 female athletes who did athletics like running long and middle distances, and 23 females who engaged in sports dance. The control group was composed of female students at the Faculty of Medicine in Banjaluca who were of similar age, but did not participate in sports actively. They answered a questionnaire aimed at finding out the general health status and detecting risks for development of eating disorders. It was found that females who do athletics, and who participated in sports that use a ball, were more physically loaded weekly and therefore were more at risk of having “low energy availability”. In regard to eating disorders, one out of three female athletes from the sample were under pressure because of looks, body weight, or composition. Many of them reported restrictive diets and dissatisfaction with looks. As a result of this study, it was found that female elite athletes were under higher risk for the development of eating disorders compared to non-athletes when attitude toward looks and weight, use of weight loss producers and low BMI are taken into account as risk factors.

Education and Prevention

According to Giel, et al. (2016), the results of their study of adolescent elite athletes shows that individuals who work with athletes in weight dependent sports need to take steps toward prevention and management of eating disorders. Eating disorder pathology should not be accepted as an unproblematic and functional part of elite sports. There are many ways for coaches, teachers, and parents of these athletes, especially those participating in the disciplines more at risk of eating disorder pathology, to proactively work to prevent disordered eating in their athletes.

Arthur-Cameselle, et al. (2017) saw 41% of the athletes in their study claim one of the reasons they began their irregular eating habits was due to a lack of knowledge on how to have

healthy eating habits. Researchers suggested interventions with professionals to assist vulnerable athletes at risk for developing eating disorders. Prevention programs were also discussed as a way to customize a program to an athlete's unique and specific needs. Discussion at the end of the study also suggested that team-based programming be completed to address misinformation on eating habits. Additional training for the coaching staff and training staff was also recommended as a way to be a resource for athletes to maintain healthy eating habits.

Similarly, Martinsen (2010) suggested that preventative work be done to avoid the development of eating disorders or disordered eating in both athletes and non-athletes. It was shown that both male and female athletes experienced pressure to lose weight from their respective coaches.

Francisco, et al. (2013) showed that parental comments have an influence on eating disorders in athletes competing in aesthetic sports. A suggestion made by the researchers was to educate parents on ways to model proper eating habits and to avoid making comments or jokes about weight. Studies have shown that healthy food models predict healthy eating behaviors and by educating parents this will help athletes make proper food choices and avoid starting dangerous eating habits.

Muia, et al. (2016) recommends that coaches get educated on an athlete's energy needs in order to reduce the risk of deficiencies and associated health and performance consequences. Their study of the effects of disordered eating on energy levels and menstrual cycles shows that coaches and families need to stay informed.

Kampouri, et al. (2019) showed that 66% of participants that were elite athletes received some type of advice on nutrition and weight loss. The researchers suggested that coaches should

be educated on ways to present positive eating habits in their athletes and also to detect early eating disorder signs so that they are able to treat athletes.

Similarly, Mockdece Neves, et al. (2016) discussed how teachers and coaches need to think about ways to promote both the physical and mental well-being of their athletes. Areas that they suggested teachers and coaches become well versed in included maintaining a healthy weight, maintaining a positive body image and avoiding body dissatisfaction, and ways to promote positive moods. Nutritional guidance was also suggested to keep athletes on the right path.

Summary

Research has shown that many factors can lead to the development of eating disorders or disordered eating in elite athletes. When multiple factors are combined, it can lead to a dangerous combination for athletes to be at risk for developing an eating disorder or disordered eating habits. While athletes often associate lower weight with higher athletic performance, research has shown that this is not always the case.

An athlete's sports discipline has shown to be a determining factor of eating disorders. Elite athletes in aesthetic, endurance, or weight-dependent sports were shown to be at a higher risk than athletes participating in ball sports. Female elite athletes in these sports were also shown to be at a higher risk of developing eating disorders or disordered eating than their male counterparts.

Elite athletes who develop eating disorders or disordered eating habits have higher health risks compared with their peers who show healthy eating habits. When elite athletes are not consuming the proper nutrients, their body begins to break down which affects their overall

performance. In addition to performance, it can severely impact the female athlete triad and cause mental health challenges in both male and female athletes.

Education and prevention of eating disorders and disordered eating is vital for keeping elite athletes safe and healthy. Coaches need to be aware of risk behaviors shown by their athletes to keep them physically and mentally stable, which will help them compete at an elite level. Early treatment methods are also vital to keeping athletes who do go undetected safe from falling into an unsafe space physically and mentally.

While elite athletes are expected to compete and perform at a high level, it needs to be understood that doing so in an unhealthy manner can be detrimental to the athletes' life. Monitoring, evaluating, and coaching athletes is vital to keep them in a healthy headspace, as well as keeping their bodies in a state where they are receiving proper nutrition.

Chapter 4

Results, Discussion, and Recommendations for Future Research

The purpose of this chapter is to present the results of the review of literature on the effects of eating disorders on performance in elite and college athletes and how these results align with the proposed research questions which guided this synthesis project. In addition, recommendations for future research for addressing and preventing eating disorders are presented.

The review of the literature displayed consistent results on the impact of eating disorders on sports performance in elite athletes. Results concluded that athletes who have eating disorders or disordered eating display lower energy levels which directly correlated to decreased performance in their respective sports. Athletes also showed lower nutritional levels, increased fatigue levels, increased psychological stress, high dehydration levels, and increased mental health challenges. The overall health of the elite athletes was confirmed to be lower when experiencing an eating disorder or disordered eating.

The literature review also displayed a higher prevalence of eating disorders or disordered eating in elite female athletes when compared to elite male athletes. Aesthetic or weight dependent sports also showed the highest levels of eating disorders when compared to ball or power sports.

Discussion

Interpretations

As part of this literature review, several research questions were posed. The first research question was, do eating disorders or disordered eating affect the overall performance of an elite athlete? The results of the literature review showed that overall performance was decreased when

athletes showed eating disorders or disordered eating habits. Giel, et al. (2016) showed the athletes bodies need for nutrition to maintain healthy bodily functions and perform at a high level. Athletes who showed rapid weight loss through eating disorders did not show high performance. Melin, et al. (2015) also concluded that energy availability was vital to elite performance, especially in elite endurance sports. Arthur-Cameselle, et al. (2017) showed decreased sports performance through athletes believing the need to maintain a certain weight for their sport, which caused an increase in eating disorders and disordered eating. Muia, et al. (2016) also showed that athletes with a desire for thinness were more likely to develop an eating disorder, and all of those elite athletes showed insufficient levels of energy intake. Kampouri, et al. (2019) presented results which showed that elite water polo athletes with eating disorders had a negative energy balance, which led to decreased sports performance and caused athletes to have higher fatigue levels and an increase in psychological stress.

The second research question that was examined was, what challenges do elite athletes with eating disorders face? The results showed that elite athletes face a variety of challenges; including physical, mental, and emotional challenges. Arthur-Cameselle, et al. (2017) reported that 100% of their athletes with eating disorders reported low self-worth, while another majority reported outside pressures from peers to perform which was a driving force to continue these eating behaviors. On an emotional level, Giel, et al. (2016) showed that athletes with eating disorders showed higher levels of depression and anxiety. Elite athletes also showed damages to their physical health as well. According to Muia, et al. (2016), female elite athletes with eating disorders displayed higher levels of menstrual dysfunction when compared to non-athlete controls. Melin, et al. (2015) found that elite endurance athletes with eating disorders displayed a 22-33% lower energy availability when compared to their peer athletes without eating disorders.

This lower energy availability was associated with effects on bone health, blood work, and reproductive systems.

The final research question that was answered was how can coaches provide ways for athletes to maintain healthy eating habits? The results of this literature review showed that education is the best way to provide athletes with proper nutrition and ideas on how to maintain a healthy lifestyle while still competing at a high level. Giel, et al. (2016) presented the need for coaches, parents, and teachers to work together with athletes to proactively prevent eating disorders and educate athletes on proper nutrition. Arthur-Cameselle, et al. (2017) showed that 41% of athletes in their study claimed that one of the reasons they began irregular eating habits was due to the lack of knowledge of healthy eating habits. Customized nutrition programs were suggested for coaches to help keep their athletes on track. Similarly, Muia, et al. (2016) recommended that coaches become more educated on an athlete's energy needs to maintain energy levels and prevent health and performance consequences. In addition to education, positive comments, positive modeling, and positive relationships with athletes was also recommended. Mockdece Neves, et al. (2016) suggested that coaches should promote positive body image to avoid body dissatisfaction as well as finding ways to promote positive moods in athletes to help with both physical and mental well-being. Francisco, et al. (2013) showed how parental comments and modeling eating habits severely affects eating disorders of elite athletes and the food choices they make.

Implications

Previous research on eating disorders in elite athletes shows the affect eating disorders has on elite athletes with performance and with physical and mental health challenges. Many of the articles in this literature review show similar data and provide ways to prevent eating

disorders and educate athletes on proper nutrition. For example, research showed that eating disorders in elite athletes negatively affects sports performance for a variety of reasons, including energy deficiency, lower nutritional levels, increased fatigue levels, and mental and emotional health challenges. Coaches and support staff who educate themselves on this topic will be able to present athletes the information necessary to maintain healthy eating habits and keep their performance at a high level. Athletes who are able to recognize how these behaviors affect their performance could drive athletes away from the desire of being “thin to win”.

Important information that was also revealed in the literature review was the prevalence of eating disorders in female versus male elite athletes. Female elite athletes should be educated on the statistics that show female athletes are at a higher risk for developing an eating disorder or disordered eating habits. Coaches of these elite athletes should be educated on warning signs of eating disorders in these athletes, and monitor their dietary intakes and physical appearances.

Statistics showed that prevention and early intervention programs are the best ways to keep athletes physically, mentally, and emotionally safe. Athletes’ education on anorexia nervosa and bulimia nervosa proved vital in preventing dangerous eating disorder habits. One of the primary reasons that athletes cited developing an eating disorder was a lack of knowledge of proper nutrition and eating habits. Education and prevention is vital to keeping these athletes on track and maintaining a healthy lifestyle.

Understanding how to keep elite athletes safe and healthy is vital to the overall well-being of the athlete, as well as helping them perform at the highest level. A higher stress level should be placed on maintaining a healthy weight and intaking proper nutrition. With this focus, athletes should be in a better place physically, mentally, and emotionally.

Limitations & Recommendations for Future Research

In reviewing the data based on eating disorders in elite athletes, the following limitations were noted regarding the studies under review. The studies were limited to information that has been collected on eating disorders in elite or collegiate athletes, instead of the general athlete population. As more data comes available, being able to study non-elite athletes will be important to prevention and early treatment methods. Another limitation of the work previously displayed was the population of elite athletes. The overwhelming majority of research was completed on female elite athletes with little concrete data on male athletes that could be supported. Similar to the lack of information on male athletes, ball game sports were rarely studied regarding eating disorders, with the majority of information pertaining to aesthetic or weight dependent sports. Information on education techniques was also limited, with little trusted information of ways to educate athletes on eating disorders or disordered eating habits.

Based on these limitations, future research should consider the following recommendations:

1. Future research should continue to study how eating disorders affect performance in elite athletes physically, mentally, and emotionally to gain a better understanding of why proper eating habits are important.
2. Future research should be broadened into elite male athletes. The majority of the research found was on elite female athletes. A better understanding of how this affects males, or risk factors for males, will help future education.
3. Future research should be broadened into non-aesthetic or non-weight dependent sports.

The majority of research pertaining to eating disorders in elite athletes was related to

aesthetic or weight dependent sports and left out ball game or non-weight dependent sports.

4. Future research should look at education techniques for the prevention of eating disorders. While many articles recommended education of coaches and athletes, few articles discussed what that education entailed. Concrete examples will help with prevention.

Summary

The purpose of this literature review was to determine how eating disorders in elite or college athletes affected their performance. Delimiting variables were used to do an exhaustive data-based search which yielded 10 articles used in this review. These articles were systematically used to determine how eating disorders affected the performance of elite or college athletes.

Research revealed that there are numerous factors that can affect athlete performance, including energy deficiency, lower nutritional levels, increased fatigue levels, increased psychological stress, high dehydration levels, and increased mental health challenges. It is clear that stressing the importance of proper eating and general health habits to elite athletes will help them maintain a healthy lifestyle while also maintaining their elite performance levels. Education and prevention methods will be vital for coaches and training staffs to maintain a positive experience for their athletes. Further research and data collection over time will only help bring awareness of eating disorders and disordered eating in elite athletes. This information will help athletes and coaches have a positive experience in their sports while promoting healthy body images for the next generations to come.

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Appendix A

Author	Title	Source	Purpose	Methods & Procedures	Analyses	Findings	Discussion/ Recommendations Research Notes — Commonalities /Differences
Arthur-Cameselle, J., Sossin, K., & Quatromoni, P.	A qualitative analysis of factors related to eating disorder onset in female collegiate athletes and non-athletes	<i>Eating Disorders</i>	The purpose of this study was to find specific triggers for athletes compared to non-athletes who were experiencing eating disorders.	Qualitative methods. Each participant was interviewed for 35-45 minutes after passing the requirements to be a part of the study.	A critical realist epistemology was employed to help participants describe what they believe contributed to their E.Ds.	Results showed four categories that lead to eating disorders: psychological factors, physical and behavioral factors, relationship factors, and environmental factors.	Athlete specific treatment programs are recommended for athletes who are experiencing eating disorders or disordered eating. Athletes who are injured were also recommended to have additional screening. Non-athletes were recommended to attend family therapy and to talk about dysfunctional peer interactions.
Bunda, M-C., & Bratu, D.-E.	Eating disorders and performance sports*	<i>Romanian Journal of Cognitive-Behavioral Therapy & Hypnosis</i>	Discussed risk factors associated with eating disorders and how they can be	Meta-analysis	Reviewed literature on eating disorders in elite athletes.	A balance between training and proper eating habits is vital to keep athletes healthy.	Early treatment and detection is vital to keeping athletes safe.

			developed.				
Giel, K.E., Herman, W.A., Diehl, K., Schneider, S., Thiel, A., & Zipfel, S.	Eating disorder pathology in elite adolescent athletes	<i>International Journal of Eating Disorders</i>	The main purpose was to investigate potential vulnerabilities for eating disorder pathology in adolescent elite athletes.	Mixed-method design of both qualitative and quantitative methods.	Data was analyzed using SPSS 20. Continuous data (FKKS subscale score and PHQ score) was also used.	Results showed higher rates of eating disorder pathology in female athletes than males. Higher levels of depression and anxiety were showing in athletes with eating disorder pathology than those without.	Researchers suggested that individuals who work with athletes need to be aware of warning signs of eating disorder pathology. This is especially true in sports that are weight dependent. Steps like education and prevention were also recommended.
Krentz, E. M., & Warschburger, P.	A longitudinal investigation of sports-related risk factors for disordered eating in aesthetic	<i>Scandinavian Journal of Medicine & Science in Sports</i>	The main purpose of this study was to investigate risk factors for disordered eating in adolescent	1-year long longitudinal study with two assessment points.	SPSS 17.0 was used for analysis. A linear regression analysis was also used.	Results showed athletes in aesthetic sports were more at risk for eating disorders, while peer pressure was	Suggestions: Is the desire to be leaner to improve sports performance a risk factor for disordered eating? More studies with a longitudinal design were suggested.

	c sports.		ents in aesthetic sports.			more significant in female aesthetic sports compared to male aesthetic sports, as well as EDs.	
Martinsen, M.	Dieting to win or be thin? A study of dieting and disordered eating among elite adolescent athletes and non-athlete controls .	<i>British Journal of Sports Medicine</i>	The purpose was to study the prevalence of dieting and difference between elite athletes and non-athletes .	Qualitative study with a questionnaire as the source of data collection.	DT, BD, BMI, were all used to during data analysis .	Control subjects were classified with ED's compared to elite athletes based on the results of the study. No differences were found between leanesses and non-leanesses sports athletes.	Self-reported ED's were more reported by controls than adolescent elite athletes. Is this based on their own opinion of ED's?
Millar, S.	To be thin: disordered eating among	<i>Journal of Sport & Exercise Psychology</i>	To educate readers on previous	Meta-analysis	Reviewed previous studies	Drive for leanesses to win was driving	Continued research in the field was recommended to understand

	adolescent elite athletes and non-athletes.*		findings relating to eating disorders in elite athletes.		(analyses).	factor for athletes beginning eating disorders.	triggering behaviors.
Muia, E.N., Wright, H.H., Onywer a, V.O., & Kuria, E.N.	Adolescent elite Kenyan runners are at risk for energy deficiency, menstrual dysfunction and disordered eating.	<i>Journal of Sports Sciences</i>	The purpose of this study was to explore risk-factors associated with elite Kenyan runners.	Qualitative study. Athletes completed questionnaires and exercise logs to track energy levels and other health related factors.	Statistical Package for Social Sciences version 21 was used. EDI-3 bulimia and body dissatisfaction subscales were also used.	Athletes were shown to have a clinical low-energy availability. Daily energy intake for athletes was below recommended levels. Athletes showed menstrual dysfunction.	Due to limited resources, subclinical menstrual abnormalities were not measured and should be explored further.
Quatromoni, P.A.	A tale of two runners: a case report of athletes' experiences with	<i>Journal of the Academy of Nutrition and Dietetics</i>	The purpose of this article was to examine a case study of two collegiate	A case study of the process of collegiate athletes who struggled with eating disorders and how they compared to one another.	IBW, BMI were both used to determine if the athlete was considered to	Results showed that treatment and intervention can help athletes overcome	Authors stated a lack of material on male elite athletes with eating disorders and suggested more studies to be done in the future to have a

	eating disorders in college.*		athletes who experienced eating disorders while performing their sports in college.		have an eating disorder.	eating disorders and still be successful and participate in their sport.	better understanding.
Robin, H., Yannis, K., Erich, S., & Christiaan, C.M.	Eating disorders in male elite athletes.*	<i>Schweizerische Zeitschrift Für Sportmedizin & Sporttraumatologie</i>	The purpose of this article was to analyze prior research done relating to eating disorders in elite athletes.	Meta-analysis	Reviewed previous studies (analyses).	Results showed the primary factors found to develop eating disorders.	Authors recommended evidence-based approaches for the management of eating disorders.
Sundgot, B.J., & Torstveit, M.K.	Aspects of disordered eating continuum in elite high-intensity sports.*	<i>Scandinavian Journal of Medicine & Science in Sports</i>	The purpose of this article was to review studies that showed the effects of eating disorders of athletes.	Mixed study of qualitative and quantitative methods. Various studies were reviewed.	EDNO S, DSM-IV diagnostic.	Results showed up to 70% of elite athletes in weight class sports have abnormal eating behaviors to	Suggestions were that unnecessary dieting should be prevented and that staff and parents should recognize symptoms of eating disorders.

			in high-intensity sports.			reduce weight. Another study also showed that the prevalence in eating disorders was much higher among male and female athletes than the control group of non-athletes.	
Ponorac, N., Spremo, M., & Sobot, T.	Body composition, eating habits, and risk factors for the development of eating disorders in female elite athletes	<i>SportLogia</i>	The purpose of this study was to detect risks for the development of eating disorders by determining harmful eating habits and other risk factors.	Qualitative Participants were asked to fill out a questionnaire and were asked health related questions.	SPSS 20 was used to analyze data.	Results showed that elite female athletes are at a statistically higher risk of developing eating disorders.	While some athletes did show better physical abilities after drastically changing their weight, lower food intake eventually reduces physical ability. Early and quick treatment are recommended for risk control and prevention of eating disorders.

Melin, A., Tornberg, Å. B., Skouby, S., Møller, S. S., Sundgot, B. J., Faber, J., Sidelman, J. J., Aziz, M., & Sjödin, A.	Energy availability and the female athlete triad in elite endurance athletes	<i>Scandinavian Journal of Medicine & Science in Sports</i>	The purpose of this article was to investigate the potential effects of eating disorders on reproductive function and energy metabolism in elite female endurance athletes.	Mixed methods- quantitative as the researchers collected blood pressure, pregnancy test, hormones, etc. Qualitative as athletes filled out a survey with questions related to eating behaviors.	Polar RS400 to monitor heart rate, VO2 max, and respiratory exchange ratio.	No causative effect between low or reduced energy availability on metabolic adaptations or endocrine alterations.	An expanded assessment was suggested to improve further research. Early prevention and detection were suggested to prevent and treat energy deficiency.
Francisco, R., Narciso, I., & Alarcão, M.	Parental influences on elite aesthetic athletes' body image dissatisfaction and disordered eating	<i>Journal of Child & Family Studies</i>	To investigate family-oriented predictors of body image dissatisfaction and disordered eating habits.	Qualitative, athletes completed a MRFS-IV self-report questionnaire.	Analysis was performed by using the SPSS 18.0	No differences in male athletes, while female athletes show lower BMI and higher levels of constraint and eating concerns.	A suggestion made by researchers was that "future studies should be conducted to clarify whether there are significant differences between parents of elite aesthetic athletes and those of adolescents in general."

Kampouri, D., Kotopoulou-Nikolaidi, M., Daskou, S., & Giannopoulou, I.	Prevalence of disordered eating in elite female athletes in team sports in Greece	<i>European Journal of Sport Science</i>	The purpose of this study was to investigate the prevalence of disordered eating in elite female team sports compared to non-athletes.	Qualitative, participants were given questionnaires to complete.	Data was analyzed using the SPSS 17.0.	Female athletes participating in team sports showed similar behaviors of DE and ED that female athletes displayed in individual sports.	It was suggested that coaches need to be aware of these problems and educate themselves on ways to prevent and treat these issues. It was also suggested that future research be done to further investigate prevalence of DE and ED in male and female team sport players to see how competition level affects eating behavior and food consumption.
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Mockdece Neves, C., Fernandes Filgueiras Meireles, J., Berbert de Carvalho, P. H., Sousa Almeida, S., & Caputo Ferreira, M. E.	Body dissatisfaction among artistic gymnastics adolescent athletes and non-athletes	<i>Brazilian Journal of Kinesiology & Human Performance</i>	The purpose of this study was to examine the risk factors associated with developing eating disorders in artistic gymnasts.	Mixed methods- Questionnaires were used to collect body image satisfaction/dissatisfaction while BMI, and BF% were collected.	SPSS 19.0 software was used to collect and analyze data.	Risk factors that led to body dissatisfaction in artistic gymnasts included ideal body search, media influence, and mood status.	It was discussed how the opinions of coaches and teachers are critical to the body image perceptions of their athletes. It was recommended that coaches become more educated in education and prevention techniques for the safety of their athletes.
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*- denotes articles used in the synthesis but not part of the 10 articles analyzed (background information)