

**The Female Athlete Triad: Understanding the Why and How**

Haley Chaney

Department of Kinesiology, Recreation, and Sport- Indiana State University

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Matt Bird

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### **Abstract**

The Female Athlete Triad consists of 3 disorders that do not necessarily have to happen in a specific order. The 3 disorders that form the Female Athlete Triad are amenorrhea, eating disorder (which coincides with low energy levels), and/or bone mineral density (osteoporosis). An athlete will most likely experience these disorders in a “slippery slope” metaphor, if you will, which we will dive deeper into later in this paper.

## Introduction

Disordered eating is the culprit to which the Female Athlete Triad stems from. An eating disorder can be brought on due to weight specifications in certain sports. Weight status can be seen in sports, such as wrestling, gymnastics, dancing, cheerleading, football, etc. This is because athletes are expected to look a certain way so they can perform to the best of their ability within their sport. While this style of coaching can be done very well, it can also lead to extreme physiological and psychological stress on their athletes. For female athletes, this can really take a toll on their body image. When researching the Female Athlete Triad, you will most of the time see “low energy levels” as one of the characteristics of this triad; however, the low energy levels stem from disordered or insufficient eating. An eating disorder could be intentional or unintentional depending on the scenario in which the athlete is placed in. Once an eating disorder is developed, more symptoms will begin to surface. If the body has not taken in enough nutrients, specifically carbohydrates, the body will begin recruiting other macronutrients to burn for energy. On an elite level athlete status, if they are not consuming enough carbohydrates, or nutrients in general, their carbohydrate expenditure will exceed their consumption levels leading to too little to no energy left to spend on activity (Raj, 2023).

Bone mineral density disorder or osteoporosis is seen shortly after an athlete has deprived the body of the sufficient nutrients it needs to perform. Referring to above text, when one component begins the others begin surfacing not too long after. An athlete’s bone mineral density will be affected by insufficient nutrients being consumed (eating disorder). Female athletes’ bodies can perform and stay functioning at low estrogen levels, and estrogen has the job of working with osteoblasts which work to form new bone. When levels of estrogen are too low, this task is not carried out appropriately leading to no new bone being constructed. According to

an article published by the National Library of Medicine, “Athletes should have a 5% to 15% higher bone mineral density than age-matched nonathlete.” Athletes will run the risk of injury due to their bones being so fragile (Raj, 2023).

The third component of the Female Athlete Triad is amenorrhea which is the absence of or the late onset of the first menstrual cycle due to an inconsistency in energy levels within the body. An absence or late first menstrual cycle means that the female body has not undergone puberty. According to the article “Female Athlete Triad: Causes and Symptoms, the female body experiences a lot during puberty that prepares them to be an adult woman, and if the body has not gone through this process by a projected age, the female body could be at risk for underlying issues. Relatively speaking, there are different levels to the menstrual dysfunction seen in the triad. A female could be experiencing just amenorrhea, oligomenorrhea which is a cycle that appears every 35 or more days, or secondary amenorrhea which is the halt of the menstrual cycle for 3 months in a row. Any of these levels of menstrual dysfunction can categorize a female athlete as having a characteristic of the triad. Menstrual dysfunctions can become apparent as little as 5 days into a female not taking in the right amount of nutrients and hitting an energy deficit (Mehta, 2018).

The only true unknown for this triad is how to screen for it or to be aware of it from a physician, coach or even parents’ point of view. Also, a common unknown factor for many disorders is what the long-term effect will have on the body. The triad can broadly affect many systems within the body. Something to note, is that something like the triad can appear in men which is known as REDS (relative energy deficiency in sport); however, male athletes will not experience the menstrual issues like female athletes will. There has since been a question set made up to help screen female athletes for signs of the triad. The results have very little record or

statistics on if the early detection question set helps to prevent or diagnose female athletes.

According to a group of medical doctors who published the article “The Female Athlete Triad: It Takes a Team.” In 2015 only 37% of physicians were aware of the Female Athlete Triad. This number was based off almost 1000 primary care physicians in the United States.

In 1992, the Female Athlete Triad was deemed a true medical disorder and something that would soon be advocated for. However, at the time the definition alluded that all three characteristics (disordered eating, amenorrhea, and bone mineral density disorder), were needed to be a full diagnostic of the Female Athletic Triad. That was then changed in 2007 when it was clarified that a female athlete experiencing any of these characteristics was deemed a valid diagnostic for the Female Athlete Triad (Mehta, 2018).

As mentioned above, screening questions have become the most effective way to test a female athlete for the triad. Just like the triad itself, the screening questions cover three components, the athlete’s nutritional status, menstrual, and bone health. This being the easiest and most effective way to test the individual for specific issues. The questions are very simple, resembling ones that you would be asked by a primary care physician. Simpler questions lead to more discussion and clearer observations to be had by the one asking the questions. Something to note is that the Female Athlete Triad is not required to be screened for by any branch of medicine, education or athletics. However, when screening for this disorder, a diverse group of people are needed to make the final diagnosis (Mehta, 2018).

Early detection and early intervention are essential for the female athlete’s life and athletic performance. For her to continue in her sport, her health needs to be taken seriously and acted upon when diagnosed with the Female Athlete Triad. For the intervention to be successful, the athlete needs to be willing to allow a diverse team of physicians and her coaches to help her.

The healing process should include goals set by the athlete herself and the team helping her. If a pharmaceutical route needs to be established, there are medications that can be prescribed to help speed up the process of rehabilitation. Researchers have concluded that once the athlete increases her food intake and begins taking her nutritional status seriously, the other components will begin to subside (Mehta, 2018). According to an article published by South Dakota State Medical Association, “The Female Athlete Triad- What is it and Why it is Important in Primary Care”, the main take away of the effects of the Female Athlete Triad is that the amount of exercise female athletes is enduring is burning more calories than what the athlete is consuming. With this consumption and expenditure difference, the symptoms of an eating disorder begin to surface leading to menstrual cycle dysfunctions which then lead to bone mineral deficiencies. All three of these characteristics of the Female Athlete Triad branch off into their categories ranging from a variety of different health concerns and expanding from each other. It is recommended that female athletes be screened annually to account for these symptoms as they are not always on the surface and can later be identified with an intervention or panel of questions. When an athlete is beginning to show one characteristic of the Triad, it is only appropriate that they be screened for others as well. Those athletes suffering from the Female Athlete Triad could likely cause irreversible damage to their body if the symptoms being increasingly more severe and are not cared for in the appropriate manner. The biggest concern is infertility and bone mineral density never being able to be strengthened (Inman, 2021).

Female athletics comes with hardships just like male athletics; however, the female body experiences many more challenges with intense sport performance and training. Once one habit has been formed, a slippery slope of health issues begins to pile up. While the Female Athlete Triad is not well-known or well- researched, there is enough information for those involved in a

female athlete's life to help prevent her from experiencing this lifestyle. Women should be able to enjoy their sports without such extreme health risks that can lead to more serious health issues later in life.

For the entirety of this paper, I will delve deep into the severity of the Female Athlete Triad while also researching how coaches can do a better job of noticing signs of an eating disorder in their athletes. Also looking at what level of athletics the triad is most common in female athletes. Slightly mentioned above was the medication route for rehabilitation, but I will conduct further research to see what the results of pharmaceutical rehabilitation are. Lastly, looking into popular sports that females are seen suffering the most from the Female Athlete Triad.

### **The Severity of the Triad and It's Causes**

As mentioned above, the Female Athlete Triad is an eating disorder, menstrual dysfunction, and osteoporosis. We can infer that this is the order or the "slippery slope" this triad falls under because once an eating disorder has been established, the body will become malnourished. Thus, leading to malnutrition throughout the entire body which means the body's systems and bones will begin to be harmed and damaged. Without proper nutrition and lack of proper nutrition intake, the female body's menstrual cycle will become highly affected. More times than not, these signs and symptoms go completely unrecognized by coaches and the athletes themselves. Female athletes run the risk of never being able to regain their bone mineral density once it has been lost (Hobart, 2000).

The severity of this Triad can lead to several chronic and life-threatening illnesses. Beginning with the many different types, stages, and outcomes of eating disorders. Some athletes

may not completely fit the diagnosis of Anorexia Nervosa or Bulimia Nervosa, but they can still be diagnosed with an unspecified eating disorder. Signs of Anorexia Nervosa include, the athlete has refused to maintain a certain/healthy body weight, increasing and extreme fear of gaining any weight, body dysmorphia, and not recognizing the body's current low body weight is an issue. The last sign of Anorexia Nervosa is amenorrhea which we know is already a sign of the Female Athlete Triad. The declaration of amenorrhea is the disappearance of 3 menstrual cycles. Bulimia Nervosa is the reoccurring of binge eating episodes. Binge eating can be seen as eating a large portion of food in a small window of time, lacking control during the episode, no feeling of being full, self-induced vomiting to compensate for large portion of food being eaten, abusing laxatives or diuretics, compensatory behaviors happening twice a week for three months, and body dysmorphia (Hobart, 2000).

As for the bone mineral density complications, it is very important to screen female athletes for possible loss in bone mineral density. As mentioned above, the loss can be irreversible and cause more health issues after the female has undergone menopause. After menopause women have been known to lose a large amount of their bone density, so therefore, if they have lost bone mineral density prior to menopause, the loss afterwards can be crucial to their health. At one time, researchers thought that peak bone mass occurred later in a female's life, but now it has been shown that it occurs earlier in life around the ages of 18-25 years old. This meaning a female struggling with menstruation earlier in life needs to be cared for sooner rather than later because the range of time between menstruation and menopause is quite a long time to be losing bone mineral density (Hobart, 2000).

Energy deficiency is used to describe "the energy status at which compensatory metabolic adaptations, such as suppression of resting metabolic rate, loss of body weight, or



suppression of metabolic hormones have occurred (De Souza, 2022).” When our bodies are not receiving the proper nutrients, our bones and muscles have a shunted growth. Nutrients are needed to help grow muscles and keep bones healthy for the body to be properly supported. Another area that will begin to shut down is a different energy system of the body when the body is not being nutritionally taken care of. Within different energy systems of the body, there are jobs that are carried out such as the growing of muscles and the formation of bones to stay strong and healthy. As continues to be mentioned, when proper nutrients are not being consumed and the body is not being cared for in the proper way, those energy systems cannot do their jobs. This results in decreased rates of bone formation. That negative effect on the body through energy systems has a direct relationship whereas an indirect relationship would be affecting one’s reproductive system by shutting down the production of estrogen. When the female body cannot produce enough estrogen, this leads to issues with the menstrual cycle. Energy deficiencies are seen alongside menstrual cycle issues and lead to extreme affects on the female body’s bone structure and formation (De Souza, 2022).

As for the severity of eating disorders, female athletes are commonly seen restricting themselves from their regular or healthy eating habits to maintain a certain body type for their respective sport. Most of the time eating disorders are seen in female athletes due to the type of sport they are active in and what the desired body type is for that sport. These actions are commonly seen in elite level sports (Borowiec, 2023). A recent study discovered that out of 1000 female athletes, almost half of them recorded high scores on an eating disorder survey (Borja, 2021). The largest component to female athletes acquiring eating disorders is based on their daily energy expenditure being more than their daily caloric intake. This stems from multiple, long practices a day to be a successful athlete and team. Research used to show that eating disorders

were only seen in female athletes who took part in lean sports. Meaning that the activities at hand were ones such as endurance, power, weight-dependent, and aesthetic, so therefore athletes were training certain ways that resulted in their body's becoming leaner with this training. Also, female athletes feel that if they appear to look a certain way that means they can perform better and be more successful but that is not always the case when the body image has been achieved in an unhealthy manner. However, research has debunked the theory that eating disorders are only seen in lean sports when they in fact are seen in non-lean sports as well (Borowiec, 2023).

Continuing with the discussion of eating disorders, as they are the biggest culprit and start of the triad, it can be inferred from research that female athletes who partake in aesthetic sports record higher chances of developing and suffering from an eating disorder. The significance in lean sports and female athletes is the factor of body dissatisfaction or suffering with body dysmorphia towards oneself. Most athletes showed lower chances of eating disorders when participating in non-lean sports due to the aesthetically pleasing body image not being considered in those sports (Chapa, 2022). Later I will discuss the difference in aesthetic/lean and nonaesthetic/non-lean sports. In a recent study conducted in 2021, 481 female athletes were assigned to three different groups to analyze the pathology of their eating disorder. The three groups consisted of a controlled group, eating disorder risk factors in the behavioral sense, and a function-based intervention setting. This study was done over the course of 18 months to see the primary analyses of the effects of an eating disorder on female athletes. Risk factors including body dysmorphia, BMI, Female Athlete Triad, and depression. These risk factors were considered with a secondary analysis. This study showed that those who were assigned to the function-based intervention group improved their BMI within the 18 months study and no longer

had the ideals of a thinner appearance (body dysmorphia) (Stewart, 2019). I will later dive deeper into the rehabilitative ways to treat certain aspects of the Female Athlete Triad.

Sadly, little research has been done to exactly pinpoint what injuries are caused by eating disorders or disordered eating (meaning one does not fall under the diagnosis of an exact type of eating disorder). What researchers do know is that bone stress injuries occur due to eating disorders or disordered eating. Also, finding that females who run cross country showed a greater risk of stress fractures than males who run cross country and have a diagnosed eating disorder or disordered eating. Research can support the idea that female athletes of multiple sports are at risk of bone stress injuries due to complications with their food intake (Hamstra-Wright, 2023).

### **Coaches Knowledge and Detection**

Looking at what coaches can do to detect Female Athlete Triad signs in their female athletes. A study was conducted amongst 227 high school coaches to gather data regarding a gender difference between coaches and their knowledge on the Female Athlete Triad. The data resulted in a major difference between male and female coaches and their knowledge and communication about the complications that a female athlete's body can endure. The solution to this issue was to put in place certain school and district policies to help increase the knowledge and better inform both genders on the different prevention and detection skills they can implement in their coaching (Kroshus, 2014). In a larger cross-sectional study, containing 240 high school female athletes and 10 coaches, they were surveyed on their overall knowledge of all aspects of the Female Athlete Triad. From the athletic portion of the survey, half reported menstrual cycle irregularity, 101 athletes from the survey met the requirements for 2 or more of the Triad factors, 53 athletes reported low caloric intake, and 10 were in the 5<sup>th</sup> percentile for BMI underweight just to list a few statistics. The saddest statistics from this study, in my opinion,

are that more than 50% (143/240) female athletes reported that they felt pressured to be a certain weight for their sport, and that 34 female athletes reported that they wanted to lose 10 pounds or more even when they were at a healthy weight. A positive statistic to take away from this study, is that 90% of coaches stated that they would feel comfortable in having conversations with their female athletes about their menstrual cycle. They also stated that time, knowledge, and resources were why they were not performing adequate screening on their female athletes. Overall, Female Athlete Triad knowledge amongst coaches was ranked low while the signs and symptoms reported by their athletes were high (Brown, 2014). From these findings we can infer that high school female athletes are at risk for suffering from the Triad due to the lack of knowledge about it, and their coaches not initiating the help because they are also lacking education and knowledge on this topic.

In another study involving high school coaches, it was inferred by those conducting the study that female high school athletes are very much at risk for developing the Triad. It is believed that their coaches should be the moving factor in identifying and educating their female athletes on this topic and aiding those who are struggling. Coaches of all levels should be more informed on the Female Athlete Triad so they can be that bridge between their athlete and their athlete's health and safety. Statistically, this study showed that only 14% of those respondents were able to name all factors of the Triad (Pantano, 2009).

Now looking at a higher level of female athletics, the NCAA division of college sports. In this study there were 4 categories of sports, subjective scoring of performance, low body weight, tight fitting clothing, and others. Gymnastics and diving were considered subjective scoring on performance sports. Cross-country and rowing were low body weight sports. Tight fitting clothing sports were swimming and volleyball. Lastly, soccer and basketball were in the other

category. Results from this study were based on the coach's knowledge of the Triad and the three factors it consists of, their confidence in discussing the signs and symptoms with their athletes, and the characteristics of all the coaches were also considered. Shockingly, coaches of low body weight sports scored higher than coaches of volleyball, swimming, basketball, and soccer. These coaches also displayed higher levels of confidence when answering these questions. With this information, many are hopeful that continuing education courses will be helpful in further instruction and knowledge on the Female Athlete Triad (Frideres, 2016).

When discussing steps that coaches can take to help prevent, detect, and acknowledge Triad factors in their female athletes, it is shown that basic knowledge about the Triad is much needed. Two factors stand in the way of coaches and their actions toward athletes who might possibly have an eating disorder. The first factor being the knowledge to simply recognize the signs and symptoms of an eating disorder, and the second being knowledge on what treatments to suggest helping their athlete. This study focused specifically on track coaches and their level of experience, workload, and mental health literacy. In simple terms, mental health literacy is how people view and understand those with mental health struggles. However, there was no direct answer on if mental health literacy was a prime component of coaches and their acknowledgement of eating disorders in athletes and how to address them. The gender of which the athletes being recognized for eating disorders was taken into consideration. Considering that male athletes most of the time go undiagnosed from an eating disorder unlike females who are easier to recognize and diagnose. So therefore, gender in athletes was looked at when considering what treatment route and coach initiation would look like when an athlete is showing signs of an eating disorder (Macpherson, 2022).

A study conducted looked at both males and females in a lab setting. The males were set-up to show signs of RED-S, relative energy deficiency in sport, the male version of the Female Athlete Triad, and of course, the females were showing signs and symptoms of the Triad. This study was designed to showcase the knowledge between coaches and non-coaches to test their knowledge in detecting these disorders in athletes of both genders; however, for the sake of this paper, I will only be informing about the results corresponding with female athletes. The subjects (coaches and non-coaches) were given scenarios with bare minimum information on the athletes. The female athletes' information read that they restricted their eating during intense workouts and high loads of training, felt pain in their foot, and had not had a menstrual cycle in almost 6 months. It can be inferred that the restricted eating while having intense training is a sign of an eating disorder. The foot pain is depicting a bone injury due to decreased bone mineral density, and menstrual cycle issues were existent. Subjects across the board were able to identify that these were all negative signs to see in an athlete and should be taken care of at another level of medical care (Macpherson, 2022).

Lastly, to defend the idea that coaches need to be better educated on the Female Athlete Triad, this is the final research study containing 106 coaches from Singapore. Considered was the coaches demographic, knowledge level, awareness level, gender difference between knowledge and awareness of the Triad, and coaching qualifications. The data collected showed that 85% of these coaches had never even heard of the Female Athlete Triad. Also, 89% of respondents could not recognize 1 factor of the Triad. Sadly, this study showed that only 2 coaches were able to identify 2 out of 3 factors of the Triad. A common finding amongst all coaches, both male and female, is that their knowledge around female athlete struggles such as

menstrual cycle irregularity, unexplained leanness, bone mineral density issues, and low body fat percentage was very low (Mukherjee, 2016).

In summation, regarding coaches' knowledge on the Female Athlete Triad, across the boards and throughout many studies is recording extremely low. Commonly and shockingly multiple studies showed that both male and female coaches had low knowledge and awareness levels about the Triad; therefore, being unable to detect or address their findings with their athletes. The common consensus from all the studies listed above were that coaches should have continued education courses revolving around the Female Athlete Triad. If they can detect and help their athletes receive help sooner rather than later, they could be the difference in their female athletes' lives.

### **Level of Sport That the Triad is Most Commonly Seen In**

The bulk of this paper so far has explained in depth the effect eating disorders have on female athletes in sports but mainly focusing on sports that put such an emphasis on the appearance of their bodies. Considering that the eating disorder/disordered eating factor is normally the first step in developing the other 2 factors of the Triad, I will once again be explaining and researching just what level of sport is the most common for the Triad to be seen in.

Elite level sports are where the Female Athlete Triad is seen the most in female athletes. Eating disorders are so prevalent in this level of sport because females feel the need to make their appearance "picture perfect" to "fit the image" that they believe the sport has. Also, feeling the need to look a certain way because they believe that will improve their performance. Another reason body image is brought into play is from the intense training sessions these athletes are

partaking in and the limited number of calories they are consuming a day. Briefly mentioned above were sports that call for a thin appearance are the root of eating disorder behavior in most female athletes (Torstveit, 2005). These sports are most of the time in the aesthetic/lean sport category which I will dive deeper into later in this paper.

Sports that require weight-limits to compete in certain events or be certain positions on the team can cause eating disorders/disordered eating habits to begin. Just like above where I discussed how coaches can help detect and prevent these symptoms, coaches need to always keep in mind that an eating disorder is possible due to the sport they are coaching and how they are coaching their female athletes. Coaches of sports that fall into the aesthetic/lean category should be able to be open to the conversation of eating disorders and how they can help their athletes break these habits and receive treatment/help for them. Eating disorders in this situation can be prevented by the athlete developing a healthy relationship with food (Torstveit, 2005).

Some would argue that college level is elite level. For the sake of this paper, they are going to be ranked the same in level of intensity. Exercise dependence is a highly addictive behavior for athletes who are wanting to look certain ways physically. With this, they are constantly exercising to achieve their desired look; however, this habit can cause extreme stress to the body in physical and mental ways. Competitive sports put athletes at such high risk for this behavior to begin happening. A study was conducted and published in the *Journal of Athletic Training*. In this study, athletes from both sex and various different sports were used. These athletes were Division I or Division II athletes. They were surveyed in areas of exercise dependence level, their relationship with food, and behaviors. Once again, females were the highest in being at-risk for an eating disorder/disordered eating. According to the conclusions of



this data, excessive exercise or someone who is exercise dependent is at a higher risk of developing an eating disorder/disordered eating to achieve their perfect body (Uriegas, 2023).

A study conducted over 7 different universities containing 425 female athletes at the collegiate level. The study used 4 different tests to see the severity of the 3 factors of the Female Athlete Triad in those who participated. Athletes who had been clinically diagnosed with Anorexia Nervosa was 3.3%, and those clinically diagnosed with Bulimia Nervosa was 2.3%. However, there were athletes who were showing signs of disordered eating but were not clinically diagnosed. That data recorded 2 sets of data from 2 different tests. One test recording 15.2% and the other recording 32.4% of athletes being at-risk for an eating disorder and showing signs of disordered eating. 31% of the female athletes reported menstrual dysfunction. Of those 31%, they were not using oral contraceptives, i.e. birth control. Injuries brought on by bone mineral density issues were reported by 65.9% of respondents. Lastly, this study showed that those female athletes who were at-risk for an eating disorder reported higher numbers of menstrual dysfunction and more injuries from poor bone mineral density. Once again showing how important it is for early detection of eating disorders/disordered eating to prevent female athletes from experiencing harsher health issues and not being able to compete in their respective sport (Beals, 2002).

Another study collected data for self-reported eating disorders/disordered eating, menstrual irregularities, and injuries. The study was conducted using only female athlete participants ranging from elite to non-elite, non-lean and lean sports, and two different age groups (15-24 and 25-45). This data was collected using an online survey. 846 female athletes took part in the study, and they represented 67 different sports. 25% reported restrictive eating. 18% reported eating disorder/disordered eating behavior and habits. Lastly 32% reported

menstrual irregularities. Majority of these numbers came from lean sport female athletes but did not matter between elite and non-elite level. However, the younger group reported more menstrual irregularities than the older group. Those who reported having an eating disorder/disordered eating associated those habits with past injuries. Interestingly, female athletes reported that menstrual irregularities caused them to miss training days (Ravi, 2021).

As I continue to make this point, female athletes who have developed eating disorders/disordered eating are more at risk to cause more issues within their health. Athletes with eating disorders/disordered eating are more likely to be injured than those athletes who consume the proper nutrients that coincide with their energy expenditure (Ravi, 2021). Athletes who can detect and recognize eating disorder/disordered eating habits are able to break the habit and seek help over those who continue to partake in the unhealthy habits. With continuing these behaviors, female athletes run the risk of being taken out of their sport completely due to the issues escalating so badly past the point that injury is too great a risk or they have caused irreversible damage to their bodies. Female athletes that are in sync with their bodies are better off than female athletes who are unable to identify that they have developed unhealthy habits that are beginning to be too intense and debilitating (Ravi, 2021).

### **Rehabilitation Methods**

There are many different forms of rehabilitation for the Female Athlete Triad. Screening questionnaires to develop an idea of the severity of the Triad factors the athlete is experiencing, nutritional aspect, and physical aspect. Some research has stated that a plant-based diet could be a fix for those experiencing an eating disorder/disordered eating; however, other research has compared eating disorders/disordered eating to a plant-based diet considering there is restriction in both. An article written by Rachel Hunter et. Al with Swansea University School of

Psychology and Bath University Department of Psychology, that the research stating the comparison between the two factors is very inconsistent. Those who partake in a plant-based diet do so for weight control while still consuming the proper nutrients, and they also use this diet if there is an intolerance or sensitivity to certain foods. Plant-based diets have been proven to help individuals form better relationships with food and their consumption of certain foods. Athletes who choose a plant-based diet can keep their thin appearance while still getting the proper nutrients their body needs. Plant-based diets are normally lower in calories and saturated fats than what a normal carnivorous diet. Another perk for athletes who have developed eating disorders/disordered eating to take on a plant-based diet, is that the portions are small. We can infer that these athletes have been consuming small portions during their eating disorder/disordered eating phase, so the plant-based diet would not make them feel as if they are consuming larger portions. This can help the mental aspect of rehabilitating these athletes who are struggling with an eating disorder/disordered eating (Hunter, 2024).

A study was conducted where 3 pathways were given towards 3 different groups of participants who struggled with an eating disorder/disordered eating. The 3 pathways included a plant-based diet as the start into recovery, changing how food being consumed is valued by the subject, and how the subjects can gain control with their eating. Those in the first group liked the motivation they developed once gradually changing to a plant-based diet to help them recover from their eating disorder/disordered eating. They also felt that they had more control over their eating disorder/disordered eating. The second group saw improvement in the relationship between their body and the food they were consuming. Some also reported that once plant-based eating turned to lifestyle there was improvement in their self-esteem. The third group had developed a positive mindset with how they mentally interpreted the food they were eating.

Subjects recorded that they felt more like themselves once they improved the relationship between their food consumption and their own body (Hunter, 2024). From this study, we can infer that athletes who are suffering from any eating disorder/disordered eating could change to a plant-based diet to reconnect with their bodies and gradually recover from their eating disorder/disordered eating.

A survey was taken in 2018 at the National Eating Disorder Awareness Week. 14.7% of the respondents were competitive athletes. 90% of the respondents were females between the ages of 13-24 years old. 86% had an eating disorder/disordered eating while only 2.5% were seeking help and treatment. Half of the responses mentioned suicidal thoughts or actions due to their eating disorder/disordered eating. With this information, it was stated that the best route for treatment and recovery was for these athletes that are experiencing eating disorders/disordered eating, and suicidal intentions should seek help from a mental health professional (Flatt, 2021).

Even though the first two forms of rehabilitation were for eating disorders/disordered eating, there are treatment options for menstrual irregularity. This study was conducted in 2017 with the objective of proving that Traditional Persian Medicine (TPM), which is ancient medicine, and Conventional Medicine, which is a modern and current form of medicine, are forms of medicine that can combine to help with oligomenorrhea and amenorrhea. This study took a deeper dive into herbal medicines and their treatment for those suffering from menstrual irregularities. At the conclusion of this study, it was found that herbal plants did indeed help in the treatment of oligomenorrhea and amenorrhea; however, there is still quite a bit of research to be conducted on this topic, but for the time being herbal medicine is a way to treatment these irregularities (Moini, 2018).

As majority of this paper has discussed eating disorders/disordered eating for the reason being it is the main factor and characteristic of the Female Athlete Triad. Also, knowing that eating disorders/disordered eating brings on menstrual irregularities. An assumption can be made that if eating disorders/disordered eating and menstrual irregularities are treated quickly and effectively, the Triad can be avoided. Discussed above were three options of possible treatments for female athletes who are experiencing 2 of the Triad factors. Plant-based diets, mental health professionals, and herbal medicine are options of treatment/rehabilitation for the Female Athlete Triad that have research behind them for them to be deemed reliable and trustworthy to use.

### **Common Sports Where Female Athletes Experience the Triad**

Throughout this paper, I have mentioned lean and non-lean sports and aesthetic and non-aesthetic sports. In this section, I will delve deeper into this topic of what sports the Female Athlete Triad is most seen in and what sports are known for causing the Triad amongst female athletes. The first sport to be discussed is gymnastics, which is an aesthetic and lean sport. This means that the athletes' physique is taken into consideration when performing in front of a crowd and their physique will play a role in how well they perform. As for the aesthetic aspect, people identify gymnast as being thin and lean-muscular athletes, and not so much larger with un-toned bodies.

A study published in the Clinical Journal of Sports Medicine with survey answers from 470 former collegiate gymnasts, reported that a great number of former gymnasts who had an eating disorder/disordered eating during their athletic career suffered from time-loss injuries in college. However, these injuries were typically non-surgical injuries, but still resulted in competitive time loss during their time in college. This number was greater than those who reported only suffering from menstrual dysfunction during their collegiate career. Interestingly,

one group that was surveyed during this study, who were diagnosed with an eating disorder/disordered eating, reported that instead of struggling with a menstrual dysfunction, they suffered from a spine injury (Fryar, 2023).

The professional level of female athletics has showcased a growing increase in menstrual irregularities. Way more than females in the public. Essentially what happens physiologically in the female body for a menstrual dysfunction to occur is an imbalance in the neuroendocrine system which later leads to an estrogen and luteinizing hormone deficiency. There are also different levels to menstrual irregularities which are primary and secondary amenorrhea and oligomenorrhea. A study was conducted to look at the prevalence of menstrual dysfunctions across various sports whether that be team or individual sports. Results were displayed for primary and secondary amenorrhea and primary oligomenorrhea. For primary amenorrhea, gymnastics, soccer, and swimming reported the highest classifications at 25%, 20%, and 19%. Secondary amenorrhea reported that cycling, triathlon athletes, and gymnastics had the highest percentage of diagnosis at 56%, 40% and 21%. Moving to the results for primary oligomenorrhea, the three sports reporting the highest numbers were boxing, rhythmic gymnastics, and artistic gymnastics with percentages of 55%, 44%, and 32%. A reoccurring theme is gymnastics of either type is showing up in all stages of menstrual dysfunctions. However, with this study we are seeing a better breakdown of what sports are recording high numbers of female athletes suffering with menstrual irregularities due to their participation in specific sports (Gimunova, 2022).

Looking at competitive gymnastics. Competitive gymnastics in today's world has very similar training aspects as gymnastics, ballet and swimming which are sports that have reported high level of Female Athlete Triad components for years due to the extensive training and need

to look a certain way to perform their best. That certain physique is normally lean and tone, and that physique is accomplished by most female athletes by insufficient eating which means low energy for performance. Sports like these have had high reports of eating disorders/disordered eating. In a study containing 19 competitive cheerleaders, 9 females had at least one factor of the Female Athlete Triad while the rest reported to have 2 factors of the Triad. From this study it was also reported that the 2 factors were eating disorder/disordered eating or menstrual dysfunction. There was no evidence to support the findings that the competitive cheerleaders had low bone mineral density (Smith, 2022).

Mentioned briefly above was the commonality of menstrual dysfunction seen in competitive swimmers. A study examined the energy availability of female swimmers to then see where they stood with the factors of the Female Athlete Triad. 64 female swimmers were surveyed on their experience with certain symptoms of the Triad. About 31% reported no menstruation for over 3 months. An estimated 22% reported no menstruation for over 6 months, and roughly 9% of the female athletes were between 3-6 months of no menstruation. With these statistics, it was found that female competitive swimmers reported more injuries due to menstrual irregularities and low body mass index (Witkos, 2022).

The summary of these studies mentioned is that female sports that leave the idea that their athletes need to be lean for better performance has led to an increase in Female Athlete Triad symptoms. Aesthetic and lean sports are the culprit for an onset to eating disorders/disordered eating, menstrual dysfunction, low bone mineral density that leads to injuries. These studies informed us that injuries are prevalent in those athletes who struggle with menstrual dysfunctions. The importance of detecting and protecting female athletes in these sports should be noted and acted upon by all coaches in these sports.

## Conclusion

From multiple research studies, we can infer that the Female Athlete Triad is a growing issue in our World today. With no specific numbers in data on just how many females are affected, the Triad is difficult to pinpoint just what is the main cause and how exactly that can be treated. We do, however, know that eating disorders/disordered eating are just the start of the “slippery slope” that we now know as the Female Athlete Triad. The severity can not be an exact score to know if the athlete will then develop a menstrual dysfunction or not. The next steps after a female athlete have developed an eating disorder/disordered eating is unknown but assumed to be menstrual dysfunction as that is what will take a negative hit first in the female body. There is a chance that bone mineral deficiencies can begin roughly around the same time as menstrual dysfunctions begin to set in, but low bone mineral density takes a while to be surface level and become noticeable.

For simple matters, the Female Athlete Triad is associated with low energy. Female bodies begin to lose energy and slow down especially when insufficient nutrients are not being consumed. Poor nutritional intake is the result of poor bone health (low bone mineral density) and puts the body at a higher risk of injury. Sadly, there is not enough research surrounding the Female Athlete Triad and all the components that it encompasses. Just as, bringing awareness for the importance of nutrition and proper nutritional intake to prevent eating disorders/disordered eating (Grabia, 2024).

In years to come, hopefully awareness can be spread for female athletes suffering in the light or silently with factors of the Female Athlete Triad. With the help of more research, athletes, coaches, and parents can develop better skills at detecting eating disorders/disordered eating and begin to feel comfortable speaking on the topic. The World of female athletics needs



to be aware of the severity at which level they compete in and what sports need the most attention given to them if they are a high-risk sport. Also, the societal acceptance for female athletes to be helped by physicians or therapist to overcome their unhealthy habits needs to have more positivity around it. The rehabilitation options for the Triad need more awareness and advocacy. Lastly, female athletes need to feel safe and happy within their sport of choice and should be surrounded by well educated coaches to help them understand that bodily harm in the sense of improper nutrition to stay lean and aesthetically pleasing is not the right choice. Female athletes need protected to continue the growth of female athletics throughout the World.

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