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Eating Disorders in Athletes – Clinical Presentation and Medical Complications

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ABSTRACT

Eating disorders (ED) are mental health conditions. They involve unhealthy eating patterns and negative thoughts about food, body weight, or body shape. Athletes have a higher risk of ED than the general population. In athletes, ED often start with patterns of disordered eating such as strict dieting, skipping meals, or exercising too much. Over time, these problems can develop into anorexia nervosa (AN), bulimia nervosa (BN), or other feeding and eating disorders. Female athletes have a higher risk than male athletes. However, all genders can be affected. Clinically, athletes can show a wide range of symptoms. These include very low energy intake, fatigue, changes in body weight, body image concerns, menstrual dysfunction in women, and compulsive exercise. Some athletes may also develop relative energy deficiency in sport (RED-S). It is a complex condition linked to low energy availability that affects many body systems. Medical complications of ED in athletes can affect many organs and systems. It is important to find them as early as possible. Also, the holistic treatment is essential. It should involve coaches, physicians, dietitians, and mental health professionals. Screening tools for athletes, regular health monitoring, and education about healthy nutrition and energy balance can help prevent serious complications.

Keywords: eating disorders; athletes; disordered eating; RED-S; low energy availability; menstrual dysfunction; medical complications.

1. INTRODUCTION

EDs are mental health conditions that affect eating behavior and thoughts about food and body weight. Feeding and eating disorders include anorexia nervosa, bulimia nervosa, binge-eating disorder, and other specified feeding and eating disorders. These conditions can harm both physical and mental health. They may also affect daily functioning and quality of life. Athletes may have a higher risk of ED than the general population. Many athletes feel pressure to maintain a certain body weight or body shape to improve performance. In some sports, a lean body is seen as an advantage. This pressure can cause unhealthy eating behaviors and strict dieting (Mancine et al., 2020).

ED is common in competitive sports. They may involve skipping meals, consuming too few calories, or too much exercising. Over time, these habits can turn into clinical EDs. Studies show that many athletes report symptoms of ED. Some sports pose higher risks than others. ED is particularly common in sports that emphasize body weight or appearance. In contrast, female athletes are more often affected. Male athletes can also experience these issues. As a result, EDs are a major health concern in sports medicine (Ghazzawi et al., 2024).

ED in athletes can be difficult to recognize. Some behaviors may seem normal in sports. Athletes often pay close attention to food intake. They also train very hard. Many athletes focus strongly on their body weight and body shape. Because of this, unhealthy eating behaviors may not be noticed. Some athletes also hide their symptoms. They may worry about losing their place on the team. They may also worry about not being able to compete. This can delay diagnosis and treatment (Colangelo et al., 2025). It is important to spot eating problems in athletes early. EDs can harm health, slow recovery and hurt athletic performance. For this reason, researchers and clinicians pay more attention to prevention, early detection, and proper care for athletes (Puscheck et al., 2025).

Researchers have also studied the link between ED and relative energy deficiency in sport (RED-S). RED-S happens when the body does not get enough energy from food. This condition can affect many body systems. It can affect hormones, metabolism, bones, and the cardiovascular system. It can also reduce athletic performance. It may increase the risk of injuries.

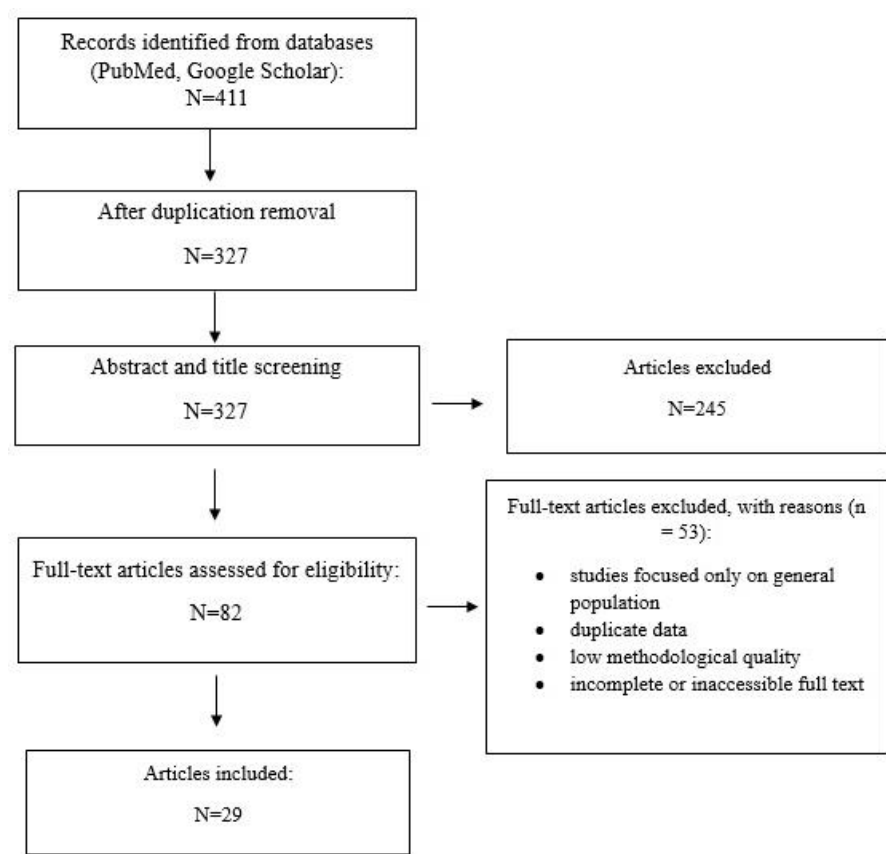


Figure 1. Prisma chart illustrating the selection process.

2. REVIEW METHODS

We searched PubMed and Google Scholar for papers published between 2015 and 2025. We focused on eating disorders in athletes, especially their clinical presentation, risk factors, relative energy deficiency in sport (RED-S), and medical complications.

We used the following keywords in different combinations: ED, athletes, disordered eating, RED-S, low energy availability, menstrual dysfunction, bone health, hormonal changes, and medical complications. We identified a total of 411 records. We excluded studies that focused only on the general population or only on psychological aspects without clinical or physiological data. Studies not related to athletes or not available in full text were also excluded. A total of 29 records were included in the final analysis. We screened

titles and abstracts to identify relevant studies. We included clinical studies, systematic reviews, and narrative reviews. All studies focused on athletes and reported physical or medical aspects of ED. The selection process is summarized in Figure 1.

3. RESULTS AND DISCUSSION

Risk factors for ED in athletes

Athletes have many risk factors for ED. One of them is sport itself. Others are similar to those in the general population. These factors can interact and increase the overall risk. One of the many risk factors is pressure to have a certain body shape. Many athletes believe that lower body weight helps to improve their performance. This may lead to extreme dieting and unhealthy eating habits (Mancine et al., 2020; Puscheck et al., 2025).

Body dissatisfaction is also often in athletes. Athletes may compare themselves with others and with ideal body images, increasing the risk of ED (Rice et al., 2016). Sex is also an essential factor. Female athletes have a higher risk of ED than males. However, male athletes are also affected. They may be underdiagnosed (Li et al., 2024; Torres-McGehee et al., 2023). The type of sport is strongly associated with the risk. Athletes in aesthetic sports, such as gymnastics or dance, and in weight-category sports show a higher prevalence. These sports regularly emphasize body weight and appearance.

The training environment may influence eating habits. Coaches can affect athletes' behavior. Teammates can also have an impact. Athletes often feel pressure to achieve good results. Intensive training can increase stress levels. Stress may affect eating behavior. Some athletes may eat too little. Others may develop unhealthy eating habits. These behaviors can be a way of coping with stress (Puscheck et al., 2025). To conclude, ED in athletes has many causes. These include body image concerns, sport demands, and social pressure. Knowing these factors is important for prevention and early detection.

Clinical presentation of ED in Athletes

Athletes with ED can show many different symptoms. They may affect both the body and the mind. They are not always easy to recognize. One common sign is low energy intake. Athletes may eat too little for their level of training. Low energy intake leads to fatigue and low energy levels during exercise (Torres-McGehee et al., 2023).

Menstrual dysfunction is common in female athletes with eating disorders. It may cause irregular menstrual cycles. In some cases, menstruation stops completely. This condition is called amenorrhea. It is often related to low energy availability. This means that the body does not receive enough energy to support normal functions. Low energy availability can affect hormone production. It affects the hypothalamus reducing the release of reproductive hormones. As a result, estrogen levels decrease. It can cause missed periods and other menstrual problems (Ravi et al., 2021). Menstrual dysfunction is an important clinical sign. It may be one of the first visible symptoms in female athletes.

In some cases, athletes do not report this problem or think it is normal. This can delay diagnosis and treatment. This condition often associated with other health risks. Low estrogen levels can reduce bone mineral density and increase the risk of stress fractures. For this reason, early recognition of menstrual disturbances is very important in athletes (Ravi et al., 2021; Ackerman and Misra, 2018).

Sometimes athletes hide their symptoms. They want to perform well and do not want others to notice their problems. As a result, doctors may find the problem later and treatment may start too late (Colangelo et al., 2025). In general, symptoms in athletes can be difficult to recognize. They include physical, behavioral, and mental signs. It is important to notice these symptoms early so athletes can get the right help.

Relative Energy Deficiency in Sport (RED-S)

Relative energy deficiency in sport (RED-S) is a condition caused by low energy availability. It happens when an athlete does not eat enough calories. This means there is not enough energy for training and daily activities. The body then lacks energy for normal functions. RED-S can affect many body systems. It can also lead to different symptoms in the body (Colangelo et al., 2025).

One of the systems affected is the hormonal system. The body lowers the production of important hormones to save energy. In female athletes, this often causes problems with their menstrual cycle because of low estrogen levels. These problems are usually caused by a condition called functional hypothalamic hypogonadism, which results to low energy availability. This condition reduces the release of gonadotropin-releasing hormone (GnRH), thereby lowering luteinizing hormone (LH) and follicle-stimulating hormone (FSH) levels. As a result, healthy menstrual cycles are disturbed (Ackerman and Misra, 2018; Lodge et al., 2023).

In female athletes, these changes are easier to notice. Problems with the menstrual cycle are an early and clear sign. This may appear as irregular periods (oligomenorrhea). It may also appear as no periods (amenorrhea). Because of this, hormonal problems in women are often detected earlier than in men. In male athletes, testosterone levels may decrease. This change is usually less visible. Hormonal problems in men are harder to recognize. This is because there are no obvious signs like changes in the menstrual cycle (Ravi et al., 2021; Cupka and Sedliak, 2023).

Low energy availability also affects other hormones that control metabolism and energy balance. Levels of leptin usually go down. This hormone is made by fat tissue and shows how much energy the body has stored. Low leptin levels can additionally slow down the reproductive system by reducing GnRH release. At the same time, levels of ghrelin may go up. Ghrelin is a hormone that signals hunger. It can also affect the hypothalamus reducing the release of reproductive hormones. Other hormones, such as peptide YY, may also change and contribute to this hormonal imbalance.

Insulin levels may go down, while the body becomes more sensitive to insulin. Levels of insulin-like growth factor 1 (IGF-1) also drop. IGF-1 is important for building bones and muscles, so its decrease may negatively affect bone health. Growth hormone levels may increase, but the body does not respond to it as effectively as it should. As a result, its normal role in tissue growth and repair is reduced.

Thyroid function is also changed. The body lowers energy use by reducing triiodothyronine (T3) levels. Thyroid-stimulating hormone (TSH) is usually normal or a bit lower. This change supports saving energy but may cause tiredness and lower performance. Also, a part of the brain and glands called the hypothalamic-pituitary-adrenal axis may activate. As a result, cortisol levels can raise, potentially harming metabolism and bone health. Hormonal changes greatly affect bone health. Low estrogen levels can lower bone strength. Over time, this may lead to conditions like osteopenia or osteoporosis. Athletes with RED-S have a higher chance of stress fractures and of bone injuries (Elliot-Sale et al., 2018; Wang et al., 2024).

RED-S can also affect metabolism. The body may slow down energy use and basic physiological functions. This can cause tiredness, low energy and slow recovery after exercise. These changes may lower athletic performance (Grabia et al., 2024). Although RED-S mainly affects hormonal and metabolic systems, other body systems can also be involved. For example, the heart and blood vessels can be affected, leading to symptoms such as a low heart rate or low blood pressure (Logue et al., 2020; Coelho et al., 2021). RED-S is closely linked to disordered eating and ED. Early recognition and proper management are important to protect both health and athletic performance.

Medical Complications

ED in athletes can cause many health problems. These problems can affect different parts of the body. They often happen because of not having enough energy and poor nutrition over time.

Bone health

Bone health is often affected in athletes with ED. Insufficient energy and changes in hormones can make bones weaker. This can cause conditions like osteopenia or osteoporosis. Athletes with ED are more likely to get stress fractures and bone injuries. These problems can also occur in young athletes and may last for a long time.

Hormonal and endocrine system

ED can greatly affect the hormone system. Not having enough energy can disrupt the body's hormone regulation, leading to lower levels of reproductive hormones. In women, this can disrupt their menstrual cycle. In men, testosterone levels may drop.

Other hormone changes are also common. These include changes in hormones like leptin, ghrelin, insulin, and cortisol. The thyroid gland may also work differently. These changes help the body save energy but can harm health and athletic performance.

Cardiovascular system

ED can also affect the heart and blood vessels. Athletes with ED may have a slow heart rate. They may also have low blood pressure. These changes often happen because of low energy levels. The body also adjusts its autonomic nervous system. In more serious cases, mineral imbalances such as low potassium can increase the risk of irregular heartbeats. These problems can be dangerous and need medical care.

Electrolyte and metabolic disturbances

Mineral imbalances such as potassium, sodium, and magnesium are common, especially in athletes who purge. These imbalances can affect muscle function and heart rhythm. Changes in metabolism also happen. The body may use less energy and slow down its processes. It can cause tiredness and slower recovery.

ED is also linked to mental health problems. Athletes may feel anxious, depressed, or have mood swings. Being a perfectionist and having high stress can make these feelings worse. These mental health issues can combine with physical problems and make athletic performance and quality of life worse. The medical complications of ED in athletes are summarized in Table 1.

Table 1. Medical complications of ED in athletes

System	Main complications	Mechanism/cause	Sources
Endocrine	Menstrual dysfunction, low testosterone	Low energy availability → decreased GnRH, LH, FSH	Elliot Sale et al., 2018; Lodge et al., 2023; Ravi et al., 2021
Bone	Low bone mineral density, stress fractures	Low estrogen, decreased IGF-1	Elliot Sale et al., 2018; Wang et al., 2024; von Brackel et al., 2024
Metabolic	Fatigue, low energy, slow metabolism	Energy conservation mechanisms	Grabia et al., 2024; Logue et al., 2020
Cardiovascular	Bradycardia, low blood pressure	Adaptation to low energy availability	Coelho et al., 2021; Logue et al., 2020;
Psychological	Anxiety, depression	Stress and body image concerns	Ibáñez-Caparrós et al., 2023; Rice et al., 2016; Rosinska et al., 2025

Screening & management

Finding ED early in athletes is very important. Many signs may be hidden, and athletes often continue training even when they have health problems. Because of this, routine check-ups should be part of normal medical care in sports. There are several ways to check if athletes might be at risk. Clinicians often use questionnaires like the Eating Attitudes Test (EAT-26) or the SCOFF questionnaire. But tools made especially for athletes might give better results. These checks should ask about eating habits, how athletes see their bodies, how much they train, and menstrual health in female athletes (Tektunalı Akman et al., 2024). It is also important to keep track regularly. It can include checking body weight, menstrual cycles, past injuries and changes in performance. Sudden weight loss, repeated injuries, or tiredness can be warning signs. Finding these problems early can help prevent bigger ones.

Treating ED in athletes needs a team approach. Doctors, dietitians, psychologists, and coaches should all help. Each person has an important role in treatment and recovery (Mountjoy et al., 2014). Good nutrition is an important part of care. Athletes need enough energy from food to help their bodies work normally again. Slowly increasing the amount of calories they eat might be needed. Teaching about healthy eating and energy use is also important (Grabia et al., 2024).

Mental health treatment is often needed. Cognitive behavioral therapy can help. It can change unhealthy thoughts about food. It can also change thoughts about body image. It can improve thoughts about performance. Support from coaches can also help. Support from family may improve recovery. This support can lead to better outcomes (Mancine et al., 2020). Sometimes, athletes may need to reduce or change their training for a while. It helps the body heal and lowers the chance of more problems. Getting back to sport should be planned carefully and executed with caution (Mountjoy et al., 2014). Overall, early screening and comprehensive management can improve health outcomes and support a safe return to sport.

4. CONCLUSION

ED is a common and serious problem in athletes. It can affect many parts of the body and lower both health and athletic performance. Spotting it early and managing it well are important to avoid problems. Working with different types of experts and learning about good nutrition can help with recovery and a safe return to sports.

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Supervision and guarantor of the integrity and accuracy of the entire work: Agata Olecka

All authors have reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Informed consent

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Ethical approval

Not applicable. This article does not contain any studies with human participants or animals performed by any of the authors.

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Data and materials availability

All data associated with this study will be available based on the reasonable request to corresponding author.

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