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# A Perfect Storm for Athletes

## Body Dysmorphia, Problematic Exercise, Eating Disorders, and Other Influences

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**KEYWORDS**

- Body dysmorphic disorder
- Compulsive exercise
- Eating disorders
- Problematic exercise
- Maladaptive perfectionism

**KEY POINTS**

- Sports sociologic factors, pressures related to body image and performance, and internal personality constructs including maladaptive perfectionism may intersect to create a "perfect storm" for athletes that can negatively impact mental health and performance.
- Conditions, such as body dysmorphic disorder, muscle dysmorphia, eating disorders, and disordered eating, share several elements that are further influenced by maladaptive perfectionism and result in a dysfunctional relationship with exercise and negative impacts on health.
- Athletes who present with distorted body image, problematic exercise patterns, and unhealthy eating approaches should be screened carefully for conditions that can significantly impact the relationship between exercise, eating, and overall health.
- Conditions, such as body dysmorphic disorder, muscle dysmorphia, eating disorders, and disordered eating, can have serious medical and psychological consequences.
- Screening tools exist to assist in recognition and monitoring of body dysmorphic disorder, muscle dysmorphia, eating disorders, and disordered eating.

## BACKGROUND

Athletes are at risk for states that may compromise their ability to approach activities, such as eating and exercise, in a healthy manner. The nature of sports may contribute to this dynamic, because increased pressure to win and importance of body weight, shape, and size are incredibly powerful drivers. Protective factors, such as objectivity and good judgment, can become compromised with the pressures related to appearance, sport performance, and results, which may increase vulnerability to conditions that are associated with diminished cognitive and behavioral control, such as body dysmorphic disorder (BDD), eating disorders (ED), and disordered eating (DE). Additional states, such as perfectionism and problematic exercise (PE; further categorized into compulsive exercise [CE] and

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exercise addiction [EA]) can impair volitional control by the athlete over eating and exercise, and negatively impact the experience of exercise and health of the athlete.

Individuals often begin their sports journey as youth, with competitive sports often beginning before the age of 10. Athletic lifestyles also span the strength, fitness, and wellness domains, and can also begin in the adolescent years [1]. This timespan overlaps with the age of onset of several of these disorders. This confluence of influences may set the stage for a perfect storm that can result in significant functional impairment and prolonged symptom burden.

It is important to establish definitions of key concepts, which are further explored next.

## Problematic Exercise

PE is a multifaceted and complex dysfunctional pattern of exercise behavior that implies losing control over exercise behavior to the point of physical, psychological, or social impairment [2].

### *Compulsive exercise*

CE refers to cognitive and behavioral rigidity applied to exercise behavior driven by positive and negative affect regulation and pursuit of exercise despite lack of enjoyment [3–5]. This rigidity can manifest as inability to reduce exercise routines, significant distress with exercise interruption, or exercising despite compromised physical health [6,7].

### *Exercise addiction*

EA refers to driven engagement in exercise despite detrimental impacts on personal, social, and professional life, and regardless of negative health consequences [8,9]. Affected individuals demonstrate significant difficulty abstaining from exercise and withdrawal symptoms including anxiety, impaired sleep, restlessness, and sexual tension [10–12]. EA demonstrates consistencies with other addictive behaviors, including mood disturbance, tolerance, relapses, loss of volitional control over the behavior, and dedicating excessive time to the behavior [8,13–15].

Although the terms "compulsion" and "addiction" are often used interchangeably, there are important differences. Compulsions are experienced as overwhelming urges to do something; however, completion of the task does not result in satisfaction. The urges create a sense of anxiety, and the compulsive behavior is intended to relieve those distressing feelings [16]. Addictions, conversely, are chronic diseases that create experiences of pleasure and satisfaction and remove discomfort from cravings. Individuals engage in addictive behaviors despite harmful consequences [16].

## Body Dysmorphic Disorder

Classified by the American Psychiatric Association Diagnostic and Statistical Manual 5th Edition-Text Revision (DSM-5-TR) [17] among the obsessive-compulsive and related disorders, BDD is characterized by preoccupation with one or more perceived defects or flaws in physical appearance that are not observable or seem slight to others. These may include looking ugly, unattractive, abnormal, or deformed. It may range in severity from mild concern about looking unattractive to extremes of undesirable appearance. Any area of the body can be the focus of concern, and preoccupations are intrusive, distressing, difficult to resist or control, and time-consuming. Repetitive acts (mental and/or behavioral) are performed in response to the preoccupation but are not pleasurable and may increase anxiety and negative affect. The appearance preoccupation is not better explained by concerns with body fat or weight in an individual whose symptoms meet diagnostic criteria for an ED.

### *Muscle dysmorphia*

Classified by the DSM-5-TR as a specifier of BDD, muscle dysmorphia (MD) is characterized by preoccupation that one's body is too small or insufficiently lean or muscular. In addition to this muscular preoccupation, the affected person can simultaneously have body dysmorphia that affects other areas of the body. Most affected individuals are men and adolescent boys who engage in diets, exercise, or resistance training excessively [17].

## Eating Disorders

EAs are disturbances in eating and eating-related behaviors that result in altered consumption of food and impact physical and/or psychological function [17]. Conditions classified according to the DSM-5-TR Feeding and Eating Disorders include pica, rumination disorder, avoidant/restrictive food intake disorder, anorexia nervosa (AN), bulimia nervosa (BN), binge-eating disorder, other specified feeding or ED, and unspecified feeding or ED. AN and BN are the specific EDs further explored in this article.

### *Disordered eating*

DE exists on a continuum between normal eating and EDs, and may feature several symptoms of Eds, such as restrictive eating, bingeing, purging, engagement in

other compensatory behavior, or compulsive, irregular or rigid approaches to eating [18]. These presentations do not fulfill DSM-5-TR criteria for feeding or EDs, but affected individuals may be at higher risk of developing such disorders [18]. DE can be associated with functional impairment and significant symptom burden.

### Maladaptive Perfectionism

Maladaptive perfectionism is rooted in a multidimensional personality construct characterized by a maladaptive pattern of behavior that consists of inappropriate expectations, unattainable goals, and a constant inability to achieve satisfaction regardless of performance [19]. Affected individuals constantly feel like failures and experience stress and pressure, which leads to maladaptive coping mechanisms. They engage in excessive self-criticism and self-blame; worry about making mistakes; and experience impairment in psychological, physical, social, occupational, and self-care domains (which can include eating and exercise).

### Relative Energy Deficiency in Sport

Relative energy deficiency in sport (RED-S) is a physiologic and clinical condition that impacts multiple body systems and has multifactorial origins. Mental health symptoms and certain eating and exercise behaviors are predisposing, precipitating, or perpetuating factors. RED-S can affect all genders, and many use this term to conceptualize conditions that were historically included in female and male athlete triads.

This article illustrates the interconnectedness of the previously mentioned clinical conditions that athletes are at risk to develop because of the characteristics of sport that are related to competition, excellence, ideal physique, and performance expectations. By understanding these relationships, practitioners, health care providers, and other athlete supports will better recognize, identify, and address challenges before they result in significant negative impacts on athlete health, well-being and performance.

## CLINICAL RELEVANCE

### Exercise Is Medicine

Exercise has been proven to have a therapeutic effect on many aspects of physical and mental health, with demonstrated reduction in rates of cardiovascular disease, various types of cancers, mental health disorders, and cognitive decline [20,21]. Exercise is Medicine is a global movement that has provided education and opportunities for communities to implement regular exercise for the purpose of overall health enhancement [22]. To maintain its positive influence on health, exercise must be incorporated with attendance to balance with rest, recovery, proper nutrition, and adequate sleep.

### When Exercise Becomes Unhealthy

Today's culture of wellness and fitness often focusses on leanness, thinness, weight loss, strength, performance, body shape, and supplements [23]. The desire to fit in to the sport culture or achieve certain body morphologies may lead to extremes in dieting, exercising, and loss of objectivity for healthy decisions. When these changes happen, individuals may find themselves without the ability to accurately appraise healthy exercise and eating behaviors and their own body morphology. Without proper guidance, the athlete who strives to become leaner, faster, stronger, and better at their sport may create unhealthy training routines that compromise their physical and mental states. In addition, there is a common saying among athletes in antigravity, aerodynamic, endurance, aesthetic, and judged sports that "lighter…is faster/stronger,…is judged more favorably,… jumps higher." Any initial (albeit generally unsustainable) improvement in performance often provides positive reinforcement for this approach, which can perpetuate those approaches and result in PE, DE, EDs, and RED-S.

Changes in eating and exercise routines were common during the COVID-19 pandemic, necessitated by such factors as public health directives for physical distancing, lockdowns, facilities closures, widespread switch to remote communication and education, and other socioeconomic factors. One study explored how uncertainty in certain domains could potentially influence maladaptive behaviors in eating and exercise routines during the pandemic [24]. A series of questionnaires administered to undergraduate athletes in 2020 identified that COVID-19 anxiety was more strongly associated with CE and ED pathology for individuals with low tolerance for uncertainty. These findings demonstrated that individual factors were important considerations in determining risk for the development of ED pathology and CE in the context of the pandemic and were consistent with the theory that CE and ED behaviors served to reduce the distress that was caused by uncertainty.

## THE PERFECT STORM

Unhealthy approaches to exercise, which may be influenced by pressures from sport or challenges with perfectionism or body image, can create a "perfect storm" of

sorts, whereby the drivers for sports participation become entangled with distorted body image and perfectionism to create a landscape of rigid, obsessional approaches to eating and exercise. The complex interplay of these elements can lead to intractable conditions that can compromise physical and mental health, and negatively impact the athlete's relationship with sports and nutrition. This section further describes each of the elements that contribute to the perfect storm model and explores the linkages that bridge each of the concepts in mapping the model. These concepts are listed in Box 1 and explored more extensively next.

## Problematic Exercise

PE is defined as a pattern of exercise behavior that results in functional impairment or compromised health [2,25]. PE includes loss of control over exercise behavior such that the individual experiences physical, social, or psychological harm [26,27]. Subtypes of PE include CE and EA.

CE and EA are terms that are sometimes used interchangeably [28]. Although they both feature engagement in exercise despite negative consequences on health, the drivers for the behaviors may subtly distinguish between the two conditions. Compulsions are described as repetitive behaviors that an individual feels driven to perform according to rules that must be applied rigidly, with the intent of reducing distress or preventing a feared outcome [17]. Conditions that share compulsive features are classified by the DSM-5-TR with the obsessive-compulsive and related disorders and include obsessive-compulsive disorder and BDD.

Addiction (nonsubstance related) is described as behavior driven by aspects of tolerance, repeated unsuccessful attempts to cut back or quit, and impairment in normal functioning [17]. For the purposes of this article, the terms addiction and dependence are used interchangeably. Neither CE nor EA/dependence are classified in the DSM-5-TR.

Individuals who engage in CE feel driven to exercise to prevent negative affect, influence positive affect, and prevent negative cognitions (which are often related to loss of fitness, loss of competitive advantage, or potential for weight gain if exercise is missed). These cognitive and affective impacts can be profound and are effectively measured with the Compulsive Exercise Test. The Compulsive Exercise Test was developed specifically for use in ED research and assessment. It is a 24-item self-report measure designed to assess the core features of excessive exercise in the EDs, including compulsivity, affect regulation, weight- and shape-driven exercise, compensatory exercise, and exercise rigidity (rigid adherence to a strict and repetitive exercise routine) [29]. In this sense, CE is tied to affect regulation, cognitive rigidity, and weight-based exercise behavior.

Individuals who experience EA describe cravings for physical training, which result in uncontrollable excessive exercise behavior that may lead to harmful consequences, such as injuries and impaired social relations [28]. Aligned with other behavioral addictions, affected individuals experience tolerance to exercise, whereby they need more volume or higher intensity to feel satisfied. The need to engage in excessive exercise results in functional and relationship impairment, and attempts to modify their behavior are met with challenging cognitions (including consuming thoughts about exercise and temptation to exercise) and cognitive and physical discomfort related to not exercising. EA is assessed with the Exercise Addiction Inventory, which explores the six general components of addiction (salience, tolerance, mood modification, withdrawal symptoms, social conflict, and relapse) [30,31].

One study demonstrated support for the well-established relationship between perfectionism and EDs, because clinical perfectionism predicted eating pathology directly and indirectly as mediated by CE [32]. CE may be a symptom of eating pathology, rather than an antecedent [32]. Exercise engagement may increase before and during EDs [33] and may be used as a method of weight and shape control [34].

**BOX 1**
**Components of the Perfect Storm Model of Interconnected Conditions that Are Frequently Observed in Athletes**

Components of the perfect storm model of interconnected conditions in athletes

1. Problematic exercise (including compulsive exercise, exercise addiction/dependence)
2. The influence of body image (including body dysmorphic disorder, muscle dysphoria)
3. The role of eating behaviors (disordered eating and/or eating disorders)
4. The influence of maladaptive perfectionism

## The Influence of Body Image

The culture of sport, with often rigid expectations, intensive scheduling, early sport specialization, weight-related beliefs, and family influences can create the milieu for developmental compromises that is expressed through psychiatric conditions, such as body image distortions

[35]. Additionally, given the nature of the culture of sport, with a focus on ultra fitness and performance, athletes often present with little insight into the perceptual distortions [36].

Several studies have explored the influence of social media on body image and ED behaviors. Studies in athlete and nonathlete populations indicated that higher exposure to social media negatively impacted the individual, with an observed increase in DE patterns, increase in body dissatisfaction, and increase in general mental health symptoms [37,38]. The onset of these symptoms in early adolescence can profoundly affect the social and emotional development in the affected individuals. Clinically this can easily be overlooked or dismissed as part of the sensitivity of the age and/or normative in terms of the culture of the sporting environment [38,39]. Additionally, the reinforcement resulting from external praise and the gender norms for particular sports can create a culture of acceptance for particular body types under the pressure to perform. Going to extreme measures to reach these elite goals can be viewed as culturally normative within the sport [38].

Grouped in the DSM-5-TR with the obsessive-compulsive and related disorders, BDD is characterized by preoccupation with one or more body parts in which there is a perceived flaw or defect in physical appearance that is not (or minimally) apparent to others, and repetitive behaviors or mental acts are performed in response to the appearance concerns. Compulsive acts include mirror checking, excessive grooming, and reassurance seeking, and affected individuals frequently compare their appearance to others [17].

BDD in elite athletes is beginning to receive increased attention, especially in aesthetic sports, such as figure skating, body building, gymnastics, dance, and artistic swimming and sports where body shape is perceived to play a particular role, such as running and swimming.

It is crucial to recognize that the onset of BDD typically occurs younger than the age of 18, with the symptoms beginning to emerge most commonly at puberty, ages 12 to 13 [39,40]. This is an age when athletes developmentally need to be exploring their sense of autonomy, identity, and self-efficacy.

MD is a subset of BDD, where the affected individual is preoccupied with their body or physique being undersized or lacking in musculature. Its distinguishing feature is the focus on increasing muscle size. Body builders can experience significant distress related to concerns that their body is not muscular or lean enough [39]. MD is often associated with dieting, excessive exercise (including weight lifting) despite detrimental effects, and use of anabolic-androgenic steroids and other substances to increase the muscular appearance of their bodies [17,41].

Screening for and monitoring BDD is achieved by using the Appearance Anxiety Inventory [42,43]. The Appearance Anxiety Inventory is a 10-item self-report questionnaire that measures the frequency of avoidance behavior and self-focused attention that characterize a response to distorted body image. The Muscle Dysmorphic Disorder Inventory is a commonly used instrument comprised of three subscales that assess drive for size, appearance intolerance, and functional impairment [44–46].

## The Role of Eating Behaviors

Athletes are at a higher risk of developing an ED or DE compared with nonathletes, particularly in sports where low body weight or leanness confer a competitive advantage [47,48]. This suggests that sport-related considerations are key factors in influencing eating behavior in athletes. Given the ambiguity between eating behavior that is adaptive and healthy for sport versus that which is pathologic, the lack of clear delineation of severity of eating pathology when suffered by athletes, the shame and secrecy often experienced, and the consequent distress, the behavior can easily be overlooked [49]. Binge-eating disorder shares several common features with BN and BDD [50]. Features common to problematic eating behaviors and body image distortions include inaccurate interpretation of body morphology and anthropometrics with subsequent changes in eating behavior to achieve an outcome that typically includes weight loss, avoidance of weight gain, and changed body morphology. This may include nutritional restriction or compensatory behaviors, such as excessive exercise. When the approach to exercise is rigid, excessive, and considered essential to achieve desired changes in body morphology despite the physical or mental cost, it becomes problematic.

A construct that has been found to be relevant to eating pathology is CE. CE is multidimensional and is known to incorporate several domains, including exercise to regulate emotions, weight- and shape-driven exercise, and exercise rigidity [5,51].

CE is important to understand in the context of other links that have been demonstrated to eating pathology [32]. The Compulsive Exercise Test [5,29] is correlated with responses to the Eating Disorder Examination Questionnaire [52,53] in a sample of competitive athletes [3] and regular exercisers [54]. These findings support the link between CE and eating pathology. CE has been associated with higher ED symptoms in nonclinical [55–57] and clinical ED samples [58,59]. Furthermore,

CE is a risk factor for relapse in AN, and is linked with higher rates of suicidal behavior, treatment drop-out, and longer hospital admissions in patients with AN [4,58].

The presence of DE or ED should be explored with a combination of physical examination and validated screening tools [60]. These include use of a comprehensive preparticipation physical examination [61], periodic health examination [62], or clinical encounters when the athlete presents for related concerns [63]. Several ED questionnaires have been validated for the athlete population, and care should be taken to select the most appropriate tool for the athlete [47]. The Eating Disorder Examination Questionnaire 6.0 is a short form screening tool based on the Eating Disorder Examination Questionnaire 17.0 and could form part of a comprehensive assessment of the athlete [52].

## The Influence of Maladaptive Perfectionism

Athletes commonly strive for excellence. This endeavor may be accompanied by rigid exercise regimens, low failure tolerance, excessive self-criticism, and the desire to achieve mastery to gain the approval of others [64]. Perfectionism has been conceptualized as a contradiction or a paradox, because some aspects of perfectionism may be helpful for performance, whereas other aspects may be detrimental. Research on perfectionism in sports distinguished between perfectionistic strivings (represented by high personal standards, self-directed perfectionism, and high personal standards of performance) [65–67] and perfectionistic concerns. Perfectionistic concerns refer to excessive concern over mistakes, fear of negative appraisal, incongruence between expectations and performance, and negative reactions to imperfect performance.

Perfectionism is additionally described in two dynamic categories: adaptive and maladaptive. Maladaptive perfectionism is also synonymous with pathologic perfectionism, which aligns with the concept of perfectionistic concerns. Adaptive perfectionism manifests as high standards that drive an individual to achieve a desired body image or performance, whereas maladaptive perfectionism aligns more with concern with mistakes and other people's opinions. Athletes who experience maladaptive perfectionism have constant fear of failure, guilt when deviations in training occur, an extreme need to control performance outcomes, an obsessive approach to training, and chronic unhappiness with their efforts and performances. These athletes minimize positive achievements and focus excessively on negative events and outcomes (real or perceived). Athletes who exhibit maladaptive perfectionism have a high perceived stress response and are at greater risk of experiencing performance struggles as traumatic events [66]. Adaptive and maladaptive perfectionism are associated with body dissatisfaction and are potential risk factors for the development of EDs [68–71].

One study demonstrated that individuals with a lower desired body mass index and smaller perceived ideal body shape displayed higher levels of perfectionistic traits, such as concern over mistakes and doubt over actions [70]. Another study demonstrated that individuals with AN and BN showed significantly higher perfectionism traits than control subjects [72]. Longitudinal evidence suggests that perfectionism is associated with increased DE behavior in young women [73].

High levels of perfectionism and rejection sensitivity are associated with BDD [17]. The excessive, unreasonable, and unrealistic expectations that affected individuals place on themselves can trigger debilitating thoughts, emotions, and behaviors as seen in BDD [64].

These concepts are linked in the perfect storm model. Maladaptive perfectionism involves the drive to achieve high standards despite adverse consequences and the basing of self-worth on achievements [34]. Maladaptive perfectionism has been identified as one of the key factors in the transdiagnostic model of EDs [34] and has also been associated with CE [74]. The transdiagnostic model of EDs describes common mechanisms in the persistence of EDs. These include shared distinctive psychopathology, migration across diagnostic categories over time, and maintenance of clinical features by similar psychopathological processes [34]. An array of studies has found that individuals who engage in exercise with high levels of perfectionism have more eating pathology than those with lower levels of perfectionism [75]. Finally, in one study involving athletes at Stanford University, perfectionism has been identified as the risk factor with the strongest effects on DE attitudes in female athletes [76].

## Where Does Relative Energy Deficiency in Sport Fit?

Energy is required to fuel all activities of the human body, from baseline functions to intense or grueling physical activities. Energy availability is the amount of surplus dietary energy that is available for use by the body after accounting for exercise-related energy expenditure [77]. Low energy availability (LEA) may arise when there is an incongruence between nutritional energy intake and exercise-related energy expenditure, leading to inadequate energy quantities to fulfill basic requirements and sustain optimal health and performance [77]. Exposure to LEA that is associated with

significant disturbances of body systems is referred to as problematic LEA [77].

Problematic LEA has been identified as the underlying physiologic cause of RED-S [77]. Although there is a dearth of studies that have explored the psychological contributing factors to the development and perpetuation of RED-S, it is important to understand the motivations and behaviors that are associated with LEA to be aware of risks and plan a comprehensive approach to management.

Energy imbalance may be created by intentional or unintentional behaviors, including dietary restriction or increased energy expenditure through exercise. In addition, such factors as dissatisfaction with body morphology, desire for leanness, conviction that lower body weight translates to better performance, and idealization of optimal physique are considered risk factors for problematic LEA and subsequent development of RED-S [77–79].

RED-S shares numerous social and psychological factors with elements of the perfect storm. Restrictive eating and the use of weight control methods are often linked to dissatisfaction with body morphology, and this occurs more frequently in aerial, weight-sensitive, and aesthetic sports [47,80,81]. Athletes who train and compete in these types of sports may be at higher risk for development of RED-S [77]. Negative commentary about weight, shape, and size in addition to public forums in which weight is addressed (eg, weighing athletes in front of a group in a gym or on a pool deck) may lead to shame, decreased nutritional intake, DE, ED, LEA, and RED-S [82–85]. A recent study on Icelandic athletes indicated that DE, CE, and MD can contribute to the risk of RED-S [86].

The sociologic, cognitive, and behavioral factors underpinning the development of LEA and RED-S are shared with the elements of the perfect storm model. These factors may represent predisposing, precipitating, and perpetuating contributors to deteriorating states of health, wellness, and performance that may be experienced by athletes.

With the recent series of published updates on various components of RED-S, the International Olympic Committee released the Relative Energy Deficiency in Sport Clinical Assessment Tool: V.2 (IOC REDs CAT2) [87]. This tool uses a three-step protocol that includes screening, severity and risk assessment, and clinical diagnosis and treatment [88].

### Other Potential Health Consequences of the Perfect Storm

Athletes may develop a variety of psychological and physical health sequelae resultant from behaviors related to BDD, MD, CE, EA, DE, and ED (specifically AN and BN). Although there is a more extensive list of psychological sequelae of these conditions, individually and when interconnected, only the key psychological components of those conditions are identified in this article. It is important for clinicians, health care providers, and other athlete supports to recognize the potential physical health sequelae of these conditions, because athletes may initially present with these physical manifestations. The most common physical health sequelae of and common screening tools for these conditions are listed in Table 1.

Considered individually or as an interconnected collective, these conditions have the potential to cause serious or life-threatening circumstances. This highlights the importance of careful clinical assessment and exploration with a comprehensive history, physical examination, screening tools, laboratory tests, diagnostic imaging, or other diagnostic tests as necessary.

## DISCUSSION

Sports and physical activity are extremely effective tools for fitness, overall health, well-being, and the pursuit of performance-specific goals. Although sport outcomes are based on external actions and results, the internal experience of exercise is significantly influenced by body image, relationships with exercise and nutrition, and perfectionism. Most athletes participate in sports with a healthy and harmonized amalgam of these elements, but when one or more of these elements is present at unhealthy or pathologic levels, a perfect storm may form and result in significant functional impairment or compromised health.

Although these concepts (ie, exercise, body image, nutrition, and perfectionism) are defined separately and represent distinct entities, they are all interconnected in a manner such that challenges in one area increase the risk for challenges in another. It is important to recognize that elements of these conditions, when in balance and moderated by objectivity, are adaptive and positive for sport performance. Commitment to exercise regimens, healthy nutrition, and high standards and expectations are essential components for success and performance outcomes in sports. When any of these components become excessive, out of control, or detrimental to health, intervention is indicated.

When any of the component conditions of the perfect storm is present, the others should be screened for based on their frequently comorbid status and shared risk factors. There exists an opportunity to engage in a comprehensive assessment to explore more broadly the presence or absence of those other components,

TABLE 1
Potential General Medical Sequelae of Body Dysmorphic Disorder, Muscle Dysmorphia, Compulsive Exercise, Exercise Addiction, Disordered Eating, Eating Disorders (Specifically Anorexia Nervosa and Bulimia Nervosa), and Relative Energy Deficiency in Sport and Common Screening Tools for Those Conditions

| Condition | Potential Health Consequences | Screening Tool |
|---|---|---|
| Body dysmorphic disorder [23,89] | • Unnecessary surgeries<br>• Infections<br>• Wounds | • Appearance Anxiety Inventory [42,43] |
| Muscle dysmorphia [23] | • Physical injury<br>• Health consequences resultant from the use of anabolic androgenic steroids, diuretics, hormones, undisclosed supplement ingredients | • Muscle Dysmorphic Disorder Inventory [45] |
| Compulsive exercise [28,90] | • Physical injury<br>• Bone mineral density loss<br>• Amenorrhea<br>• RED-S<br>• Myalgia<br>• Fatigue<br>• Increased frequency of illness<br>• Serious medical complications including changes in vital signs, pain, infections, electrolyte imbalances, or involving the cardiovascular system, digestive system, and/or endocrine system | • Compulsive Exercise Test [29] |
| Exercise addiction | • Same as for CE | • Exercise Addiction Inventory [30,31] |
| Anorexia nervosa [91] | • Menstrual irregularities<br>• Dizziness<br>• Syncope<br>• Feeling cold all of the time<br>• Dry skin<br>• Brittle nails<br>• Stomach cramps<br>• Abnormal laboratory results: low blood cell counts, anemia, low potassium, low thyroid and sex hormone levels<br>• Abnormal vital signs (bradycardia, hypotension)<br>• Cardiac abnormalities | • Comprehensive preparticipation physical examination and assessment [47]<br>• Eating Disorder Examination Questionnaire 6.0 [52] |
| Bulimia nervosa [92] | • In addition to the sequelae listed for anorexia nervosa, the recurrent binge and purge cycles associated with bulimia can affect the entire digestive system and can lead to electrolyte and chemical imbalances in the body that affect the heart and other major organ functions | • Same as for AN |
| Disordered eating [47,63] | • Health consequences for DE can be the same as for AN and BN | • Same as for AN |

(*continued on next page*)

**TABLE 1**
***(continued)***

| Condition | Potential Health Consequences | Screening Tool |
|---|---|---|
| Relative energy deficiency in sport [93] | • Reduced hormone levels<br>• Impaired bone health<br>• Impairment involving digestive, endocrine, metabolic, reproductive, cardiovascular, musculoskeletal, and immune systems | • IOC REDS CAT2 [87,88] |

potential contributing factors, and possible medical sequelae. This model is represented in Fig. 1.

Understanding and recognizing the key features of these conditions equips practitioners, health care providers, and other athlete supports with an enhanced knowledge base to explore elements of each one individually, or as comorbid and interconnected entities.

The purpose of this article is to define the key conditions that commonly interconnect in athletes and contribute to compromised general medical and mental health. Treatment of each condition is beyond the scope of this article and should be further researched and described, especially when occurring as comorbid conditions and within the context of sport.

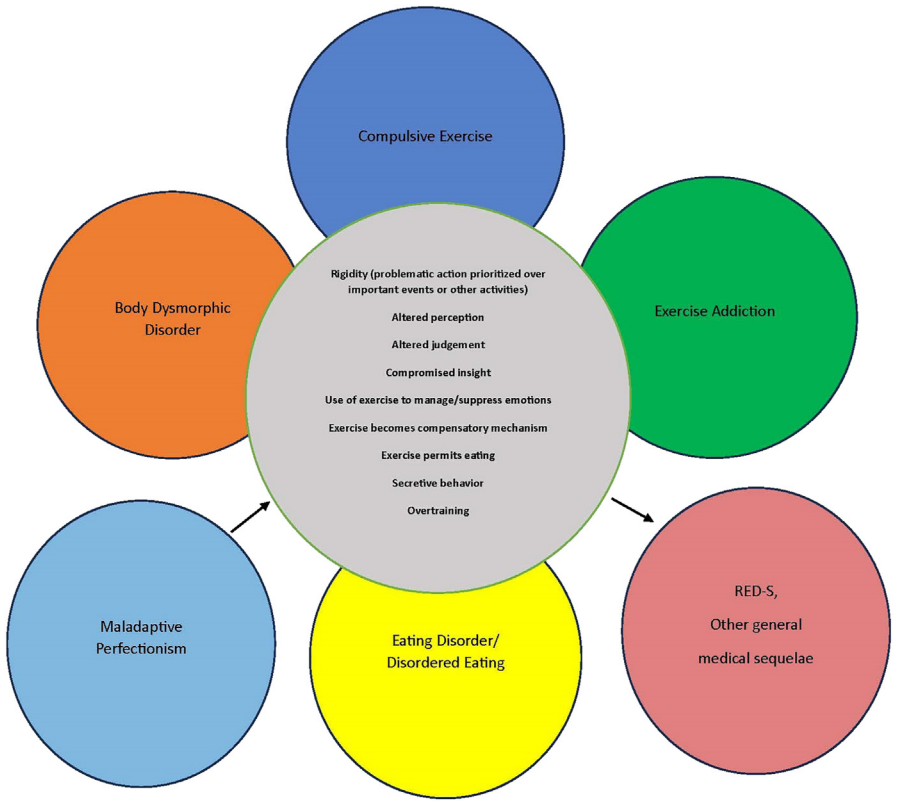


FIG. 1 Overlapping features of conditions that are associated with loss of cognitive and/or behavioral control and that can interfere with health and sport performance. The arrows indicate that maladaptive perfectionism may fuel the central constellation of symptoms and overlapping conditions, and that the central symptoms may lead to RED-S or other general medical sequelae.

## SUMMARY

Sports and exercise are important for health and well-being. When engaged with objectivity, reasonable expectations, and a balanced approach, there are many general medical and mental health benefits. The sociologic landscape of sports and exercise, including performance outcomes, social media, idealization of certain physiques, and the conviction that low body weight is necessary for better performance can disrupt this balanced approach and lead to a perfect storm. This circumstance influences the athlete's perception of their body and their relationships with exercise and nutrition to the detriment of health. Although BDD, PE, EDs, and DE may exist in isolation, a broad array of studies has demonstrated their interconnectedness.

It is important for practitioners, health care providers, and other athlete supports to be aware of the risk factors for these conditions and their potential health sequelae. Because of the complexities presented by the interplay among sociologic, psychological, and general medical factors, careful clinical assessment, early identification and intervention, and strong communication between team members for coordination of care are important. Complexities that can be encountered by athletes require the expertise of comprehensive multidisciplinary teams, which should include a combination of sports scientists, certified athletic therapists/trainers, sports and exercise medicine physicians, licensed mental health providers (ie, sports psychiatrists, clinical social workers, clinical psychologists, and/or licensed clinical counselors), certified sports performance providers, and registered/licensed sports dieticians.

Early identification and recognition of these conditions are important for intervention, management, and prevention of potential severe psychological and general medical sequelae. Although treatment of these conditions is beyond the scope of this article, exploration of multidimensional treatment approaches is an important future direction for guiding the multidisciplinary team in comprehensive care of the athlete.

## CLINICS CARE POINTS

- Exploring the athlete's perspective on their body image, exercise patterns, and approach to nutrition could identify risk factors for clinical conditions that may negatively impact mental health and performance.
- Recognizing maladaptive perfectionism in an athlete can guide the mental health clinician to explore potentially co-occuring conditions that could result in a dysfunctional relationship with exercise and negative impacts on health.
- Regular screening related to body image, approach to exercise, nutritional intake, and perfectionism would facilitate earlier recognition, intervention, and management of the conditions related to "the perfect storm."
- Emphasizing healthy approaches to body image, nutrition, exercise, and performance outcomes could facilitate maintaining exercise as a positive experience for overall health enhancement.

## DISCLOSURE

The authors have nothing to disclose.

## REFERENCES

[1] Myer GD, Lloyd RS, Brent JL, et al. How young is "too young" to start training? ACSM's Health & Fit J 2013; 17(5):14–23.

[2] Alcaraz-Ibáñez M, Paterna A, Sicilia Á, et al. Examining the reliability of the scores of self-report instruments assessing problematic exercise: a systematic review and meta-analysis. J Behav Addict 2022 Apr 28;11(2): 326–47.

[3] Plateau CR, Shanmugam V, Duckham RL, et al. Use of the Compulsive Exercise Test With Athletes: norms and links with eating psychopathology. J Appl Sport Psychol 2014;26(3):287–301.

[4] Meyer C, Taranis L, Goodwin H, et al. Compulsive exercise and eating disorders. Eur Eat Disord Rev 2011;19: 174–89.

[5] Taranis L, Touyz S, Meyer C. Disordered eating and exercise: development and preliminary validation of the Compulsive Exercise Test (CET). Eur Eat Disord Rev 2011;19:256–68.

[6] Bamber D, Cockerill IM, Rodgers S, et al. Diagnostic criteria for exercise dependence in women. Br J Sports Med 2003;37:393–400.

[7] Boyd C, Abraham S, Luscombe G. Exercise behaviours and feelings in eating disorder and non-eating disorder groups. Eur Eat Disord Rev 2007;15:112–8.

[8] Landolf E. Exercise addiction. Sports Med 2013;43(2): 111–9.

[9] Freimuth M, Moniz S, Kim SR. Clarifying exercise addiction: differential diagnosis, co-occurring disorders, and phases of addiction. Int J Environ Res Publ Health 2011;8(10):4069–81.

[10] Egorov AY, Szabo A. The exercise paradox: an interactional model for a clearer conceptualization of exercise addiction. J Behav Addict 2013;2(4):199–208.

[11] Szabo A, Grifths MD, de La Vega Marcos R, et al. Methodological and conceptual limitations in exercise addiction research. Yale J Biol Med 2015;88(3):303–8.
[12] Baekeland F. Exercise deprivation. Sleep and psychological reactions. Arch Gen Psychiatr 1970;22(4):365–9.
[13] Weinstein A, Weinstein Y. Exercise addiction: diagnosis, biopsychological mechanisms and treatment issues. Curr Pharmaceut Des 2014;20(25):4062–9.
[14] Hausenblas HA, Downs DS. Exercise dependence: a systematic review. Psychol Sport Exerc 2002;3(2):89–123.
[15] Szabo A. Addiction to exercise: a symptom or a disorder? New York: Nova Science Publishers; 2010.
[16] E. Hartney, The difference between an addiction and a compulsion, Verywell Mind, 2023. Available at: https://www.verywellmind.com/the-difference-between-an-addiction-and-a-compulsion-22240. (Accessed 11 February 2024).
[17] American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th edition. Arlington VA: Author; 2022.
[18] National Eating Disorders Collaboration. Disordered Eating & Dieting. Available at: https://nedc.com.au/eating-disorders/eating-disorders-explained/disordered-eating-and-dieting#:~:text=Disordered%20eating%20sits%20on%20a,irregular%20or%20inflexible%20eating%20patterns. [Accessed 24 November 2023].
[19] Hewitt PL, Ge S, Flett GL. Canadian Psychological Association. "Psychology Works" Fact Sheet: Perfectionism. 2020. Available at: https://cpa.ca/psychology-works-fact-sheet-perfectionism/. [Accessed 24 November 2023].
[20] National Institutes of Health. National Cancer Institute. Physical Activity and Cancer. Available at: https://www.cancer.gov/about-cancer/causes-prevention/risk/obesity/physical-activity-fact-sheet. [Accessed 23 November 2023].
[21] Centers for Disease Control and Prevention. Physical Activity Boosts Brain Health. Available at: https://www.cdc.gov/nccdphp/dnpao/features/physical-activity-brain-health/index.html#:~:text=Physical%20activity%20can%20help%20you,of%20cognitive%20decline%2C%20including%20dementia. [Accessed 23 November 2023].
[22] American College of Sports Medicine. Exercise Is Medicine. Available at: https://www.exerciseismedicine.org/. [Accessed 30 November 2023].
[23] Corazza O, Simonato P, Demetrovics Z, et al. The emergence of exercise addiction, body dysmorphic disorder, and other image related psychopathological correlates in fitness settings: a cross sectional study. PLoS One 2019;14(4):e0213060.
[24] Scharmer C, Martinez K, Gorrell S, et al. Eating disorder pathology and compulsive exercise during the COVID-19 public health emergency: examining risk associated with COVID-19 anxiety and intolerance of uncertainty. Int J Eat Disord 2020;53(12):2049–54.
[25] Marques A, Peralta M, Sarmento H, et al. Prevalence of risk for exercise dependence: a systematic review. Sports Med 2019;49(2):319–30.
[26] Juwono ID, Szabo A. 100 cases of exercise addiction: more evidence for a widely researched but rarely identified dysfunction. Int J Ment Health Addiction 2021;19:1799–811.
[27] Szabo A, Demetrovics Z, Griffiths MD. Morbid exercise behavior: addiction or psychological escape?. In: Budde H, Wegner M, editors. The exercise effect on mental health: neurobiological mechanisms. Routledge; 2018. p. 277–311.
[28] Lichtenstein MB, Hinze CJ, Emborg B, et al. Compulsive exercise: links, risks and challenges faced. Psychol Res Behav Manag 2017 Mar 30;10:85–95.
[29] Compulsive Exercise Test. Available at: https://static1.squarespace.com/static/6372fb189c91484937a70591/t/637ee8ba8f09c66ced7574f5/1669261498250/Compulsive+Exercise+Test+%28CET%29+Pre+and+Post+LEAP.pdf. [Accessed 27 November 2023].
[30] Grima JS, Estrada-Marcén N, Montero-Marín J. Exercise addiction measure through the Exercise Addiction Inventory (EAI) and health in habitual exercisers. A systematic review and meta-analysis. Adicciones 2018 Jul 13;0(0):990.
[31] Griffiths MD, Szabo A, Terry A. The exercise addiction inventory: a quick and easy screening tool for health practitioners. Br J Sports Med 2005;39:e30.
[32] Egan SJ, Bodill K, Watson HJ, et al. Compulsive exercise as a mediator between clinical perfectionism and eating pathology. Eat Behav 2017 Jan;24:11–6.
[33] Davis C, Kennedy SH, Ravelski E, et al. The role of physical activity in the development and maintenance of eating disorders. Psychol Med 1994;24(4):957–67.
[34] Fairburn CG, Cooper Z, Shafran R. Cognitive behaviour therapy for eating disorders: a "transdiagnostic" theory and treatment. Behav Res Ther 2003a;41:509–28.
[35] Reel JJ, Conviser JH, Tierney AS. Body image and disordered eating among athletes. In: Marks DR, Wolanin, editors. A.T. and Shortway K.M., editors. The Routledge handbook of clinical sport psychology. New York, NY: Routledge; 2021. p. 77–94.
[36] Edwards CD, Aron CM. Obsessive–compulsive disorder in sports: beyond superstitions. Advances in Psychiatry and Behavioral Health 2023;3(1):43–55.
[37] Rizwan B, Zaki M, Javaid S, et al. Increase in body dysmorphia and eating disorders among adolescents due to social media: increase in body dysmorphia and eating disorders among adolescents. Pakistan BioMedical Journal 2022;148–52.
[38] Freedman J, Hage S, Quatromoni PS. Eating disorders in male athletes: factors associated with onset and maintenance. J Clin Sport Psychol 2021;15(3):227–48.
[39] Phillips KA, Kelly MM. Body dysmorphic disorder: clinical overview and relationship to obsessive-compulsive disorder. Focus 2020;19(4):413–9.
[40] Esco MR, Olson MS, Williford HN. Muscle dysmorphia: an emerging body image concern in men. Strength Condit J 2005;27(6):76.
[41] Pope CG, Pope HG, Menard W, et al. Clinical features of muscle dysmorphia among males with body dysmorphic disorder. Body Image 2005 Dec;2(4):395–400.

[42] Veale D, Eshkevari E, Kanakam N, et al. The appearance anxiety inventory: validation of a process measure in the treatment of body dysmorphic disorder. Behav Cognit Psychother 2014;42(5):605–16.
[43] Veale D, Anson M, Miles S, et al. Efficacy of cognitive behaviour therapy versus anxiety management for body dysmorphic disorder: a randomised controlled trial. Psychother Psychosom 2014;83:341–53.
[44] Compte EJ, Cattle CJ, Lavender JM, et al. Psychometric evaluation of the muscle dysmorphic disorder inventory (MDDI) among gender-expansive people. J Eat Disord 2022;10:95.
[45] Hildebrandt T, Langenbucher J, Schlundt DG. Muscularity concerns among men: development of attitudinal and perceptual measures. Body Image 2004;1:169–81.
[46] Mitchell L, Murray SB, Cobley S, et al. Muscle dysmorphia symptomatology and associated psychological features in bodybuilders and non-bodybuilder resistance trainers: a systematic review and meta-analysis. Sports Med 2017;47:233–59.
[47] Wells KR, Jeacocke NA, Appaneal R, et al. The Australian Institute of Sport (AIS) and National Eating Disorders Collaboration (NEDC) position statement on disordered eating in high performance sport. Br J Sports Med 2020;54:1247–58.
[48] Sundgot-Borgen J, Torstveit MK. Prevalence of eating disorders in elite athletes is higher than in the general population. Clin J Sport Med 2004;14:25–32.
[49] Aron CM, LeFay S, Rodriguez RR. Eating disorders in sport. In: Baron D, Wenzel T, Ströhle A, et al, editors. Sport and mental health. Cham: Springer; 2023.
[50] Javaras KN, Pope HG, Lalonde JK, et al. Co-occurrence of binge eating disorder with psychiatric and medical disorders. J Clin Psychiatry 2008;69:266–73.
[51] Meyer C, Taranis L, Goodwin H, et al. Compulsive exercise and eating disorders. Eur Eat Disord Rev 2011;19:174–89.
[52] Fairburn CG, Beglin S. Eating Disorders Questionnaire 6.0 (EDE-Q 6.0). Available at: https://www.corc.uk.net/media/1273/ede-q_quesionnaire.pdf. [Accessed 28 August 2023].
[53] Fairburn CG, Beglin SJ. Assessment of eating disorders: Interview or self-report questionnaire? Int J Eat Disord 1994;16:363–70.
[54] Limburg K, Bodill K, Watson HJ, et al. Validity of the compulsive exercise test in regular exercisers. Eat Disord 2021;29(5):447–62.
[55] Elbourne KE, Chen J. The continuum model of obligatory exercise: a preliminary investigation. J Psychosom Res 2007;62:73–80.
[56] Goodwin H, Haycraft E, Taranis L, et al. Psychometric evaluation of the Compulsive Exercise Test (CET) in an adolescent population: links with eating psychopathology. Eur Eat Disord Rev 2011;19:269–79.
[57] Lipsey Z, Barton SB, Hulley A, et al. "After a workout." Beliefs about exercise, eating and appearance in female exercisers with and without eating disorder features. Psychol Sport Exerc 2006;7:425–36.
[58] Formby P, Watson HJ, Hilyard A, et al. Psychometric properties of the compulsive exercise test in an adolescent eating disorder population. Eat Behav 2014;15:555–7.
[59] Shroff H, Reba L, Thornton LM, et al. Features associated with excessive exercise in women with eating disorders. Int J Eat Disord 2006;39:454–61.
[60] Edwards C. Mental health considerations for athlete removal from play and return to play planning. Sports Psychiatry 2023;1–15. https://doi.org/10.1024/2674-0052/a000058. . [Accessed 20 November 2023].
[61] American Academy of Pediatrics, American Academy of Family Physicians, American College of Sports Medicine, et al. Preparticipation physical evaluation. 5th ed. Itasca, IL: American Academy of Pediatrics; 2019.
[62] Ljungqvist A, Jenoure PJ, Engebretsen L, et al. The International Olympic Committee (IOC) consensus statement on periodic health evaluation of elite athletes. Clin J Sport Med 2009;19(5):347–65.
[63] Joy E. Eating disorders. In: Reardon CL, editor. Mental health care for elite athletes. Cham: Springer Nature; 2022.
[64] Gilman S. Coherence Associates Inc. Sports Psychology: Striving for Perfection in Sport – Does it help or hinder your performance?. Available at: https://www.coherenceassociates.com/blog/sports-psychology-striving-for-perfection-in-sport-does-it-help-or-hinder-your-performance. [Accessed 29 November 2023].
[65] Madigan D, Hill A, Mallinson-Howard S, et al. Perfectionism and performance in sport, education. And the workplace. Oxford Research Encyclopedia of Psychology; 2023. Available at: https://oxfordre.com/psychology/view/10.1093/acrefore/9780190236557.001.0001/acrefore-9780190236557-e-166.
[66] Stoeber J, Madigan DJ. Measuring perfectionism in sport, dance, and exercise: review, critique, recommendations. In: Hill AP, editor. The psychology of perfectionism in sport, dance and exercise. London, UK: Routledge; 2016. p. 31–56.
[67] Aron CM, Harvey S, Hainline B, et al. Post-traumatic stress disorder (PTSD) and other trauma-related mental disorders in elite athletes: a narrative review. Br J Sports Med 2019;53(12):779–84.
[68] BioMed Central Limited. Perfectionism and eating disorders: Complex issue. ScienceDaily 2013. Available at: www.sciencedaily.com/releases/2013/01/130121192019.htm.
[69] Boone L, Soenens B, Vansteenkiste M, et al. Is there a perfectionist in each of us? An experimental study on perfectionism and eating disorder symptoms. Appetite 2012;59(2):531–40.
[70] Wade TD, Tiggemann M. The role of perfectionism in body dissatisfaction. Journal of Eating Disorders 2013;1(1):2. . [Accessed 29 November 2023].
[71] Brown AJ, Parman KM, Rudat DA, et al. Disordered eating, perfectionism, and food rules. Eat Behav 2012;13(4):347–53.
[72] Sassaroli S, Lauro LJR, Ruggiero GM, et al. Perfectionism in depression, obsessive–compulsive disorder and eating disorders. Behav Res Ther 2008;46:757–65.

[73] Wade TD, O'Shea A, Shafran R. Perfectionism and eating disorders. In: Sirois F, Molnar DS, editors. Perfectionism, health, and well-being. Switzerland: Springer; 2016. p. 205–22.
[74] Taranis L, Meyer C. Perfectionism and compulsive exercise among female exercisers: high personal standards or self-criticism? Pers Indiv Differ 2010;49(1):3–7.
[75] Penniment KJ, Egan SJ. Perfectionism and learning experiences in dance class as risk factors for eating disorders in dancers. Eur Eat Disord Rev 2012;20:13–22.
[76] Hopkinson RA, Lock J. Athletics, perfectionism, and disordered eating. Eating and weight disorders studies on anorexia. Bulimia and Obesity 2004;9:99–106.
[77] Pensgaard AM, Sundgot-Borgen J, Edwards C, et al. Intersection of mental health issues and Relative Energy Deficiency in Sport (REDs): a narrative review by a subgroup of the IOC consensus on REDs. Br J Sports Med 2023 Sep;57(17):1127–35.
[78] Wasserfurth P, Palmowski J, Hahn A, et al. Reasons for and consequences of low energy availability in female and male athletes: social environment, adaptations, and prevention. Sports Med Open 2020;6:44.
[79] Marzuki MIH, Mohamad MI, Chai WJ, et al. Prevalence of relative energy deficiency in sport (RED-S) among national athletes in Malaysia. Nutrients 2023;15:1697.
[80] Sesbreno E, Dziedzic CE, Sygo J, et al. Elite male volleyball players are at risk of insufficient energy and carbohydrate intake. Nutrients 2021;13:1435.
[81] Walsh M, Crowell N, Merenstein D. Exploring health demographics of female collegiate rowers. J Athl Train 2020;55:636–43.
[82] Mountjoy M, Junge A, Magnusson C, et al. Beneath the surface: mental health and harassment and abuse of athletes participating in the FINA (Aquatics) world championships, 2019. Clin J Sport Med 2022;32:95–102.
[83] Burke LM, Close GL, Lundy B, et al. Relative energy deficiency in sport in male athletes: a commentary on its presentation among selected groups of male athletes. Int J Sport Nutr Exerc Metabol 2018;28:364–7.
[84] Langbein RK, Martin D, Allen-Collinson J, et al. "I'd got self-destruction down to a fine art": a qualitative exploration of relative energy deficiency in sport (RED-S) in endurance athletes. J Sports Sci 2021;39:1555–64.
[85] Langbein RK, Martin D, Allen-Collinson J, et al. It's hard to find balance when you're broken": exploring female endurance athletes' psychological experience of recovery from relative energy deficiency in sport (RED-S). Perform Enhanc Health 2022;10:100214.
[86] Vardardottir B, Olafsdottir AS, Gudmundsdottir SL. Body dissatisfaction, disordered eating and exercise behaviours: associations with symptoms of REDs in male and female athletes. BMJ Open Sport & Exercise Medicine 2023;9:e001731. . [Accessed 20 November 2023].
[87] International Olympic Committee. International Olympic Committee Relative Energy Deficiency in Sport Clinical Assessment Tool 2 (IOC REDs CAT2). Br J Sports Med 2023;57:1068–72.
[88] Stellingwerff T, Mountjoy M, McCluskey WTP, et al. Review of the scientific rationale, development and validation of the International Olympic Committee Relative Energy Deficiency in Sport Clinical Assessment Tool: V.2 (IOC REDs CAT2)—by a subgroup of the IOC consensus on REDs. Br J Sports Med 2023;57:1109–18.
[89] Buhlmann U, Glaesmer H, Mewes R, et al. Updates on the prevalence of body dysmorphic disorder: a population-based survey. Psychiatry Res 2010 Jun 30;178(1):171–5.
[90] NEDA Feeding Hope. Compulsive Exercise. Available at: https://www.nationaleatingdisorders.org/learn/general-information/compulsive-exercise. [Accessed 2 December 2023].
[91] NEDA Feeding Hope. Anorexia Nervosa. Available at: https://www.nationaleatingdisorders.org/learn/by-eating-disorder/anorexia. [Accessed 2 December 2023].
[92] NEDA Feeding Hope. Bulimia Nervosa. Available at: https://www.nationaleatingdisorders.org/learn/by-eating-disorder/bulimia. [Accessed 2 December 2023].
[93] Mountjoy M, Ackerman KE, Bailey DM, et al. 2023 International Olympic Committee's (IOC) consensus statement on Relative Energy Deficiency in Sport (REDs). Br J Sports Med 2023;57:1073–97.