Role of the Athletic Trainer in Protecting Athletes at Risk of Low Energy Availability

Know the signs and don't be afraid to ask the tough questions

By Christina Scribner, MS, RD, CSSD, CEDRD, NBC-HWC

We yearn to see our athletes ascend to the top of the podium. How do we encourage, motive and nudge our athlete while simultaneously expressing that we care enough to hold the line and not yield to the lure of temporary success at the expense of health?

The culture of the athlete is broad in the sense that it includes both males and females, all sports, all levels of competition and spreads across nations, races and ethnicities. The fitness and sports industry is fueled by a culture that places strong emphasis and value in extremes of performance and appearance that may lead to unhealthy nutritional practices.

It is imperative that professionals in exercise science recognize nutritional threats among athletes and take steps to protect the athlete. The athlete who is not well-nourished is at risk of both short-term and long-term health complications,[1] and the professional is held accountable for protecting the athlete regarding what could or should be known about the athlete's health status to participate in exercise and competitive sport.

Low Energy Availability – The Triad and RED-S

The potential health consequences of insufficient energy intake among athletes is the subject of both the Female Athlete Triad (the Triad) and Relative Energy Deficiency in Sport (RED-S). Energy availability (EA) is an operational term that describes the amount of energy available for healthy physiological function above exercise energy expenditure (EEE), calculated as the additional energy to support activities of daily living and bouts of exercise. EA is expressed relative to fat-free mass (FFM), reflecting the most metabolically active body tissues (EA equals caloric intake minus caloric expenditure per kilogram of fat-free mass).[1]

In 1992, the American College of Sports Medicine (ACSM) recognized health risks to females and defined the Triad as three separate, yet interrelated entities: disordered eating and low energy availability (LEA); menstrual disturbance and amenorrhea; and bone loss and osteoporosis along a continuum ranging from health to disease.[2] The Triad was updated in 2007 and again in 2013. Figure 1 conceptualizes spectrum of interrelationships between EA, menstrual function and bone health in females.[3]

Energy intake was evaluated based upon the amount of energy available for physical activity and that LEA may result for a variety of reasons, with or without an eating disorder. While the three disorders may occur as inter-related, they may also exist alone or as independent entities.[4]

There is potential for misunderstanding regarding the terms EA and energy balance (EB). The concepts are similar and related. EA is often used as it relates to exercise training and performance. EB is discussed as the state of balance between energy intake and energy output; imbalance affects body composition and weight. It is expected that one can assess adequacy or inadequacy of habitual energy intake by monitoring body weight. [5] However, EB is not as simple as it initially appears as there are a plethora of factors that regulate and influence both the "intake" and "expenditure" sides of the energy balance equation. Our understanding of EB has progressed from a static (linear process) to a "dynamic" (non-linear process) explained by evidence that altering

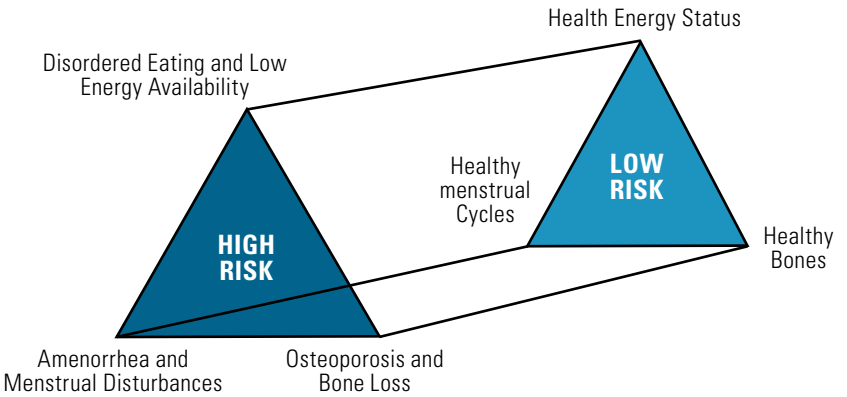

FIGURE 1. FEMALE ATHLETE TRIAD

either energy intake or energy expenditure influences both biological and behavioral factors that alter the EB equation "in unpredictable and unintended ways."[6]

The Institute of Medicine explains that the body is capable of diverting energy use based on "adaptation" and "accommodation." Adaptation describes a change in the body that supports maintenance of function even when steady-state conditions have been altered. An example of adaptation is increased hemoglobin to carry oxygen at high altitudes. Accommodation is an adaptive process that supports survival "in more or less serious consequences on health or physiological function."[5] When energy intake is insufficient, available energy will be diverted toward functions essential to immediate survival (body temperature regulation, metabolism and activity of daily movement) at the cost of reducing energy available for "nonessential" functions (functions that are not essential for survival in the short term, such as growth and development, reproduction and resting metabolic rate).[1, 10]

There is no simple method for accurately identifying an individual's healthful body weight range. A BMI of less than 17.5 kg/m2, less than 85 percent expected body weight for adolescents or more than 10 percent weight loss in one month have been proposed as markers for LEA.[8] While these benchmarks may signal LEA, they will likely miss identifying many people suffering from LEA. Among those who suffer from anorexia nervosa, a "significantly low body weight" is hallmark to the diagnosis, yet the American Psychiatric Association allows for clinical judgement as to what constitutes "too low" for an individual, rather than specifying a BMI threshold.[9] While most people will recognize an adult with a BMI of 17 or below as low body weight, a BMI between 17 and 18.5 or even great may also be considered low weight depending on the individual and physical complications related to malnutrition such as bradycardia, hypothermia and hormonal abnormalities.[10] Similarly, leaving the criteria loosely defined allows the clinician working with a child or adolescent the wiggle room to consider previous growth trajectory from growth charts in addition to behavior and physical complications – it also adds to the complexity of decision-making.

The International Olympic Committee (IOC) introduced the syndrome RED-S[4] in 2014. RED-S updated the Triad's recognition of risks described in female athletes to include males, various ethnicities and expands upon the psychological and physical health consequences of LEA. More recently, the RED-S 2018 update[1] reflects the current state of science, includes considerations for para-athletes and identifies limitations in the clinical assessment of LEA, discusses non-pharmacological and pharmacological treatment strategies for RED-S with and without disordered eating/eating disorders and raises greater awareness for RED-S.

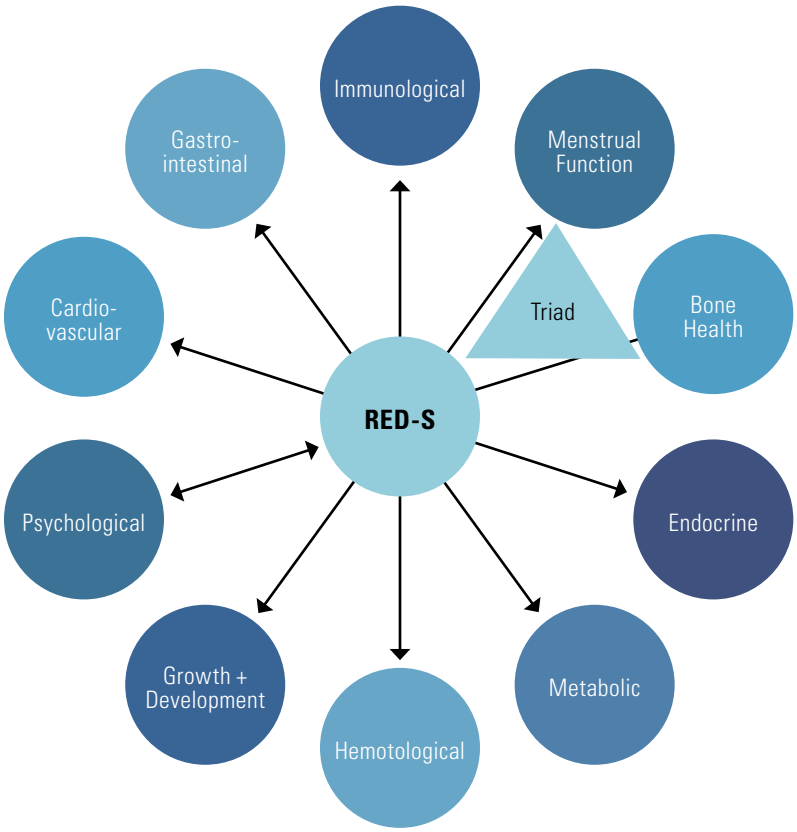

FIGURE 2. HEALTH CONSEQUENCES OF RED-S EXPANDING THE CONCEPT OF THE TRIAD[1]

Lack of an accurate and practical tool for the measurement of LEA complicates identification of risk, yet there is clear potential for physiological complications (metabolic, cardiovascular, endocrine, gastrointestinal, bone and others) among both males and females as depicted by RED-S, with psychological consequences that may either precede RED-S or be the result of RED-S.[1] (See Figure 2.)

Figure 3 conceptualizes potential performance consequences to RED-S, which are likely to engage the attention of the athlete and coach.[1]

The athlete may be in a state of LEA for a variety of reasons, including intentional dietary restriction or unintentional under-eating. Athletes may lack information about their nutritional needs, lack access to food, have limited financial resources or engage in cultural practices that place restriction on eating or types of foods. In addition, inordinate amounts of energy used for exercise may result in LEA.[1,11]

Screening and Prevention

Early identification of LEA is essential to prevention of long-term health consequences described by RED-S. It has been suggested that the determination of LEA be determined by coaches and athletic trainers via assessing a 24-hour dietary intake, EEE and FFM in the field setting,[7] yet there is much potential for error in this seemingly simple equation that limit its accuracy and application.

Each component in the EA equation is an estimate. The gold standard method for measuring energy expenditure from activity is by measurement of heat output with a metabolic chamber rather than based on calculations. The 2018 IOC RED-S update

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underscores difficulties in accurately assessing EA.[1] There are numerous potential errors in estimating EEE, including omission of forms of physical activity such as recreational or lifestyle activity, methods of collecting and assessing data on dietary intake, EEE and body composition, the time frame difference between inadequate intake that results in LEA and assessment of EA, and other dietary factors including dietary fiber and the distribution of energy intake over the day.[1] Furthermore, non-exercise activity thermogenesis (NEAT) may contribute to inaccuracy. Wearable devices used to assess the energy cost of physical activity are fraught with variability in their accuracy.[12] The actual energy expended by an individual is complicated by factors such as sleep patterns and circadian rhythm[13] and stress can affect endocrine homeostasis and energy availability through both metabolic and psychogenic components.[14]

While optimal EA is typically identified at about 45 kcal/kg FFM/d plus the amount of energy needed for physical activity, an EA of less than 30 kcal/kg FFM has historically been identified as a target threshold for LEA. Yet, there is not a specific threshold at which energy availability is clearly "too low."[1] Among females, the pathways that signal reproductive and menstrual function are complex. There is a range of energy intakes that are associated with menstrual disturbances[1] and while severe energy deficiency is frequently associated with amenorrhea, the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5)[9] removed amenorrhea as a diagnostic criteria for anorexia nervosa since many girls and women who severely restrict their food intake continue to have their menstrual periods.

Intervention

As health care professional, you are in a position to help bridge the gap between the world of your athlete/client and health care, especially if you have an understanding relationship with your athletic clients. What can and should you do to improve the health and performance of your clients, as well as protect yourself and your facility? Instructors, athletic trainers and coaches need to identify individuals who may be inadequately fueled, suffering from LEA and at risk for RED-S. As a multidisciplinary member of your athlete's performance team, you play an important role in the prevention, early recognition and risk management of unhealthy eating and activity-related behaviors.

There is a lack of scientifically validated prevention interventions.[1] Yet, there is a need to recognize both physical and psychological markers of LEA and address them through modification of exercise and nutritional intake.

The NATA statements[15] define the athletic trainer's responsibilities to their athletes. Recommendations of national organizations, such as the 2015 IOC RED-S Clinical Assessment Tool (CAT)[16] and Female Athlete Triad, guide athletic trainers in clearance to participate or return to play. Legal duties flow from the athletic trainer-athlete relationship, including:

- The duty to assess the athlete's condition
- The duty to monitor the athlete
- The duty to evaluate and refer the athlete for medical treatment

Signs or symptoms of dysfunction (energy deficiency relative to energy intake or exercise dependence) or an eating disorder warrant a thorough medical examination for safe participation. Athletic training program protocols may vary regarding return to play.

The RED-S CAT utilizes a red-yellow-green stoplight metaphor to categorize varying levels of risk and guide participation in activity/return to play: red light means high risk; yellow light means moderate risk; and green light means low risk. The RED-S CAT may assist clinicians in identifying athletes at risk and managing the play decisions related to LEA and RED-S risk. As the body of science related to the health and performance risks of LEA in both female and male athletes evolve, it is expected that the RED-S CAT will be further developed to protect athletes' health and improve performance.

While it may feel awkward to pose questions related to reproductive function and mental health, remember that appearances can be deceiving, and it is risky to presume health based on good performance. Athletes may not be forthcoming about their health, but when the athletic trainer, who holds a position of trust and authority, asks the tough questions in a compassionate and matter-of-fact way, it may reduce fear and raise the odds for truthfulness and protection of the athlete.

Strategies for reducing risk for LEA, RED-S and addressing disordered eating or eating disorders include:

- Adopt a stance similar to the U.S. Figure Skating Policy on Health and Well-Being[17] which promotes competitive success and achievement of personal athletic potential, without compromising the long-term health and well-being of athletes.
- Utilize screening tools such as the Periodic Health Examination and Preparticipation Physical Exam.[1]
- Develop mandatory educational programs to improve awareness of LEA and RED-S.1
- Understand and convey the performance consequences of RED-S to coaches and athletes.[1]
- Provide education about the health consequences of the female athlete triad and RED-S to male and female athletes for recognition of the nutrition and health requirements necessary for safe participation in sport.[18]
- Include nutrition in the training program, specifically utilizing a sports dietitian.[18]
- Promote open communication and avoid secrecy surrounding disordered eating or eating disorders.
- Express empathy and understanding. Maintain a compassionate and nonjudgmental tone. Don't judge or criticize. The sense of trust will determine if the client is honest with you; dishonesty often results from shame and guilt.
- If you suspect an eating disorder, make a referral. Explain that an evaluation with a medical specialist is necessary. Include your client in the process, look for providers together, and review a list of referrals in your area (be prepared). A referral to a specific person you have recommend is more apt to be accepted.
- Emphasize that health is of paramount importance and you aren't taking any chances with a valuable life.

Athletes often want to push the limit and raise the bar for performance. At the same time, they recognize that there are limits and conditions for optimal performance, and there are consequences to going too far. Athletic trainers play an important role in protection of the athlete's health. Know the risks related to relative energy deficiency and the basic criteria for diagnosis of eating disorders. Don't be scared to intervene and be prepared with resources for further education, support and treatment.

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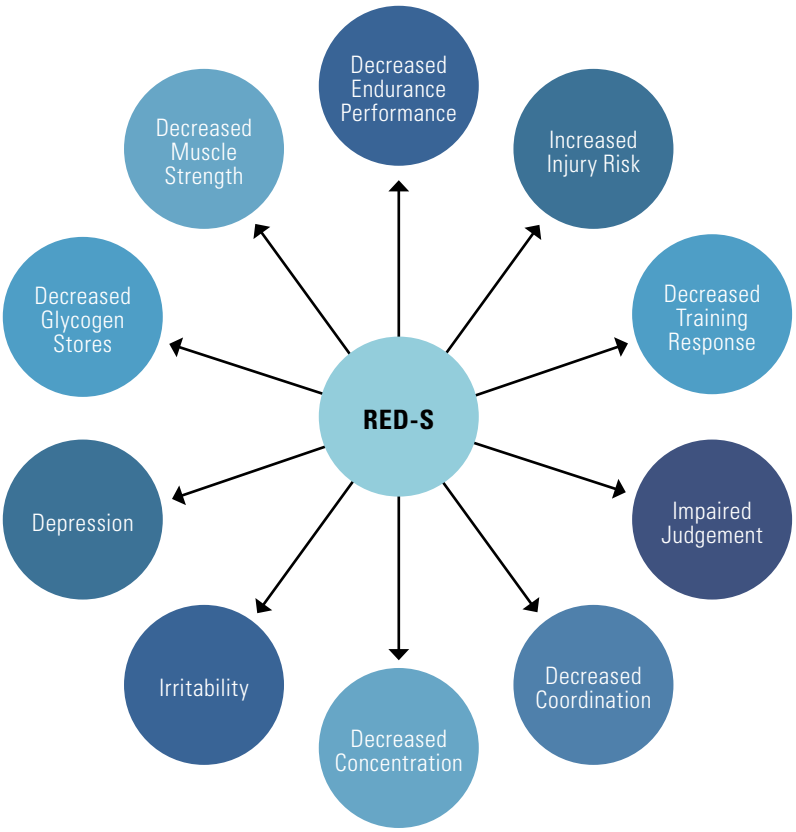

FIGURE 3. POTENTIAL PERFORMANCE CONSEQUENCES OF RED-S[1]

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