RELATIVE ENERGY DEFICIENCY IN SPORT (REDS) – AWARENESS, IDENTIFICATION, AND MANAGEMENT

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INTRODUCTION

Relative energy deficiency in sport (REDs, also referred to as RED-S in literature) is a condition that affects both male and female athletes, resulting from low energy availability (LEA), a state where caloric intake is insufficient to support both training demands and essential physiological functions (2). Originally recognized in female athletes as the female athlete triad, research now confirms that male athletes experience similar negative effects, including hormonal disturbances, such as reduced testosterone and elevated cortisol, decreased bone density, increased risk of stress fractures, suppressed immune function leading to higher illness rates, reduced protein synthesis and muscle recovery, and psychological disturbances including low mood and decreased motivation (10,11). Collectively, these factors contribute to impaired performance, delayed recovery, and long-term health risks for both men and women (11).

Despite increased awareness, REDs remains underdiagnosed and often mistaken for overtraining, burnout, or simply the price of elite performance. Strength and conditioning coaches are uniquely positioned to identify early warning signs because of their daily interaction with athletes in training environments. Subtle but consistent changes, such as reduced lifting capacity, slower recovery between sessions, frequent illness, or a decline in motivation may signal LEA. Strength and conditioning coaches can take proactive steps by monitoring training loads, encouraging open dialogue about nutrition and recovery, and collaborating with athletic trainers, dietitians, and sports medicine staff when concerns arise. By framing REDs as a performance and health issue, not just a nutrition problem, strength and conditioning coaches can play a pivotal role in prevention, early intervention, and referral, helping athletes maintain both competitive success and long-term well-being.

This article aims to equip collegiate strength and conditioning coaches, athletic trainers, and student-athlete support staff with the knowledge and tools necessary to identify, prevent, and manage REDs among college athletes. By understanding its physiological consequences, recognizing risk factors, and implementing targeted nutrition, recovery, and training strategies, collegiate strength and conditioning coaches can help student-athletes sustain peak performance, academic balance, and long-term health.

PHYSIOLOGICAL IMPACT

REDs stems from prolonged or severe LEA in athletes, where energy intake is unable to meet energy expenditure required for sport and daily activities (2,10). LEA frequently occurs in aesthetic sports (e.g., gymnastics, figure skating) where athletes are pressured to maintain a lean physique for appearance-based scoring, and in endurance sports (e.g., cross country, cycling) where athletes are often encouraged to minimize body mass to improve power-to-weight ratio. In both cases, athletes may restrict caloric intake in an attempt to enhance performance or meet body image expectations (5). Eating disorders, massive caloric restriction, and rapid weight loss are risk factors for LEA. Other factors could include ignorance of proper nutrition or adequate recovery, poor nutrition planning, diets, overtraining, repetitive injury, or high levels of training and unintentional underconsumption of energy (5). The physiological consequences of REDs are extensive and include impairments to metabolic rate, immune system functioning, protein synthesis, and cardiovascular health (2).

A common consequence of LEA is low bone mineral density, bone area, and bone strength, which can lead to bone stress fractures (1). Inadequate nutrition and energy can cause a decrease in the body's ability to maintain bone health. Research shows that bone mineral density is significantly lower in athletes with REDs compared to both strength and endurance athletes without REDs, reflecting the consequences of catabolic bone metabolism (13). This not only affects bone health but can also disrupt muscle function, recovery, and overall performance (4,8). Hormonal disturbances, such as reduced testosterone in males and menstrual dysfunction in females, also contribute to the negative physiological effects seen in REDs (2,6).

Additionally, athletes with REDs may experience changes in eating behavior, mood disturbances such as anxiety or irritability, persistent fatigue, and decreased motivation to train or compete (5). When combined with the psychological stressors of collegiate athletics, including academic pressures, time management challenges, social expectations, competition for playing time, and the demands of travel, these variables amplify both the physical and mental strain associated with the syndrome (4). Because such physiological and psychological disturbances are often masked by athletes' outward performance or hidden within team culture, it is essential to practice early detection and consistent monitoring rather than relying solely on observable outcomes.

COACHING CONSIDERATIONS

Strength and conditioning coaches play a pivotal role in the early detection and management of REDs within the collegiate setting. Because symptoms often emerge subtly and progress gradually, attentive monitoring is essential. While some athletes may show clear performance-related warning signs, such as consistent declines in strength, speed, or endurance despite adequate training stimulus, others may maintain or even temporarily improve performance despite underlying energy deficiency, masking the condition. This makes it critical to evaluate performance outcomes and recovery patterns, as REDs athletes often experience prolonged soreness, delayed recovery regardless of training intensity, or recurrent illness and injury. Strength and conditioning coaches are uniquely positioned to observe day-to-day fluctuations in training response, track load versus recovery, and notice behavioral red flags, such as heightened anxiety around food, excessive exercise beyond prescribed training, or withdrawal from team meals. Physical health markers, including stress

fractures, menstrual irregularities in female athletes, and growth disturbances in adolescents, are additional indicators that warrant follow-up. Because strength and conditioning coaches interact with athletes in high-frequency, performance-driven contexts, they are integral members of the athletic care team, serving as the first line of observation and referral for sports medicine and nutrition professionals. Importantly, any concerns should be raised in a private and supportive manner to protect the athlete's well-being. Research underscores that strength and conditioning coaches can provide critical frontline surveillance for REDs, particularly by monitoring recovery, training adaptations, and psychosocial indicators that may otherwise be overlooked (9).

Early detection of REDs symptoms is a simple way to prevent the syndrome from progressing and producing long-term effects. A great way to do this is through a questionnaire, asking athletes questions regarding their nutrition, training, and overall well-being (2,11). Sample questions are provided in Tables 1 and 2 and were derived from the Low Energy Availability in Females Questionnaire (LEAF-Q) and the Low Energy Availability in Males Questionnaire (LEAM-Q) (7,14). Personal interviews are another way strength and conditioning coaches can identify any abnormal behaviors in their athletes (11). A simple way to ensure regular assessment is by integrating REDs screenings into pre-season assessments and mid-season check-ins in a private yet comfortable environment for the athlete. Following the screenings, it is important for strength and conditioning coaches to discuss the results with clinicians to ensure proper diagnosis and provide appropriate treatment. Blood work may be helpful for early detection of REDs by identifying hormone dysfunction in males, such as low testosterone and elevated cortisol, because these changes are not as visible.

In addition to screening, strength and conditioning coaches can take proactive steps to create an environment that minimizes the risk of REDs. Reducing emphasis on weight management and instead prioritizing more effective strategies to achieve optimal performance is necessary (8). Strength and conditioning coaches should emphasize the importance of proper nutrition, adequate sleep, and overall health as opposed to encouraging athletes to meet certain weight or body image goals. One way to identify gaps in nutrition and assess energy availability is by encouraging athletes to record their food intake for a short period, such as one week (5).

However, in team settings, individualized food tracking may be impractical due to the time and workload required to review everyone's food diaries. In these contexts, strength and conditioning coaches can implement more feasible strategies to foster nutrition awareness. For example, initiating brief team discussions about pre- and post-practice fueling during warm-ups or stretching sessions can help normalize conversations about nutrition. Encouraging athletes to share examples of what they eat before and after training can promote peer learning and accountability, allowing athletes to model healthy fueling behaviors for one another.

These informal discussions allow strength and conditioning coaches to monitor general trends in energy availability without the burden of reviewing individual records. More importantly, they create consistent opportunities for athletes to communicate changes in their eating habits, energy levels, or recovery status, which are indicators that may suggest LEA or early signs of REDs. This proactive, team-based approach supports ongoing education about proper fueling and serves as an early detection tool that helps identify potential cases of REDs before they progress. By creating a team culture that values health, communication, and adequate energy intake, strength and conditioning coaches can significantly reduce the likelihood of REDs developing and promote both long-term well-being and optimal performance (8).

PRACTICAL INTERVENTIONS

The treatment of REDs primarily focuses on increasing energy availability through nutrition and training adjustments.

NUTRITION

Adequate nutrition is essential when treating REDs because energy intake is the most direct way for athletes to improve energy availability. Athletes should eat regular meals throughout the day, including breakfast, lunch, dinner, and snacks, to ensure appropriate energy availability for training and competition (2,4). The timing of meals is also important, as athletes should consume carbohydrates before and during exercise to provide active muscles with enough fuel (4). Table 3 elaborates on proper nutrient timing; it also provides the purpose for consuming certain nutrients at specific times and some examples of ways to achieve proper nutrition before, during, and after exercise. Athletes may unknowingly consume high-fiber, low-calorie diets that further limit energy availability. Instead, athletes should opt for low-fiber, high-energy foods to address energy availability (4). In addition, sufficient intake of bone-building micronutrients, such as calcium, protein, magnesium, phosphorus, Vitamin D, potassium, and fluoride, should be ensured to keep bone health at desirable levels and reduce risk of stress fractures (4,8).

TRAINING

Caloric consumption should continue to be the primary intervention, as high training loads will only benefit the athletes if they possess sufficient energy to adapt and recover (1,2,4). Training should be adjusted to match energy availability and prevent further physiological stress. This can be accomplished by reducing training volume and intensity, prioritizing resistance training over high-impact cardio, optimizing rest and recovery, and following return-to-play protocol for REDs recovery (9).

For an athlete diagnosed with REDs, strength and conditioning coaches should consider substantially lowering the training load and limiting prolonged endurance sessions during recovery from the syndrome (2). Also, strength and conditioning coaches should prioritize resistance training to improve bone health and preserve muscle mass while reducing excessive energy expenditure. Resistance training exercises should focus on

multi-joint movements, such as squats, deadlifts, and overhead presses, that are performed 2 – 3 times a week for 3 – 5 sets at 8 – 12 repetitions for each set (1). There is no need to perform repetitions until failure because this can cause added stress, but the load should require high amounts of effort (60 – 80% of one-repetition maximum [1RM]) (1). It remains imperative for strength and conditioning coaches to stay cautious when implementing resistance training, especially for those with disordered eating or low bone mineral density because of their increased risk for stress fractures (1). Training programs should be individual-specific and based on the athlete's energy levels and recovery status.

Following training, it is crucial for strength and conditioning coaches to emphasize and help athletes with REDs optimize rest and recovery. They can implement this by increasing rest days per week; for example, increasing rest days from one day a week to two or three per week. Strength and conditioning coaches should encourage active recovery sessions like mobility work, swimming, or yoga. Sleep disturbances are common in athletes with REDs, so strength and conditioning coaches should monitor resting heart rate and sleep quality to ensure the athlete is receiving adequate rest and excellent sleep.

PSYCHOLOGICAL SUPPORT

Successful treatment of REDs cannot be achieved without also addressing psychological stressors associated with the syndrome. Athletes experiencing REDs often struggle with disordered eating, body image dissatisfaction, and heightened performance anxiety, all of which contribute to and exacerbate LEA (9). Male and female athletes alike may feel pressured to conform to sport-specific body ideals, such as leanness, strength, or speed, which can reinforce restrictive eating and excessive training behaviors (12). Strength and conditioning coaches are uniquely positioned to observe early warning signs such as preoccupation with weight, withdrawal from team meals, compulsive exercise outside prescribed training, or emotional distress following performance setbacks.

Addressing these psychological dimensions requires both vigilance and supportive communication. Strength and conditioning coaches should foster an environment that emphasizes health, resilience, and long-term development over body composition or short-term performance metrics. Using athlete-centered language and private, nonjudgmental check-ins can help reduce stigma and encourage athletes to share concerns. Emphasizing the normalcy and importance of psychological support, including counseling and therapy, can help athletes view mental health care as integral to performance, not separate from it (10). Strength and conditioning coaches should also recognize the limits of their scope of practice: while they can provide encouragement, normalize help-seeking behaviors, and reinforce healthy messaging, referrals to qualified mental health professionals are essential for treatment. Ultimately, a multidisciplinary approach involving nutritionists, athletic trainers, sports psychologists, and counseling services offers the best pathway to recovery and prevention of REDs-related complications (10).

EXAMPLE: REDS IN A COLLEGIATE MALE BASKETBALL PLAYER

A 20-year-old male collegiate basketball player presented to his athletic training staff with persistent fatigue, declining motivation, and recurring stress fractures in the foot and tibia despite modifications to practice intensity. Blood work indicated low testosterone and elevated cortisol levels, consistent with REDs. The athlete reported restricting calories in an effort to "stay lean and quick," frequently skipping breakfast, limiting carbohydrate intake, and avoiding post-practice team meals due to body image concerns. Teammates and coaches noted decreased explosiveness on the court, slower recovery between practices, and diminished performance during late-game situations, though he occasionally maintained adequate performance in short, controlled drills, thus masking the severity of his energy deficiency.

Based on the clinical evaluation, he was classified as moderate-to-high risk for REDs. A coordinated treatment plan was developed involving the athletic trainer, sports dietitian, strength and conditioning coach, and campus counseling services. Nutritional interventions focused on structured meals and snacks to increase overall energy intake, with specific emphasis on carbohydrate timing before and after practices and games. Training load was reduced by approximately 25%, with added emphasis on resistance training to preserve lean mass, individualized recovery strategies, and monitored return-to-play progression. Counseling sessions targeted body image concerns, stress management, and coping with student-athlete pressures.

After 10 weeks, the athlete demonstrated improved mood, normalized hormone levels, resolution of bone pain, and enhanced recovery between practices. His on-court performance gradually returned to baseline, particularly in sustained efforts requiring repeated sprints and explosive jumps. This case underscores the importance of early detection, psychosocial support, and the vital role of the strength and conditioning coach as part of the athlete's interdisciplinary care team in monitoring training responses, identifying red flags, and facilitating communication among providers. Proactive, coordinated management is critical for protecting both the performance and long-term health of male collegiate athletes at risk for REDs (9).

CONCLUSION

As awareness of REDs continues to grow, so must the role of strength and conditioning coaches in its prevention and management. While REDs can have severe consequences on an athlete's bone health, metabolism, hormone function, and performance, early detection and intervention can prevent long-term damage.

To support their athletes effectively, strength and conditioning coaches should:

- Implement regular screenings using validated questionnaires and personal interviews.
- Encourage proper nutrition by emphasizing energy balance and educating athletes on fueling strategies.
- Modify training programs and recovery based on an athlete's energy availability, ensuring that performance goals do not come at the expense of health.
- Foster a positive performance culture that prioritizes strength, resilience, and well-being over weight and body composition.

REDs is more likely to be prevented or identified early when strength and conditioning coaches take a proactive, informed approach. By integrating evidence-based screening, training, and nutrition strategies, as well as collaborating with medical and nutrition professionals, strength and conditioning coaches can help reduce risk and support safer, more sustainable performance.

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TABLE 1. SAMPLE QUESTIONNAIRE FOR FEMALE ATHLETES

Have you noticed unexplained fatigue or frequent illness?
Have you experienced persistent muscle soreness or prolonged recovery?
How many days were you absent from training or competition due to injury?
How often do you have bowel movements on average?
Has your period ever stopped for three consecutive months or longer?
Have you noticed your menstruation change when you increase exercise intensity, frequency, or duration? If yes, how so?

TABLE 2. SAMPLE QUESTIONNAIRE FOR MALE ATHLETES

Have you noticed unexplained fatigue or frequent illness?
Have you experienced persistent muscle soreness or prolonged recovery?
How many days were you absent from training or competition due to injury?
How often do you have bowel movements on average?
Have you noticed a decrease in sex drive or morning erections?

TABLE 3. NUTRITION TIMING

WHEN	FOCUS	PURPOSE	EXAMPLES
Before and During Exercise	Carb + fluid	Provide energy and hydration for optimal performance	Pretzels + water, banana + Gatorade, granola bar + Powerade
After Exercise	Protein + carb + fluid	Provide energy and build/maintain muscle for optimal recovery	Smoothie, chocolate milk, Greek yogurt, balanced meal

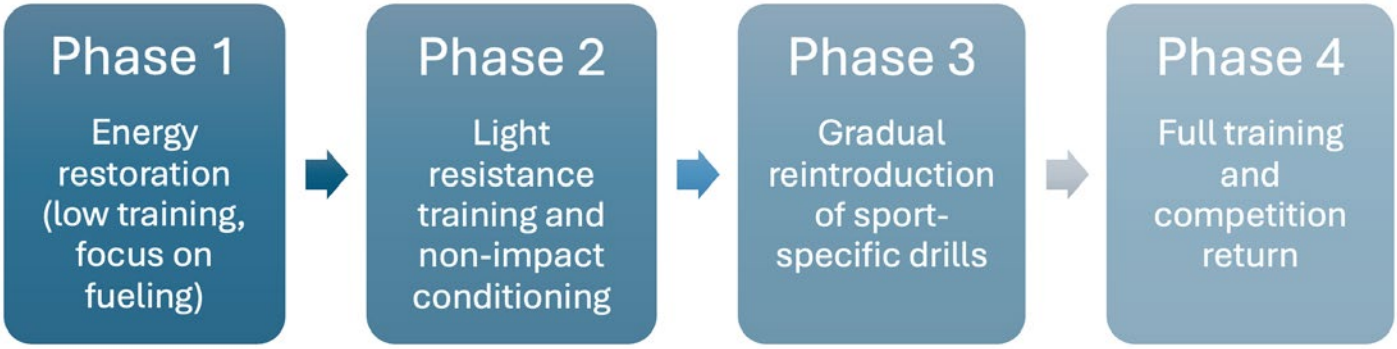

FIGURE 1. RETURN-TO-TRAINING PROTOCOL FOR REDS RECOVERY

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