

Prolonged mismatch between calories eaten and burned may be putting many athletes at risk

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The estimated prevalence of relative energy deficiencies (REDs) varies by sport, ranging from 15% to 80%. The syndrome often goes unrecognized by athletes themselves, their coaches, and team clinicians, and may unwittingly be exacerbated by the "sports culture," because of the perceived short term gains on performance from intentionally or unintentionally limiting calorie intake, warns the Statement.

REDs was first recognized as a distinct entity by the IOC in a 2014 [consensus statement](#). This latest consensus, informed by a panel of international experts, draws on key advances in REDs science over the past 5 years, with the aim of promoting wider recognition and prevention of the syndrome and optimizing athlete health, psychological well-being, and performance.

In particular, the Statement highlights new evidence on the emerging role of inadequate carbohydrate intake; the overlap between REDs and overtraining syndrome; the time course of REDs development; the interplay between mental health and REDs; and advances in the understanding of the syndrome in male [athletes](#) and para athletes.

And it includes a summary of practical clinical guidelines both for assessing persistent calorie deficit and for safe body composition measurement that deliberately excludes under-18s, plus an updated clinical assessment tool (IOC REDs CAT2) incorporating a 4-color traffic light system to assist accurate diagnosis and assessment of risk/severity.

This ranges from full participation in training and competition (green) to continued monitoring (yellow) through to intensive medical interventions and monitoring (orange) all the way to full medical support, coupled with possible removal from competition and training (red).

A deficit in the amount of available energy needed to maintain optimal health and athletic performance is referred to as low energy availability (LEA), explains the Statement.

In the short term, the body is able to adapt to this, a process known as "adaptable LEA," but it isn't able to cope with large, prolonged, and frequent deficits in available energy, known as "problematic LEA," which leads to REDs, highlights the Statement.

While age, gender, genes, external factors and behaviors may worsen or mitigate the effects, these can be many and varied as the body is forced to divert energy from processes involved in growth, reproduction, and maintenance, says the Statement.

The effects of REDs on the body can include:

- Hormonal disturbances, loss of periods, erectile dysfunction, low libido
- Weakened bones, susceptibility to stress fractures
- Abdominal pain, cramps, bloating
- Impaired energy metabolism
- Low iron, insufficient red blood cell oxygen carrying capacity (hemoglobin)
- Urinary incontinence
- Impaired glucose and blood fat (lipid) metabolism
- Depression, exercise dependence/addiction, eating disorders
- Impaired cognitive skills, such as memory, decision-making, spatial awareness

- Sleep disturbances
- Heart rhythm and blood flow abnormalities
- Reduced muscle function
- Reduced growth and development
- Impaired immunity

It also affects performance, and can manifest as:

- Reduced availability for training and competition as a result of injury/illness
- Reduced response to training
- Taking longer to recover from training/competition
- Slowed reaction times
- Reduced motivation, low mood
- Lower muscle strength
- Reduced endurance capacity
- Reduced performance power

The latest advances in REDs science outlined in the Statement include:

Carbohydrate intake

Recent research shows that low carbohydrate availability speeds up the development of REDs as it's associated with poor bone health, lowered immunity, and depleted iron, and sometimes in the absence of LEA, highlights the Statement.

Overlap with overtraining syndrome

There's considerable overlap between the symptoms of REDs and overtraining syndrome. This occurs when an athlete doesn't adequately recover after repetitive intense training, and can include fatigue,

declining performance, and susceptibility to injury. This overlap emphasizes the importance of excluding low energy and/or low carbohydrate availability before diagnosing overtraining syndrome, says the Statement.

Time course of REDs development

The evidence for this is still emerging, notes the Statement, with short-term LEA starting to be defined as a few days to weeks, medium-term as weeks to months, and long-term as months to years. But further scientific validation is required, as the time course may differ between the sexes, and change according to the severity and duration of LEA, cautions the Statement.

Mental health

Short term intentional or unintentional LEA can boost performance and garner approval from the coach and the sports culture, notes the Statement, but these short term "positives" make it even more challenging for athletes to recognize the longer term implications of REDs, it points out.

Disordered eating behaviors, eating disorders, and/or REDs are relatively common among some athletes, says the Statement, and may be worsened by social media, societal pressures, the athlete's training/coaching entourage, a belief that a specific physique/weight/appearance will improve performance and/or overall body dissatisfaction.

The picture is still unclear, however, as to whether the dynamics of [mental health](#) and eating disorders differ by sex, competition level, and physical disabilities, notes the Statement.

REDs in male athletes

Only 20% of research studies published between 2018 and 2022 have included male athletes. Although the outcomes of REDs are similar to those found in [female athletes](#), it seems as if the threshold of available energy before REDs symptoms appear is lower than that proposed for female athletes, the evidence suggests.

Two emerging potential indicators of REDs in male athletes are low libido and decreased morning erections, both of which have been identified as physiological consequences of problematic LEA, says the Statement.

Para athletes

The estimated prevalence of REDs in para athletes is unknown, but they may be at even higher risk of problematic LEA and eating disorders than able-bodied athletes, the evidence suggests.

To raise awareness of REDs among athletes, coaches, sports scientists, and health care professionals, the Statement includes a set of visual wheels (REDs conceptual models), showing the health and performance effects of LEA on a continuum.

When it comes to prevention, there's just not enough solid evidence on the most effective ways of raising much needed awareness of REDs and its causes and consequences among athletes, coaches, parents, and athletes' health and performance teams, notes the Statement.

But once diagnosed, the existing body of research on restoring energy availability for health and sport performance suggests that dietary interventions are the most effective. Notably, the various consequences

of REDs improve at different rates, and the duration and severity of LEA may influence time to recovery.

The Statement recommends a comprehensive team approach for successful recovery, to include sports medicine specialists, nutritionists, psychologists and sports scientists, together with coach and family involvement.

And given the potentially serious outcomes of REDs, early identification and timely interventions should be prioritized, says the Statement.

Future research—and there needs to be a great deal more of it, using standardized methodology—needs to triangulate data from cross-sectional, long term, and well designed interventional studies, in order to uncover the complexity of the relationship between LEA and REDs, recommends the Statement.

Lead author and IOC Games Group member, Professor Margo Mountjoy, comments, "REDs is common in both male and female athletes in many sports, and although we understand a lot more about its causes, awareness of the syndrome and its consequences for health and performance is still low among athletes, their medical and performance support teams, and the general public."

"We very much hope that this Consensus Statement will enhance awareness and understanding of REDs and stimulate action by sports organizations and scientists, and athlete health and performance teams to protect the health and well-being of the many athletes at risk of this syndrome."

IOC Medical Director Dr. Richard Budgett added, "IOC consensus statements have a central role to play in the translation of research and theory into clinical practice. And this statement will do much to protect

athletes' health through improvements in both the prevention and management of REDs."

The research is published in *British Journal of Sports Medicine*

More information: Margo Mountjoy et al, 2023 International Olympic Committee's (IOC) consensus statement on Relative Energy Deficiency in Sport (REDs), *British Journal of Sports Medicine* (2023).
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